INNOVATION & RESEARCH CAUCUS

REPUTATIONAL IMPACTS OF INTERNATIONAL RESEARCH AND INNOVATION

IRC Report No. 020

REPORT PREPARED BY

Professor Muthu De Silva
Birkbeck, University of London

Dr Maryam Ghorbankhani
Birkbeck, University of London

Delivered with ESRC and Innovate UK

Contents

Authors

The core members of the research team for this project were as follows:

- Professor Muthu De Silva, Birkbeck, University of London
- Dr Maryam Ghorbankhani, Birkbeck, University of London

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Executive Summary

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Aim of the Report

An aim of the UK government is to enhance the UK's global reputation and influence, is to enhance the UK's global reputation and influence (Integrated Review Refresh, 2023). Despite this goal, there is a significant gap in understanding how international R&I activities impact the UK's reputation. This lack of knowledge makes it challenging to capture and measure the reputational benefits of such investments. This report thus seeks to address this gap by reviewing the literature on how international R&I activities and associated investments contribute to the UK's reputation. Given the lack of literature in this area, the report provides a conceptual analysis of existing studies [Appendix 1 for more details on methodology] to lay the groundwork for developing a measure of the reputational impacts of the UK's international R&I investments.

International R&I includes national, organisational, and individual level collaborations between the UK and other countries. These collaborations may include knowledge transfer, exchange, co-creation, alliances, and networks etc.

National Enablement of International R&I: The UK's policies, regulatory frameworks, and infrastructure that support international R&I, and the UK's bilateral, multilateral, unilateral, international development grant funding programmes play key roles in enabling the UK's engagement in international R&I. The UK's funding for international R&I is likely to result in generating international research output, product and service innovations, knowledge sharing, social and environmental impacts, resource and infrastructure and networks. One of the benefits of these investments and associated output often cited is the positive change made to the UK's reputation (O'Sullivan et al 2024). This is identified as a key property of science and technology (S&T) diplomacy in the Integrated Review (2021) and the Integrated Review Refresh (2023).

Reputation is a term used to indicate the perception of a nation, organisation or an individual. National reputation is defined as a country having a good name or image in the world nations as a collective judgement of foreign countries. The national reputation is reported to have economic, social and environmental impacts (Mercer, 1996). Especially concerning R&I, it is not only government policies and political relationships but also the reputation of a country's R&I ecosystem and its organisational-level relationships with international counterparts that are likely to influence national reputation (European Commission 2022; OECD 2022).

Against the backdrop of the lack of understanding of the national reputational impact of the UK's international R&I investment, a systematic review of literature was conducted by reviewing 450

articles identified by using combinations of keywords related to the term "reputation" (please see Appendix 1 for more details of the methodology). The report is predominantly based on key concepts we derived from the existing literature on the reputational impacts of international R&I.

International R&I activities

Our review reveals that the definition of national reputation and its impact vary by the differing types of international R&I. We identify 16 different types of international R&I, which we group into four different categories (Figure I). *Company-focused* and *research organization-focused* international R&I denote organizational-level activities, and *national enablements* and *funding programmes* outline national activities supporting international R&I. The report – through conceptual derivation - discusses how each of these international R&I activities generates reputational impacts.

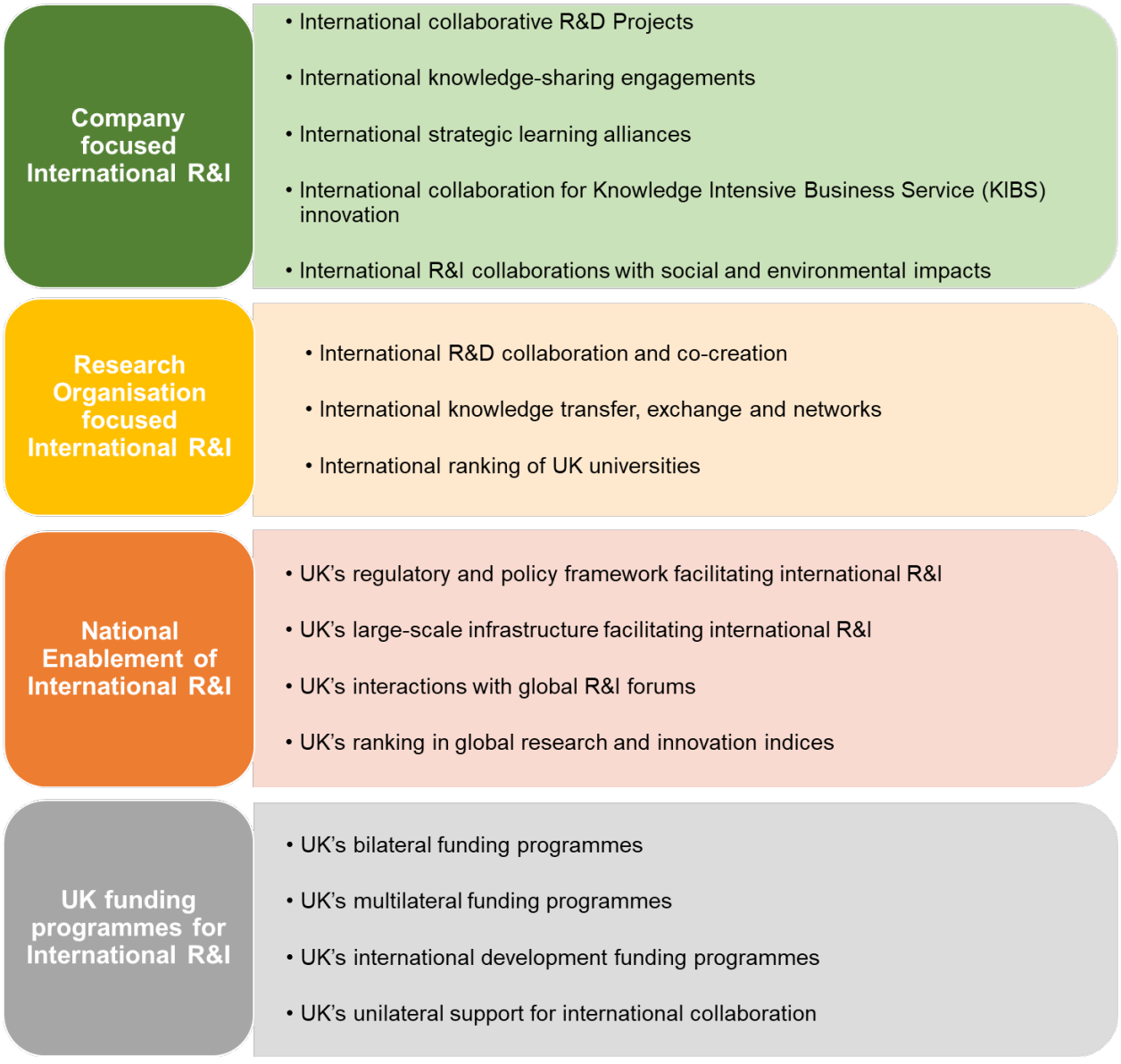

Figure I: International R&I activities

Conceptual summary of international R&I generating reputational impacts

Figure II provides a summary framework of international R&I *activities*, and the *reputation* these can generate, leading to additional *impacts*. While the identified national-level activities directly boost the UK's reputation, the organisational-level activities in aggregation collectively lead to building the UK's reputation. However, we also see that national-level initiatives not only enhance the UK's reputation, but also further support organisational-level international R&I. These four categories of international R&I at different levels including individual, organisational, local, regional and national thus interact to enhance the UK's reputation.

Engagement in international R&I by UK companies and research organisations enhances their reputations. For instance, UK companies are seen as innovative, financially strong, scientifically capable, and trustworthy. UK research organisations are recognised as world-leading experts in research, knowledge, and impact generation. Collectively, these organizational activities and national level investment and enablements bolster the UK's reputation as a leading, attractive, resourceful, impactful, and supportive destination for international research and innovation. **Chapters 2-5** of this report discuss how these organisational and national level activities generate reputational impacts together with case study examples.

The national reputation established through international research and innovation (R&I) activities generates a wide range of valuable *impacts*, including financial gains, strengthened relationships, enhanced resources, advancements in research and innovation, political influence, social benefits, and positive environmental impacts. **Chapter 1** of this report discusses the impacts of reputation developed through international R&I. These impacts generated through the reputation built from international R&I further justify the need to better understand, capture and measure reputation. As highlighted in Figure II the relationship between activities and reputational impacts is non-linear, involving several feedback loops.

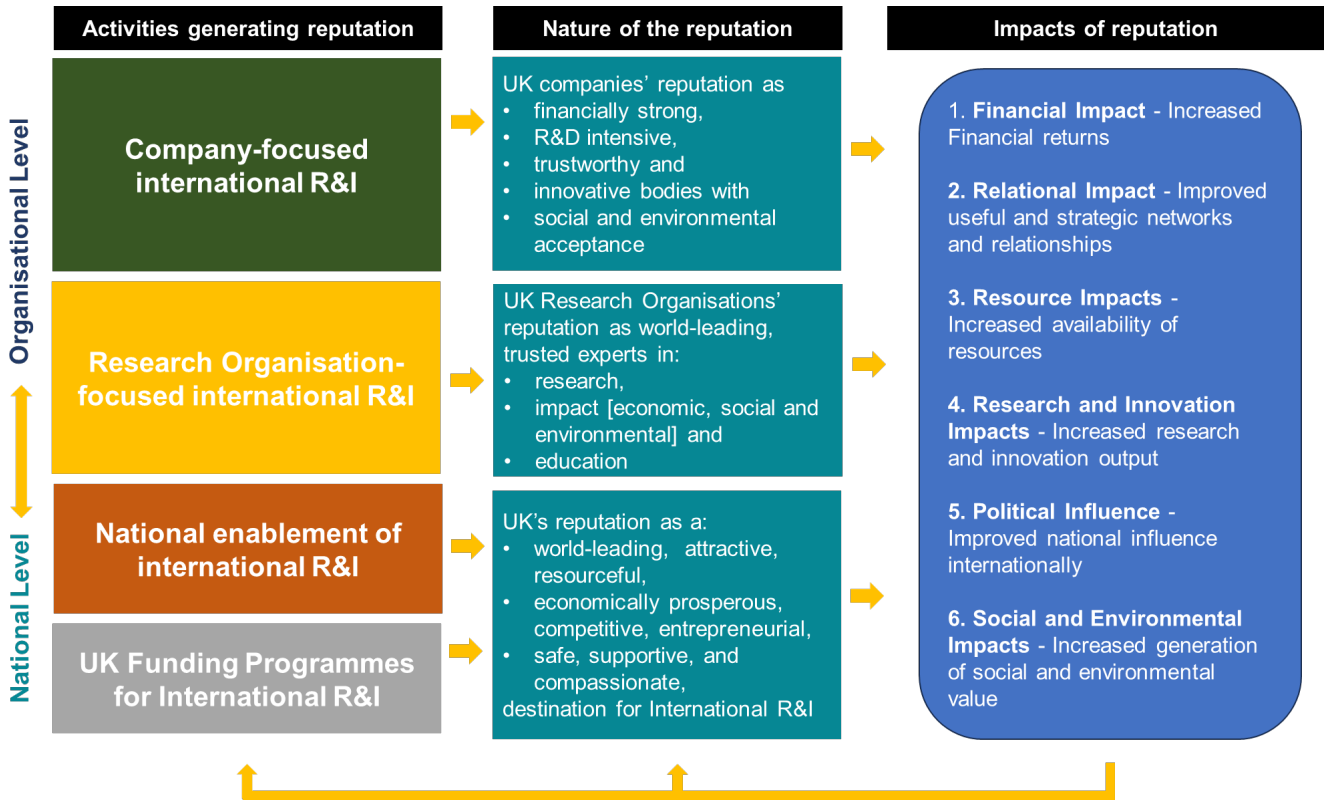

Figure II: Reputational Impacts of International R&I: Conceptual Summary

It is evident that comprehending these nuanced pathways for generating reputational impacts is essential for making key decisions that support international R&I. This understanding also provides a robust foundation for developing methods to capture and measure reputation. The following sections briefly present the reputational impacts generated through each category of international R&I.

Category 1: Company-focused reputational impacts

- At the organisational level, *company-focused international R&I* includes collaborative R&D projects, knowledge-sharing engagements, strategic learning alliances, innovation in knowledge-intensive business services, and collaboration to address grand challenges such as climate change. It can involve collaboration with many other different actors in the ecosystem.
- These engagements could boost *UK firms' reputation* as financially strong, R&D intensive, trustworthy, innovative, learning-focused, and socially and environmentally conscious organisations. The aggregation of international R&I activities conducted by many companies

in a specific geographical location or sector could develop the UK's reputation as having competitive advantage.

- Such positive reputational building would result in generating financial, relational, resource, research and innovation, social and environmental *impacts* [Figure III].
- **Chapter 2** of this report discusses how each of the company-focused international R&I activities generates reputational impacts together with relevant case study examples.

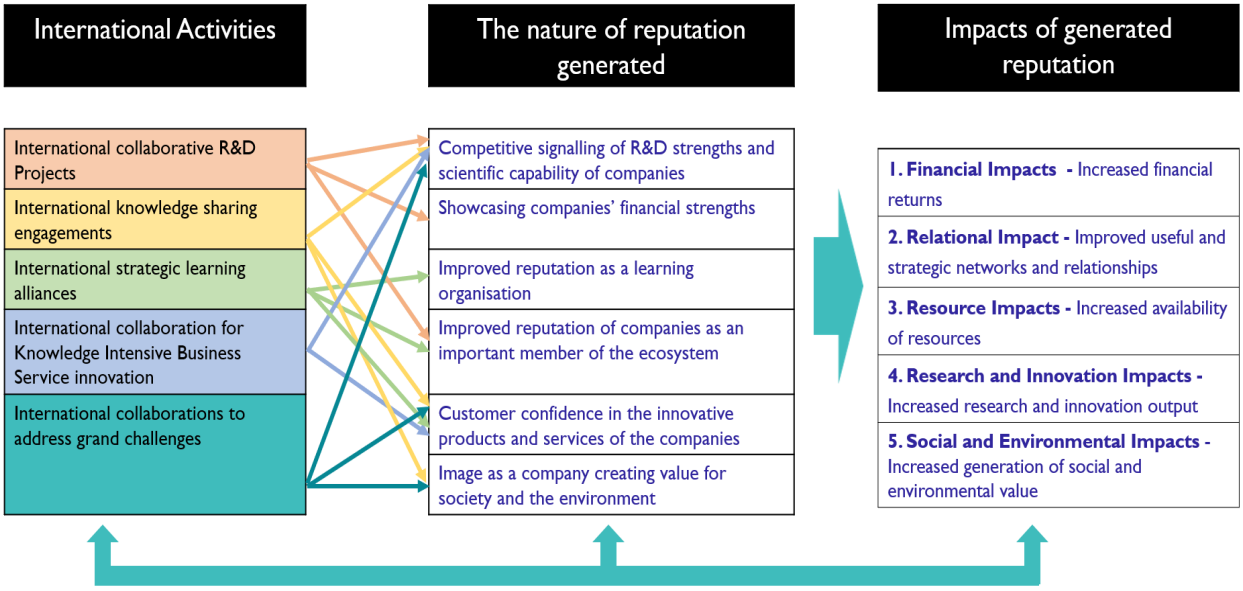

Figure III: Company-focused international R&I generating reputational impacts

Category 2: Research Organisation-focused reputational impacts

- Research Organisation-focused *international R&I* includes universities and other public research organisations conducting research in collaboration with the international ecosystem. They engage in knowledge transfer, exchange, and co-creation with international ecosystem actors, and participate in international research networks. International ranking systems, such as those of universities, sit slightly differently from the other activities in this category but are also included due to their ability to generate reputation at organisational and national levels.
- These engagements enhance the UK Research Organisations' *reputation* as world-leading, neutral, trusted experts in research, impact and education, and influencers of the direction of the global research and higher education sector.
- Positive reputation results in increased financial, relational, research, innovation, social and environmental *impacts* [Figure IV].

- Chapter 3 of this report discusses how each of the research organisation-focused international R&I activities generates reputational impacts together with relevant case study examples.

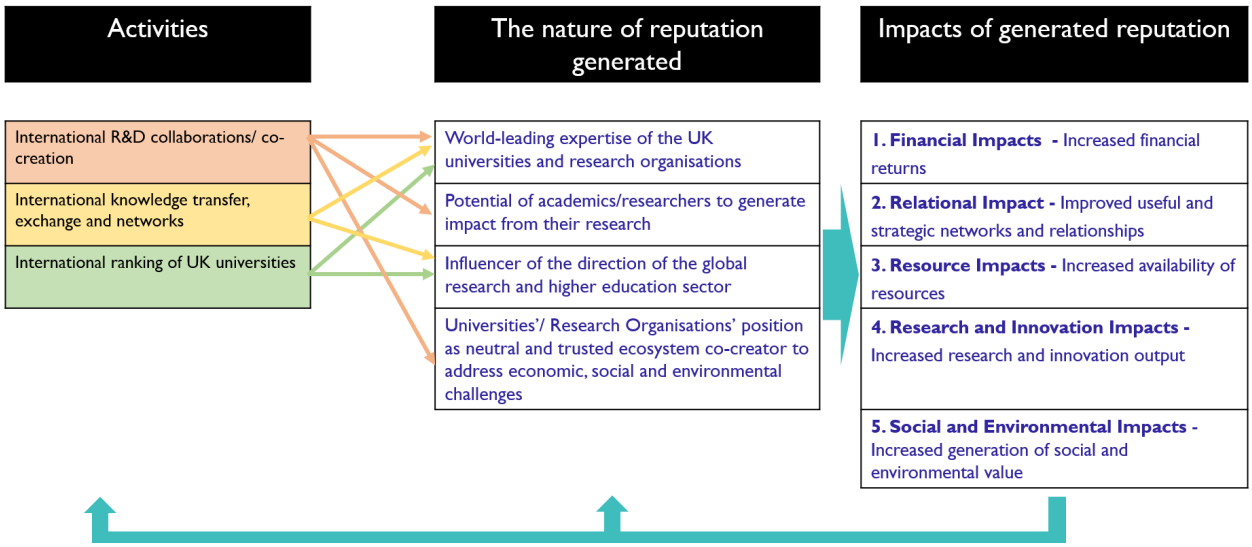

Figure IV: Research Organisation-focused international R&I generating reputational impacts

Category 3: 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 international R&I collaborations. Additionally, the UK's ranking in global R&I indices, which is influenced by organisational and national level engagements, also generates reputational impacts for the UK.
- These national enablement's are reported to enhance the *UK's reputation* as a safe, transparent, fair, trustworthy, attractive, resourceful, supportive, and competitive destination for international R&I. These activities also generate the reputation of the UK as an R&I destination that offers coherent policy and regulatory frameworks to address the evolving needs of stakeholders, which makes the UK a thought leader, influencer and committed member in the global R&I community.
- This positive reputation could lead to increased financial, relational, resource, research, innovation, political, social, and environmental *impacts* [Figure V].
- **Chapter 4** of this report discusses how each national enablement activities generates reputational impacts together with relevant case study examples.

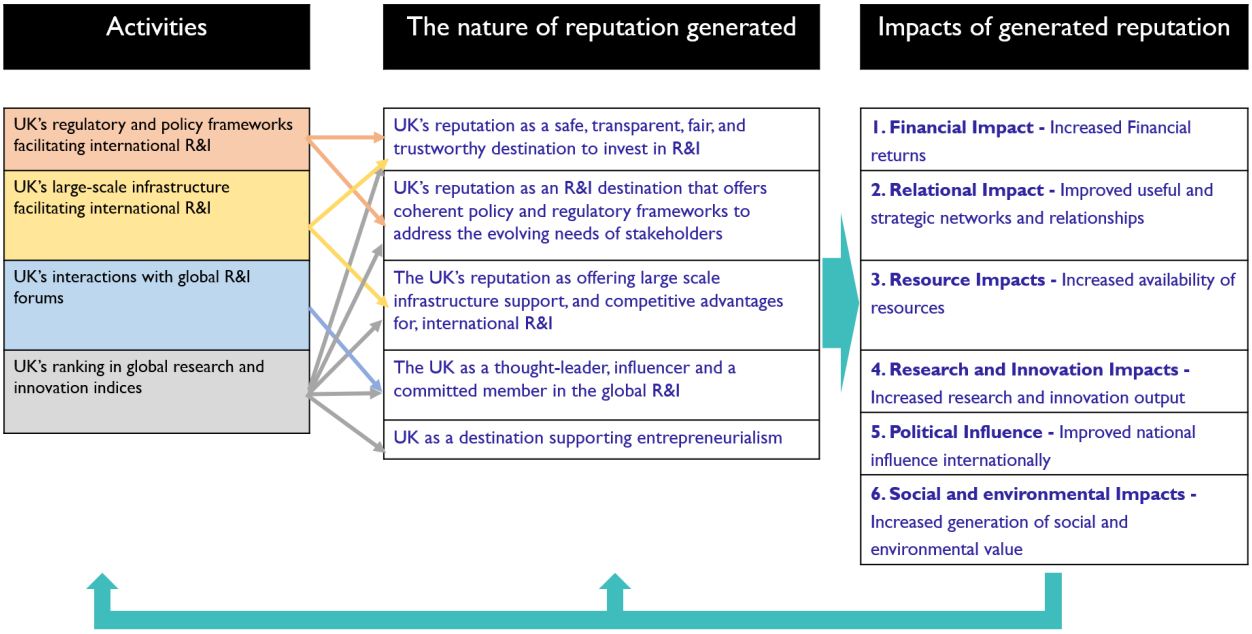

Figure V: National enablement of international R&I generating reputational impacts

Category 4: UK Funding Programmes for International R&I generating reputational impacts

- UK Funding Programmes for *international R&I* include bilateral, multilateral, international development, and unilateral funding.
- These investments are reported to enhance the *UK's reputation* as a global leader that generates research, innovation, social, economic, and environmental outcomes across national, European Union, and international levels. These grants also enhance the UK's reputation as an attractive destination to conduct international R&I and as a global leader in directing the international funding landscape, cross-country collaboration, policy, and practice.
- Such reputational building could lead to improved financial, relational, research and innovation, resource, political, social and environmental *impacts* [Figure VI].
- **Chapter 5** of this report discusses how each funding programme supporting international R&I generates reputational impacts together with relevant case study examples.

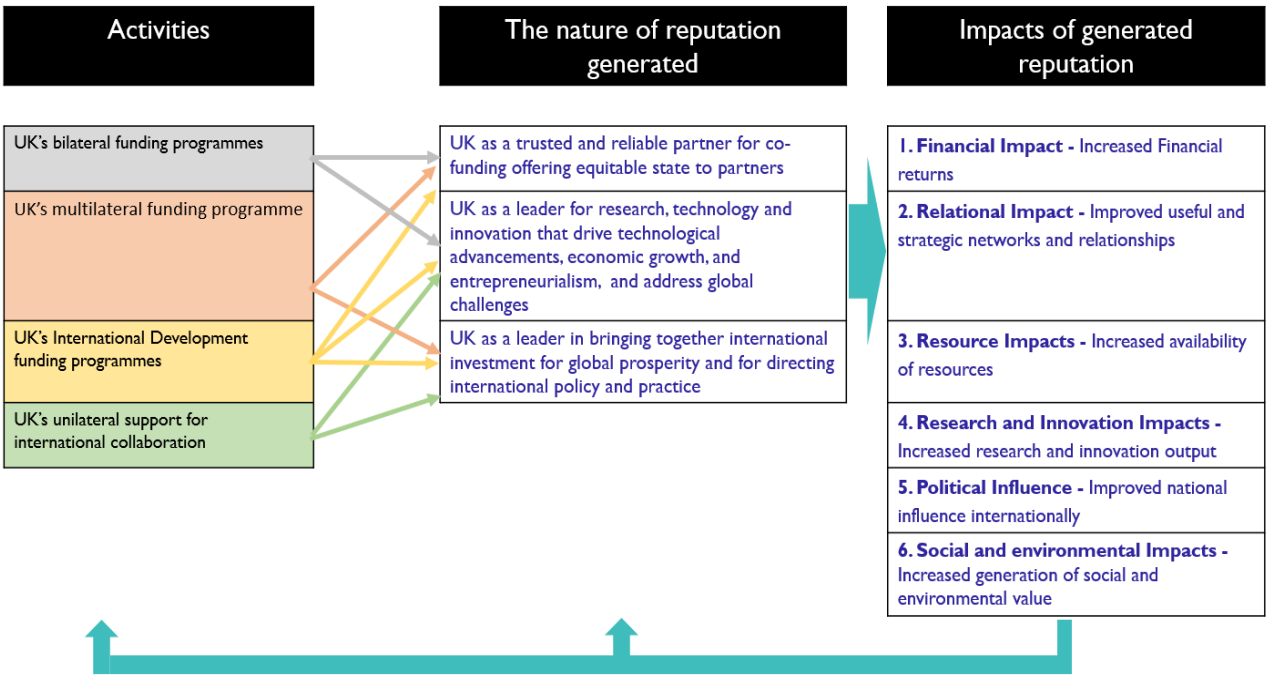

Figure VI: UK Funding Programmes for International R&I

Limitations in rigorously tracking and measuring reputational impacts of international R&I

Tracking and measuring the reputational impacts of international R&I presents several challenges. Firstly, there is a notable lack of explicit literature addressing this specific area, making it difficult to draw direct conclusions. Additionally, the inherent complexities of reputation as a psychological and perceptual construct further complicate the measurement process, especially in the context of international activities with broad and varied impacts. The following sections of the executive summary briefly present these limitations in rigorously tracking and measuring the reputational impacts of international R&I.

- **Lack of explicit literature:** It has to be noted that the review hasn't identified literature that has explicitly discussed the reputational impacts of international R&I even though there were a handful of papers that have discussed corporate reputation building through R&D activities in general (e.g. Fombrun & Shanley, 1990; Gassmann, et al., 2009; Padgett & Galan, 2010; Padgett & Moura-Leite, 2012; Tlemsani, et al., 2023) or measures the perception of nations without necessarily linking to R&I (British Council 2024). Therefore, the report is based on analysing a wide array of benefits/impacts outlined in the literature about each type of international R&I. These benefits are then used to conceptually derive reputational impacts.

- **Difficulties in capturing the scope of a psychological construct:** The lack of literature that discusses the reputational benefits of international R&I is mainly due to inherent difficulties associated with tracking and measuring reputation. Since reputation is a psychological, perceptual, and subjective construct, it is difficult to measure reputation and derive explicit causalities of reputation building. Yet, some attempts have been made to measure the perception of different countries. One example is the survey conducted by the British Council in 2021 of 37,158 young people from across 36 countries on the perception of countries (British Council 2024). While it is possible to measure perception in such a large-scale survey, it is difficult to rigorously derive the causality of the factors that may have led to the building of this perception.
- **Reputation in the context of international R&I is particularly complex**: Especially in the context of international R&I, the difficulty of tracking and measuring reputation is further complicated due to the international scope and spillover effects, leading to attribution challenges. International R&I could generate reputational impacts across borders both as direct and spillover effects. While the direct reputational effects may arise from specific investments and associated international R&I activities, the spillover effects could include unintended reputation building over the long term, resulting from these activities and their direct impact. Yet, it is impossible to track and measure whose individual and collective perception would be influenced by the international R&I activities, leading to the generation of national reputation. Also, it is difficult to differentiate between the reputation of a nation built through international R&I compared to other international activities such as trade, tourism. Therefore, these conceptually derived associations should be considered with caution. In order to minimise errors in conceptualisation, we have discussed exemplar cases for each type.
- **Interaction between types of international R&I activities when generating reputational impacts**: It should also be noted that even though the types of engagements leading to reputational impacts are presented independently, some of these may interact as well as overlap. For example, research organisations and companies are likely to interact with each other in many international R&I initiatives and are supported by national enablement and international grants. However, reputational impacts of each type of interaction are discussed separately to outline some unique benefits. It is also believed that presenting different categories/types will support decision-makers in understanding which activities are more likely to result in generating specific reputational impacts. Yet, it is important to consider that each type of activity is likely to be influenced by other types when generating reputational impacts.

- **Complex feedback loops:** As presented in the diagrams, there are complex feedback loops concerning the generation of reputational impacts, which could then influence engagement in certain activities. Due to the conceptual nature of these derivations, in some instances, it was impossible to clearly outline some complexities. The perceptual nature of the reputation as a construct makes it further difficult to empirically measure and identify complex and dynamic interactions between activities and reputational impacts.

Report Outline

The first chapter of this report examines the impacts of reputation gained through international Research and Innovation (R&I), encompassing financial, relational, resource-based, research and innovation, political, environmental, and social impacts. This chapter thus offers a justification as to why we need to better understand reputation generated through international R&I. **Chapters 2 to 5** delve into how each category of international R&I generates reputational impacts, supported by case studies. Discussing the categories separately is aimed at helping decision-makers understand which activities need to be undertaken to generate specific reputational impacts. Appendix 1 offers a detailed account of the methodology used in this study.

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Chapter 1

Why reputation generated through international R&I matter

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The reputation gained through international research and innovation (R&I) generates a wide array of impacts. These impacts can manifest at various levels, including local, regional, national, and international. The reputation built through such R&I efforts not only enhances the UK's standing in the global community but also brings about tangible benefits across different sectors and geographies. Some of these impacts and the pathways for generating them are closely linked to specific types of R&I collaborations, highlighting the importance of strategically selecting specific mechanisms of international R&I based on intended impacts. We discuss in this chapter the different impacts generated by the reputation gained through international R&I, showcasing the multifaceted benefits that arise from a strong and respected presence in the global research and innovation landscape. These impacts generated from the reputation further justify the need to better understand, capture, and measure reputation.

1.1. Financial Impacts of Reputation Building through International R&I

1. New pathways for generating financial returns
2. Enhanced national and international funding and foreign investment in the UK
3. Improved market advantages
4. Reduced risks and costs through the leveraging of increased opportunities for shared addressing of common challenges

Box 1.1: Financial Impacts of Reputation Building through International R&I: Overview

The reputation gained through international research and innovation (R&I) has profound financial impacts by way of increasing financial returns.

- **Firstly**, due to the reputation developed through international research and innovation (R&I), new pathways for generating financial returns are emerging, driven by improved

relationships with clients and beneficiaries, new business development opportunities, and increased chances to launch new products, services, and processes in new markets (Rodríguez et al., 2018; Teixeira et al., 2016; Teixeira et al., 2008; Abecassis-Moedas et al., 2012; Appiah-Adu & Singh, 1998; Laforet & Tann, 2006; Laforet, 2008, 2009; Salavou et al., 2004).

- **Secondly**, the reputation increases investor confidence and enhances national and international funding and foreign investment in the UK, which in turn fuels economic growth and development (Wittneben & Kiyar, 2009; Laforet, 2011; Salman & Saives, 2005; Freel & Harrison, 2007; Dodgson & Rothwell, 1991; UKRI India; Horizon 2020; Gov 2024).
- **Thirdly**, the reputation results in improving market advantages, such as better market positioning, market access, market share, and market valuation, enhancing the UK's credibility and trustworthiness in the global market, making it a preferred destination for investors (Gassman et al., 2009; Barnett & Storey, 2000; Birchall et al., 1996; Bowen & Ricketts, 1992; Chandler et al., 2000; Dodgson & Rothwell, 1991; McAdam et al., 2004; Amel-Zadeh et al., 2021; Potepa and Thomas (2023).
- **Lastly**, reinforcing the UK's standing as a resilient and forward-thinking country, developed through international R&I, increases opportunities for shared addressing of common challenges and high-risk projects, which reduces the risks and costs of R&I (Reuer & Ragozzino 2014). This financial robustness, driven by a strong international R&I reputation, ensures sustained economic benefits and long-term prosperity (Huang et al 2024).

1.2. Resource Impacts of Reputation Building through International R&I

1. Enhanced opportunities to access and/or develop new national and international resources, capabilities, and knowledge
2. Enhanced opportunities to access, and/or engage in the development of national and international infrastructure
3. Improved consideration of the UK as a resource for future R&I

Box 1.2: Financial Impacts of Reputation Building through International R&I: Overview

The reputation developed through international research and innovation (R&I) has significant resource impacts by way of access to, and/or development of, resources of value to the UK. These resources would be of value for scaled-up collaboration, economic growth, and other advantages.

- **Firstly**, the reputation enhances opportunities to access and develop new national and international resources, capabilities, and knowledge, that might otherwise be inaccessible. In particular, the reputation developed through international R&I would offer access to cutting-edge laboratories, knowledge, and databases as well as associated skill development opportunities. These resources foster further collaboration and economic growth (Laforet, 2011; Salman & Saives, 2005; Freel & Harrison, 2007).
- **Secondly**, the reputation provides increased chances to access international infrastructure or engage in the development of new international infrastructure, laying the groundwork for future advancements. The reputation developed by companies and research organisations by engaging in international R&I also offers enhanced opportunities to win additional grants and collaboration opportunities to jointly further develop and/or access national infrastructure (Ryan 2023).
- **Lastly**, the enhanced perception of the UK as a resource for future R&I is crucial for seizing resources and opportunities to unlock new paths to improve the UK's key competitive advantages that have not existed before, further solidifying the UK's position as a leader in innovation and ensuring sustained resource availability and development (Amanatidou et al 2016; Cunningham 2015).

1.3. Research and Innovation Impacts of Reputation Building through International R&I

1. Increased opportunities and willingness of national and international actors to collaborate with the UK
2. Long-term commitments from international stakeholders and investors on UK R&I
3. Reduced risk of research and innovation

Box 1.3: Financial Impacts of Reputation Building through International R&I: Overview

The reputation gained through international research and innovation (R&I) has profound impacts on various R&I fronts.

- **Firstly**, the reputation increases opportunities and willingness among national and international actors to collaborate with UK organisations. This collaboration can take multiple forms, such as developing new products, services, technologies, processes, and business models for local, national, and global markets, associated with relatively high Technology Readiness Levels (TRL) (Haberberg & Rieple, 2001). It also encourages engagement in larger, international, profitable, and strategically relevant projects (Tlemsani et al., 2023), as well as participation in ground-breaking research, which is often at lower TRLs (Siegel & Wright, 2015).
- **Secondly,** this reputation fosters long-term commitments from international stakeholders and investors in UK R&I, exemplified by the establishment of international R&I centres and associated investments. These commitments ensure sustained investment and support for ongoing and future projects (Integrated Review Refresh, IRR 2023; Global Innovation Index 2023).
- **Lastly**, the enhanced reputation reduces the risk associated with research and innovation, particularly for larger and complex projects. This risk reduction is due to the increased trust and confidence from partners and investors as well as the distribution of risk among collaborators, which in turn facilitates more ambitious and impactful R&I initiatives (Dodgson & Rothwell, 1991; Gassman et al., 2009; Turpin et al., 2004). Overall, the reputation built through international R&I significantly bolsters the UK's ability to attract collaborations, secure long-term R&I commitments, and undertake high-risk, high-reward projects.

1.4. Relational Impact of Reputation Building through International R&I

1. Enhanced opportunities to access, strengthen, collaborate with, and/or develop new networks
2. Increased acceptance within the broader international scientific community
3. Enhanced satisfaction of shareholders and their encouragement of others to join UK companies
4. Enhanced employee satisfaction and opportunities to recruit high-profile staff members
5. Increased international student enrolment in UK universities

Box 1.4: Relational Impacts of Reputation Building through International R&I: Overview

The reputation gained through international research and innovation (R&I) has significant relational impacts by way of improved useful and strategic relationships and networks.

- **Firstly**, the reputation enhances opportunities to access, strengthen, collaborate with, and develop new, useful networks at local, regional, national, and international levels. These networks are crucial for fostering collaboration, sharing knowledge, and driving innovation and economic growth (Moriarty et al., 2005; Altbach & Salmi, 2011; Lepori et al., 2013).
- **Secondly**, the reputation leads to increased acceptance within the broader international scientific community, which is essential for scaling up research and innovation outcomes (Gassmann et al., 2009).
- **Thirdly**, the enhanced reputation of UK companies due to their engagement in international R&I boosts shareholder satisfaction, encouraging them to invest further and attract others to join UK companies. This positive perception among shareholders is vital for securing ongoing financial support and growth (Financial Services and Markets Act 2000; Raithel and Schwaiger 2015).
- **Fourthly**, the reputation improves employee satisfaction, creating a more motivated and engaged workforce, and provides opportunities to recruit high-profile staff members who are drawn to the UK's esteemed R&I environment (Clark et al., 2015; Abreu et al., 2015; Jones et al., 2014).
- **Lastly**, the reputation attracts increased international student enrolment in UK universities, as students seek to benefit from the high-quality education and research opportunities available (Siegel & Wright, 2015). These relational impacts collectively strengthen the UK's position as a leader in research and innovation, fostering a supportive and dynamic ecosystem for continued growth and success.

1.5. Political Influence of Reputation Building through International R&I

1. Enhanced status, acceptance, and soft influence of, the UK globally
2. Strategic and successful country-level partnerships between the UK and other countries

Box 1.5: Political Influence of Reputation Building through International R&I: Overview

The reputation gained through international R&I significantly enhances the UK's political influence on the global stage.

- **Firstly**, the reputation elevates the UK's status and acceptance worldwide, allowing it to exert soft influence (Lomer 2017) in various domains. This influence can shape key decisions (e.g. policy makers, international bodies, funders, companies, and research orgaisations), such as the choice of sectors and technologies to focus on, as well as global policy and practice. The UK's respected position gained through international R&I enables it to lead and guide international discussions and initiatives, promoting its interests and values. Reputational resilience and soft power are interlinked and the development of trust in a country plays a key role in strengthening this link (House of Commons 2018; British Council 2021). A state's ability to influence and be respected on the global stage relies equally on its diplomatic efforts and the social and human capital within its international networks, which are built through the reputation generated through international R&I, as it does on its GDP or military strength (British Council 2020).
- **Secondly**, the reputation fosters strategic and successful country-level partnerships between the UK and other nations. These partnerships are built on mutual respect and shared goals, facilitating collaboration on large-scale projects and policy development. The UK's strong R&I reputation thus enables it to form and maintain influential alliances, driving forward international cooperation and progress (Archetti 2014; Turner 2019).

1.6. Social and Environmental Impacts of Reputation Building through International R&I

1. Enhanced opportunities to simultaneously generate business, academic, social, and/or environmental value
2. Increased opportunities for UK organisations and academics to engage in local, regional, national and international policy-making and advisory roles

Box 1.6: Social and Environmental Impacts of Reputation Building through International R&I: Overview

Increasingly collaborative R&I is aimed at simultaneously generating different types of value, especially when addressing grand challenges, developing green innovation, and addressing socio-economic challenges. The reputation generated as a socially and environmentally responsive organisation and nation can thus offer further opportunities to scale up social and environmental impacts (Hoffman, 2005; Kolk & Pinkse, 2004; Wittneben & Kiyar, 2009).

- **Firstly**, the reputation generated by the UK as a socially and environmentally conscious nation offers additional opportunities to collectively address local, regional, national, and international socio-economic challenges. This ensures that the solutions developed are sustainable and beneficial across multiple sectors, and simultaneously generate business, academic, social, and/or environmental value (Dyer & Chu, 2003; Li et al., 2014; Akhavan and Beckmann, 2017).
- **Secondly**, the increased recognition and credibility gained through socially and environmentally responsive international R&I efforts open up more opportunities for UK organisations, including businesses, public sector entities, and not-for-profit organisations, as well as academics, to engage in policy-making and advisory roles at various levels. This involvement in policy-making can lead to more informed and effective policies that better address the complex socio-economic and environmental issues faced by communities globally (Perkmann et al., 2013; Bozeman & Gaughan, 2007). Thus, the reputation gained from international R&I facilitates a more integrated and impactful approach to solving global challenges.

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Chapter 2

Company-focused international R&I generating reputational impacts

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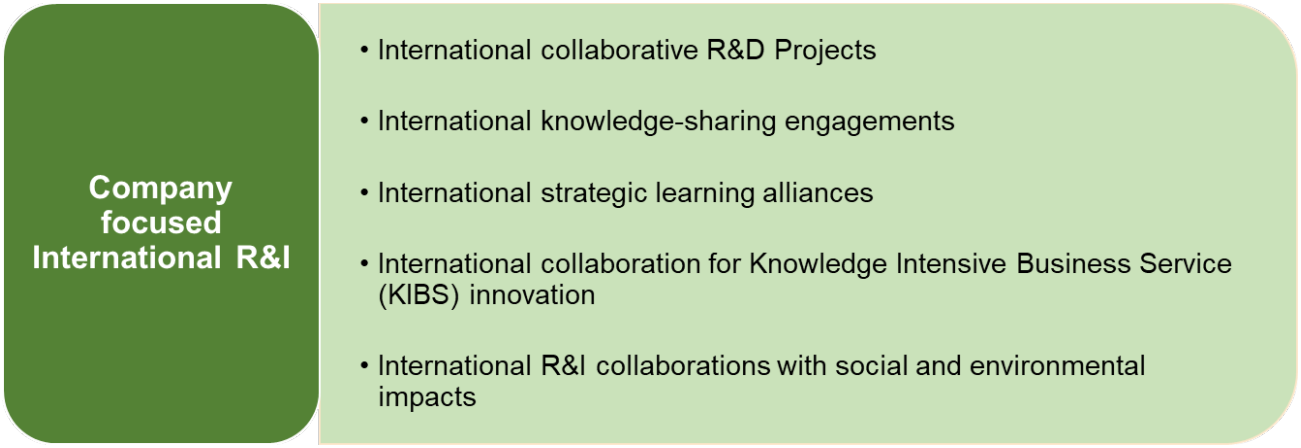
UK companies are deeply committed to advancing international research and innovation through a variety of activities that generate valuable reputational impacts. These activities include engaging in international collaborative R&D projects, knowledge sharing, strategic learning alliances, collaborative Knowledge Intensive Business Service innovation, and collaborations to address grand challenges[1]. By participating in these engagements, UK companies can enhance their reputation as financially robust, R&D-focused, trustworthy, and innovative learning organizations with social and environmental acceptance. This, in turn, generates a myriad of impacts ranging from financial, relational, resource, research, innovation, social to environmental impacts. The categorisation of activities is based on the review of the literature conducted for this study.



[1] These five types of activities are derived from conceptual analyses of how they lead to different reputational benefits. For instance, while international collaborative R&D projects focus on developing products, services, and processes, knowledge-intensive business services (KIBS) innovation follows distinct pathways to reputation building, driven by specialised expertise and knowledge.

Click here to download subsection 2.1

2.1. Company-focused international collaborative R&D projects

R&D-intensive firms, including small and medium-sized and large companies, collaborate with other international companies, customers, supply chains, universities, and public sector bodies to produce new knowledge, research output, products, processes, and/or services (Appiah-Adu & Singh, 1998; Laforet & Tann, 2006; Laforet, 2008, 2009; Salavou et al., 2004). These international collaborations highlight the R&D strengths, scientific capabilities and financial robustness of UK companies, while also demonstrating their ecosystem influence. The developed reputation could result in generating financial, relational, resource, and research and innovation impacts (Figure 2.1).

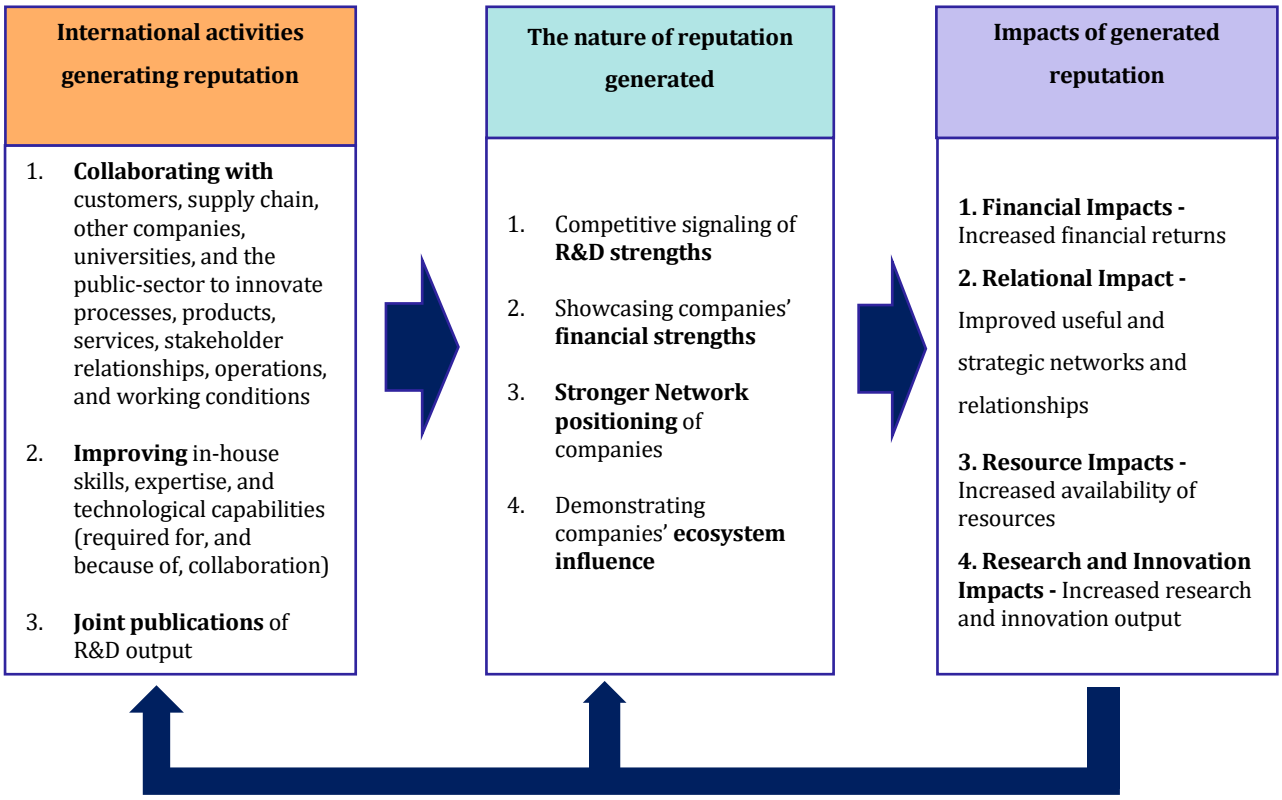


Figure 2.1: Company-focused international collaborative R&D projects generating reputational impacts

2.1.1 International activities

- **Collaborating with international customers, supply chain, other companies, universities, and public sector to innovate processes, products, services, stakeholder relationships, operations, and working conditions**.

  International collaborations for R&I are critical for R&D-intensive firms as they provide access to external knowledge, skills, networks and resources. Firms are required to

converge many sources of complementary international knowledge and expertise and develop useful networks to facilitate innovation (Salman and Saives, 2005). Firms engage in international collaboration with both the public and private sectors for their innovation purposes, which includes innovating processes, products, services, stakeholder relationships, operations, and working conditions (Laforet, 2008, 2009; Salavou et al., 2004)

The most critical sources of information for innovation are market-based, which is provided through collaboration with customers, suppliers, and competitors. In the UK, firms tend to collaborate with international customers and suppliers which are the most commonly used sources of information for innovation (Freel & Harrison, 2007). Collaboration with international customers is important to generate new ideas and has a significant impact on product development, which is reflected in new product ideas, product launches, process innovations, cross-functional teamwork, interdepartmental connections, and, to a lesser extent, business strategy (Appiah-Adu & Singh, 1998; Laforet & Tann, 2006; Laforet, 2008, 2009; Salavou et al., 2004). Collaboration with suppliers has been used to shorten time to market, enhance product quality, and lower development costs (Johnsen, 2009). Consequently, companies are increasingly seeking to harness their suppliers' innovation potential in the collaborative innovation of their products (Smals and Smits, 2012).

Firms' engagement with public research institutes for R&I is more limited. According to Freel and Harrison (2007), public sector knowledge infrastructure is the least commonly used source of information for innovation, while private sector knowledge infrastructure is more commonly utilised by firms. However, the extent of use varies significantly across different sectors. Firms also collaborate with international universities in joint projects and spinouts (Laforet, 2011).

The combination of various sources of innovation and leveraging networks have been acknowledged to have differential positive effects on a firm’s innovative performance (Barnett and Storey, 2000; Birchall et al., 1996; Chandler et al., 2000; McAdam et al., 2004). For instance, UK firms’ collaboration with international customers and public sector entities has been more positively associated with the success of product innovations, while cooperation with suppliers and universities is more positively associated with process innovation success (Freel & Harrison, 2007).

- **Improving in-house skills, expertise, and technological capabilities for international R&I**

  Continuous improvement of in-house skills, expertise, and technological capabilities is crucial for maintaining a competitive edge in international R&I. This is achieved through training, hiring skilled employees, and investing in new technologies. Improvements in in-house capabilities lead to improved financial performance and attracting a skilled workforce, which is important to sustain international R&I (Laforet, 2011). Conversely, a significant barrier to SME engagement in international R&I is the shortage of adequately skilled or trained personnel (Scott et al., 1996; Freel, 2005; Laforet & Tann, 2006). Inhouse skill development increases a firm's absorptive capacity, which is crucial to engaging with diverse international partners. Improving technological capabilities, skills, training, and education underscores the company's dedication to developing a highly skilled workforce, essential for successful international R&I (Laforet, 2011).

- **Publishing joint research**

  Some collaborative R&D output is jointly published with international collaborators. Corporate R&D centres gain international visibility through joint publications in popular science, and business media. Publishing international joint research in academic journals and conference proceedings significantly enhances an R&D organisation's international visibility. This demonstrates the company's commitment to contributing to scientific knowledge (Gassman et al., 2009). For instance, Rolls-Royce has published several research papers based on their joint R&D activities with national and international academics in journals such as the Journal of Power Sources, European Journal of Innovation Management, and Research Technology Management.

2.1.2 The nature of the reputation generated

Companies' engagement in international R&I results in generating different types of R&D-focused reputation.

- **Competitive signalling of R&D Strength**

  By engaging with international customers, supply chain partners, other companies, universities, and the public sector, firms can generate reputation as collaborative, strong, adaptive, and capable of leveraging external partnerships to achieve innovation breakthroughs. Active international partnerships thus position the firm as a key player in the international scientific and industrial community (Freel & Harrison, 2007; Gassman et al., 2009). Co-creating with international customer enhances their trust and loyalty of R&D strengths of the company (Iglesias et al 2020).

Showcasing companies' financial strengths

International collaboration helps firms understand international market needs and develop products that meet specific requirements, thereby enhancing their reputation as responsive and customer-oriented innovators. This leads to successful international innovations reflecting strong financial health and resource management of companies since international R&D is possible through relatively large financial investment (Appiah-Adu & Singh, 1998; Laforet & Tann, 2006; Laforet, 2008, 2009; Salavou et al., 2004). Even when they win grants from the government, required co-investment by the firm indicates financial strength. In particular, the outcome of the grant is likely to portray the company as a financially strong entity due to the financially scalable output developed through the government grant (Knapp 2024).

Stronger network positioning of companies

Continuous improvement and engagement in international R&D collaborations solidifies the firm's standing in the scientific community and enhances its network positioning. This in turn attracts top talent and demonstrates the firm's competitiveness and long-term viability, enhancing its image as a leader in the market and associated networks (e.g. Abreu et al., 2007; Freel and Robson, 2004; Freel, 2005; McDonald et al., 2007).

Demonstrating companies' ecosystem influences

The innovative international R&D collaborations that impact stakeholder and supply chain relationships and operations highlight the firm's influence on its ecosystem (Oke et al. 2013).

2.1.3 Impacts of generated reputation

Table 2.1: Impacts of reputation generated through international collaborative R&D projects

Types of Impact	Specific Impacts
1. Financial Impacts - Increased financial returns	Improved market access and associated advantages Improved profit through new products, process, services etc
2. Relational Impact - Improved useful and strategic networks and relationships	Enhanced employee satisfaction and opportunities to recruit high-profile staff members
3. Resource Impacts - Increased availability of resources	Enhanced access to resources and networks
4. Research and Innovation Impacts - Increased research and innovation output	Increased opportunities to collaborate with sources of knowledge and skills e.g. universities, research institutes, and other innovative firms Increased opportunities to engage in new product development and radical and sustainable innovation Reduced risk of innovation and greater willingness for risk taking

Case Study: GSK's Reputation building through International Research and Innovation in Vaccine Development

GlaxoSmithKline plc (GSK), the oldest continuously operating British pharmaceutical company, has played a crucial role in global health since its inception in 1715 with the establishment of the Plough Court pharmacy in London. Through its dedication to international collaboration, investment in internal capabilities, and the sharing of research findings, GSK has cemented its position as a leader in international research and innovation (R&I). This case study highlights how GSK's activities across its global R&D locations and international collaborations contribute to its reputation, particularly in developing vaccines and medicines.

» *International R&I activities:*

Through the acquisition of Affinivax, Inc. in Cambridge, Massachusetts, GSK has leveraged its in-house capability through Affinivax's MAPS (Multiple Antigen Presenting System) technologies to create vaccines that can target several pathogens at once, helping to tackle complex health issues such as pneumococcal disease.

In 2023, GSK invested S$343 million to expand its state-of-the-art vaccine facility at Tuas, reinforcing its presence in Singapore, where it has operated for over 60 years. This facility produces drug substances for vaccines that prevent Hepatitis B, contributing to global public health efforts and reinforcing its international R&I.

GSK's global network of R&D locations is essential for maintaining its leading position in vaccine and medicine development. These sites are not only centres of innovation but also hubs for enhancing the company's technological capabilities and expertise. GSK operates several R&D hubs across the world, including China, Germany, India, Italy, Japan, and Poland. These locations are integral to GSK's strategy of advancing international R&D in key therapeutic areas. GSK's international collaborations often result in joint research publications in peer-reviewed journals.

» *The nature of reputational impacts generated:*

When analyzing the GSK's activities in international R&I using the conceptual derivations discussed in the chapter, it is possible to argue that these activities contribute to generating reputation across several key areas. GSK's extensive global R&D network, signals its robust capabilities in research and development. The company's significant financial investments in international R&I highlight its financial stability and commitment to long-term R&D. It also demonstrates GSK's capacity to sustain large-scale projects that contribute to global public health.

GSK's collaborations with leading academic institutions and biotech companies underscore its influence within the global R&D ecosystem. Its collaborations with top-tier partners and integration of advanced technologies, joint ventures, and licensing agreements across internation R&D hubs also position GSK as a key player capable of driving significant advancements in healthcare, and enhance GSK's visibility and reputation as a leader in scientific research. Publication of joint R&D activities builds its reputation as a reliable and experienced leader in the pharmaceutical industry.

Based on the literature and classification of activities that generate an international R&I reputation and the nature of the generated reputation, the following impacts are expected as a result of the generated reputation for GSK: Improved market positioning, market access, market share, and associated advantages, enhanced access to national and international resources, funding, capabilities, infrastructure, knowledge and networks, increased opportunities to engage in new sustainable innovation, reduced risk of innovation

Sources :
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https://www.nature.com/nature-index/institution-outputs/united-kingdom-uk/glaxosmithkline-plc-gsk/5139074134d6b65e6a002305
GSK profiles innovative R&D portfolio to investors | GSK

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2.2. Company-focused international knowledge sharing engagements

Firms are engaged in sharing their knowledge and expertise through various channels, such as publications and attendance at events and conferences. International knowledge sharing could generate reputation of competitive signaling as an important source of knowledge and collaboration and socially responsible business, and ensure customer confidence in innovative products and services. This reputation building could generate relational, resource, research and innovation impacts (Figure 2.2).

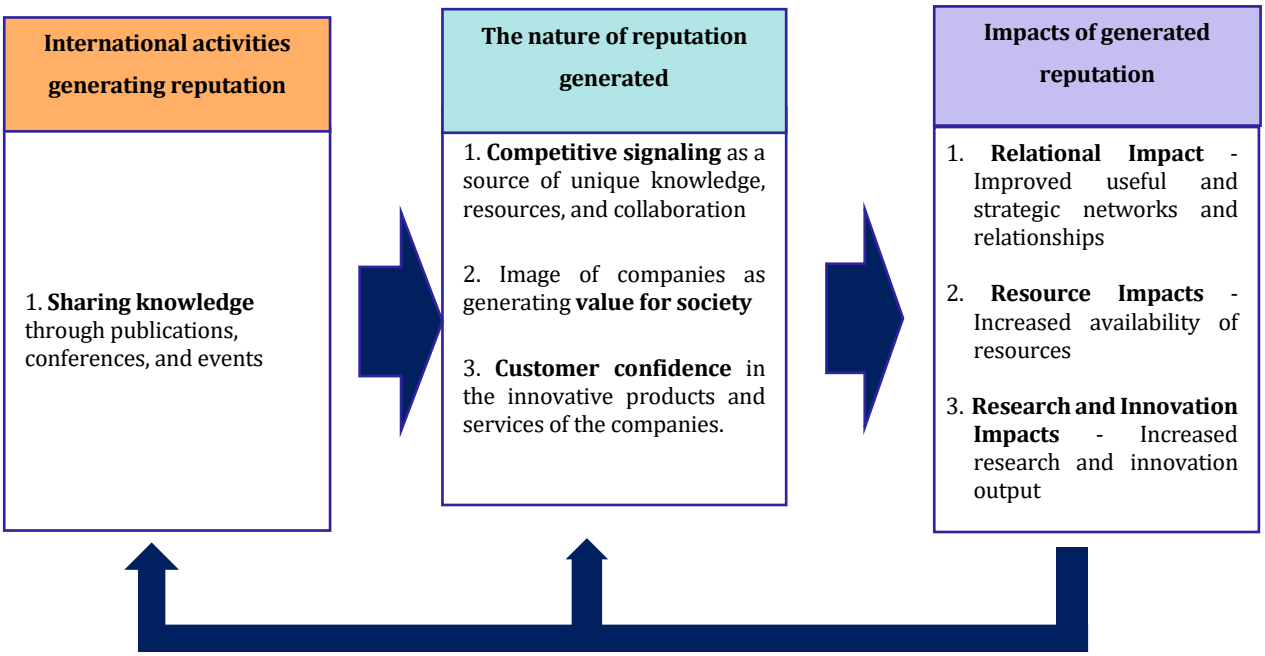

Figure 2.2: Company-focused international knowledge sharing engagements generating reputational impacts

2.2.1 International activities

Sharing knowledge through publications, conferences and events

Participating in national and international conferences and events allows firms to showcase their latest research findings and innovations, and establish themselves as influencers and thought leaders in their industry. Firms encourage their scientists and engineers to publish their research output often in collaboration with national and international academic institutions in scientific journals, at leading conferences and events, and in industry reports to enhance their visibility while allowing participation in the broader scientific community

(Gassmann et al., 2009). Gaining visibility within specialist and strategically advantageous communities is one of the most significant purposes of international knowledge sharing (Joly & Mangematin,1996).

For example, AstraZeneca and GlaxoSmithKline (GSK), the UK's leading pharmaceutical and healthcare companies, share their inventions and research output in scientific peer-reviewed journals across the fields of medicine, pharmacology, and biotechnology. They also participate actively in international conferences offering opportunities to build personal connections with professionals working in similar companies, which helps structure social capital (Majuri, 2022) and facilitates further collaborations on international projects.

Similarly, British Petroleum (BP) publishes research in the areas of energy, sustainability, and environmental science, with a focus on advancements in oil, gas, and renewable energy technologies (Gassman et al., 2009). Siemens, through its 'Pictures of the Future' magazine, effectively showcases its technological advancements. Such international knowledge sharing is facilitated through a structured media strategy, which ensures consistent and effective communication of a company's innovations and research developments (Gassman et al., 2009).

2.2.2 The nature of reputation generated

Competitive signalling as a source of unique knowledge, resources, and collaboration

By presenting research findings through publication in high-profile international media outlets and peer-reviewed journals, and participating in discussions at international conferences or events, firms signal their cutting-edge expertise, R&D achievements, and leadership in their field. These activities demonstrate their capacity for global innovation and thought leadership, establishing them as key players in their industry. When companies actively share knowledge and communicate their strengths and capabilities, this visibility highlights the unique resources and innovative capabilities of their R&D labs, positioning them as attractive partners for international and national collaboration. Popular media coverage acts as a platform to inform the public and industry stakeholders about the company's strengths, fostering a perception of reliability and resourcefulness as a research and innovation collaborator, which in turn enhances its competitive position and attracts potential partners, collaborators, and investors (Gassman et al., 2009; Majuri, 2022).

Image of companies as generating value for society

A well-crafted international knowledge-sharing and media strategy allows companies to effectively communicate their contributions to societal well-being. This enhances their

reputation as organizations committed to creating positive societal impacts, which can attract customers, investors, and partners who value corporate social responsibility. Through this strategy – which reinforces the image of companies as generating value for society – companies generate customer confidence in their innovative products and services (Wittneben & Kiyar, 2009; Oake et al. 2013).

For instance, Roche, a well-known company recognised as an innovation leader in the healthcare, science, and R&D sectors, strategically launched a “targeted media campaign”, a remarkable knowledge-sharing strategy aimed at a defined audience. One of its recent media campaigns focused on engaging the “concerned citizen” has been a successful disease awareness campaign targeted at a selected segment of the general public. This campaign has generated 4.4M impressions (incl. 1.3 mill video views), 82K users (99% new users and 12% of all users on roche.comduring campaign period), and 121K pageviews (>100K unique pageviews). By showcasing its contributions to healthcare and society, Roche builds an image of a company that creates significant societal value. Through its targeted campaign, Roche demonstrates its commitment to reducing the healthcare burden of society and enhancing awareness, thereby reinforcing its reputation as a socially embedded innovator and a leader in the healthcare industry.

- **Confidence of customers in innovative products and services offered by the companies**

  Promoting the publication of research in international peer-reviewed journals and participation in scientific conferences that attract a global audience enhances the credibility and perceived quality of a company’s products and services, awareness of the company’s scientific achievement, and the perception that the company is at the forefront of innovation. As publications are peer-reviewed, these generate awareness of the robustness of GSK’s R&I activities. Since healthcare is a susceptible and regulated area of R&I, such reputation building of robustness of their R&I plays a greater role in building customer confidence. Additionally, multiple methods used by corporations to raise awareness of their international R&I activities enhance customer confidence and loyalty of firm innovation (Peacock 1993) Enhanced awareness, bolsters confidence in the reliability and superiority of the company’s offerings among customers, including other businesses, leading to increased customer trust and loyalty as well as market positioning (Gassman et al., 2009; Barnett and Storey, 2000; Birchall et al., 1996).

2.2.3 Impacts of generated reputation

Table 2.2: Impacts of reputation generated through international knowledge sharing engagements

Types of Impact	Specific Impacts
1. Relational Impact - Improved useful and strategic networks and relationships	Acceptance within the broader international scientific community Reducing partners' uncertainty of firms' capabilities
2. Resource Impacts - Increased availability of resources	Increased likelihood of becoming a source of valuable knowledge in the future
3. Research and Innovation Impacts - Increased research and innovation output	Increased partners' willingness to enter partnerships

Case Study: British Petroleum (BP)'s knowledge sharing strategy

British Petroleum (BP) is a leading global energy company, operating in more than 70 countries worldwide. It is known for its extensive operations as a n international producer of oil and gas and renewable energy. BP has adopted a remarkable strategic approach to knowledge sharing by effectively leveraging publications, conferences and industry events. While there may be no objective analysis definitively proving that this strategy increases trust and loyalty among its stakeholders including other businesses, customers and overall society, it offers valuable insights into the reasoning behind BP's decision to invest in such an approach. By examining BP's strategy and its impacts, we can better understand how the company aims to build an international reputation that enhances trust in its resources and capabilities, ultimately positioning itself for successful international collaboration.

International R&I activities:

BP disseminates its research, expertise and innovation through its publications, such as the BP Energy Outlook, and its publications in Digital Energy Journal. BP Energy Outlook explores the key trends and uncertainties, surrounding the energy transition, as well as explores the possible implications of different assumptions concerning the nature of energy transition based on existing technologies and predicting scenarios- for example, current trajectory and Net Zero. Digital Energy journal where it shares the latest discoveries and innovations in drilling, production, and related technologies. Since 1952, BP has produced a comprehensive review of the energy industry through its Statistical Review of World Energy, providing objective data and analysis on world energy markets. BP also shares valuable insights into its strategic initiatives, sustainability efforts, and financial performance through its Annual Report and sustainability reports. By leveraging high-quality and data-driven publications and addressing multiple stakeholders, BP solidifies its reputation and establishes itself as a thought leader in the energy sector. BP is also an active participant in major industry conferences, such as Cambridge Energy Research Associates (CERAWeek), the Offshore Technology Conference (OTC), and the World Petroleum Congress (WPC) as well as international aviation and sustainability conferences and exhibitions.

The nature of reputational impacts generated:

These knowledge-sharing activities provide BP with more opportunities to showcase its latest technological advancement, share best practices, and discuss trends in the energy industry and global energy landscape. Thereby, BP contributes to influential forums and demonstrates its leadership role in shaping the future of energy. For instance, BP's Energy Outlook has a significant global readership, attracting a wide audience interested in the future of energy markets and the energy transition. The report is widely used by policymakers, industry leaders, academics, and analysts to understand key trends and uncertainties in the global energy system. The 2024 edition of the Energy Outlook was viewed by over 20,000 people during its online launch. The reputation built on sharing insights, sustainability efforts, and technological advancement enhances the likelihood of increased trust among potential partners regarding the company's expertise and long-term visions. This underscores the company's reputation as a source of knowledge, unique resources, and collaboration, generating value for society with greater credibility in international R&I.

Source:
https://www.bp.com/en/global/corporate/sustainability.html
https://ceraweek.com/index.html
https://www.bp.com/en/global/corporate/energy-economics.html
https://www.bp.com/en/global/air-bp/news-and-views/air-bp-news

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2.3. Company-focused international strategic learning alliances

Forming international strategic learning alliances has become a popular strategy for companies looking to acquire new knowledge, capabilities, and access to markets in foreign countries. A learning alliance is an important category of strategic alliances where the primary objective of the partners is to learn from each other. As a result, strategic learning alliances have become a powerful tool for creating mutual benefits and enhancing the competitive positions of the partners (Tlemsani, et al., 2023). Joining an international learning alliance with other reputed members, who share similar values, enhances the company's reputation as a learning organisation, boosts confidence in the company's innovation, and improves the company's competitive positioning and brand awareness. This positive reputation then results in generating financial, relational, resources and research and innovation impacts (Figure 2.3).

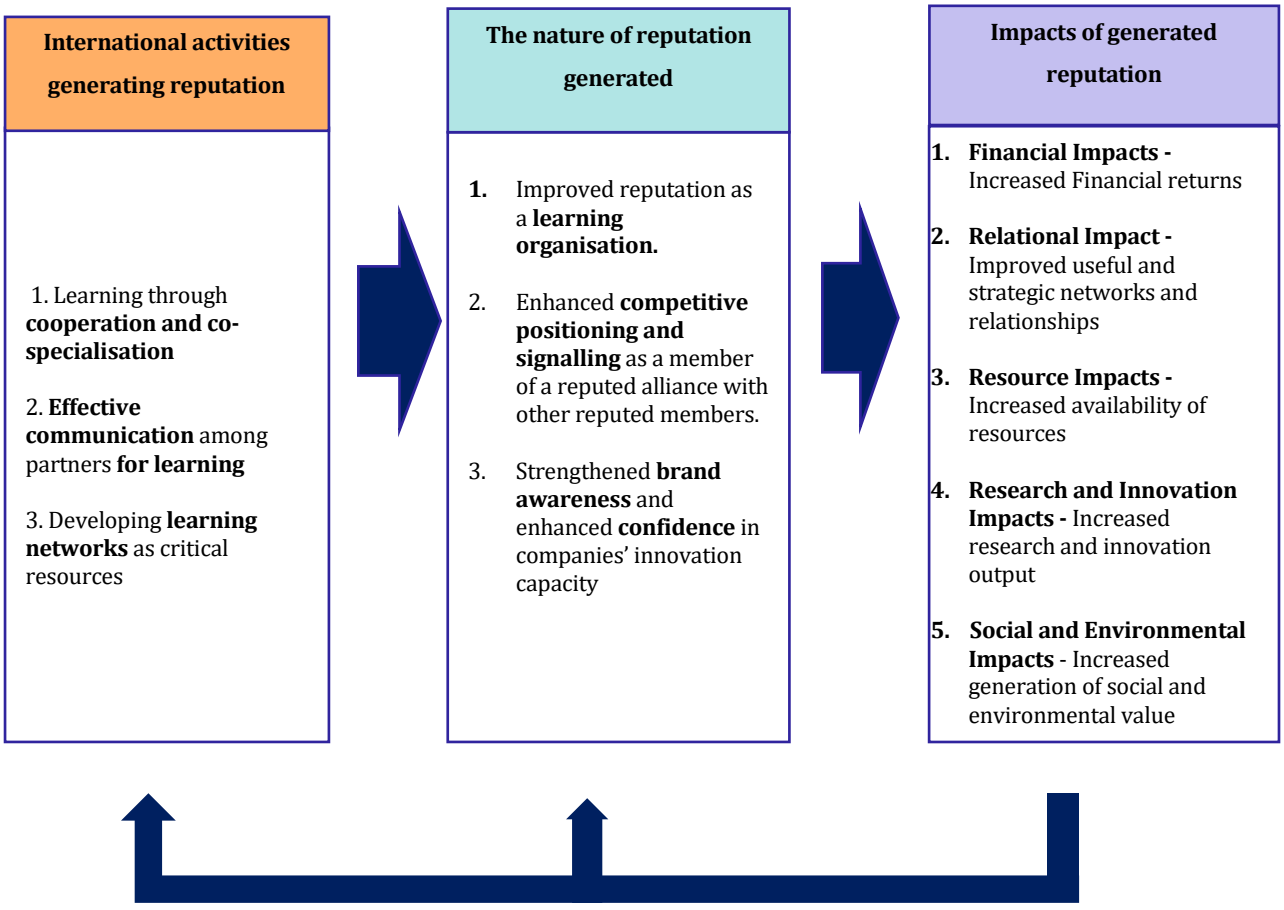

Figure 2.3. Company-focused international strategic learning alliances generating reputational impacts

2.3.1 International activities

Learning through cooperation and co-specialisation

Cooperation within strategic alliances involves learning through collaborative activities, which is essential for firms to achieve competitive advantages (Geleilate et al., 2021; Al-Tabbaa et al., 2019). The core idea behind the learning alliance approach is that by focusing equally on the processes of innovation and associated shared learning, as on the innovation itself, barriers to innovation, adoption, and replication can be effectively overcome (Moriarty et al., 2005). A thorough selection process of identifying research questions that link international partner coalitions ensures that members contribute effectively to the alliance's goals of scaling up and implementing innovative solutions that enhance learning (Moriarty et al., 2005).

Learning alliances enhance the international partners' ability to access tacit knowledge through collaborative activities within a team working environment (Kogut,1988). The learning alliance emphasises learning through collaboration among diverse national and international actors and the integration of multiple knowledge sources to address the complexities of fostering continuous technological, social, and institutional innovations in response to rapidly changing contexts and demands (Gotrett et al., 2005, p. 2).

Due to the emphasis on learning within the alliance, the national and international partners co-specialise through the corporation (Moriarty et al., 2005). For example, an alliance is formed between a tech company and a healthcare provider to develop innovative health monitoring systems. They leverage the tech company's software expertise alongside the healthcare provider's medical knowledge. In this context, each partner further specialises in their own area through further learning facilitated by the corporation.

One notable example of an international learning alliance is the partnership between Starbucks and Tata Global Beverages in India. In 2012, these companies formed a 50/50 joint venture to help Starbucks enter the Indian market. Tata provided local knowledge and expertise, while Starbucks brought its brand and coffeehouse experience.This alliance allowed both companies to learn from each other and leverage their strengths to achieve mutual benefits. Starbucks gained insights into the Indian market, and Tata benefited from Starbucks' global coffee expertise and brand recognition (The Strategy Society 2024).

It has been discussed in the literature that the future success of international strategic learning alliances depends on cooperative learning to establish a mutually beneficial relationship based on cooperation rather than competition. In this context, companies

develop a mutually beneficial learning environment to enable alliance partners to build a relationship that strengthens the strategic fit between the national and international companies for the long term (Morrison & Mezentseff, 1997). Learning alliances are sometimes formed as a series of interconnected national and international stakeholder platforms, accelerating the identification, development, and adoption of innovation. Each platform brings together national and international partners with complementary skills in areas like implementation, policy and legislation, research, learning, and documentation, as well as dissemination (Tlemsani, et al., 2023).

Effective communication among partners for learning- Creating learning platforms

Effective communication among national and international partners in a learning alliance is essential for learning, transferring knowledge and maintaining information flow in all directions. It is particularly crucial when partners believe that cooperation is the best strategy for achieving mutual benefits within a learning alliance (Tlemsani et al., 2023; Moriarty et al., 2005). Methods can include workshops, seminars, training and reflection sessions, joint fieldwork, process documentation, the use of a virtual learning platform and list server, and documenting positive experiences that exist in similar cultural or geographic contexts. These methods facilitate communication among members of the alliance, allowing participants—such as researchers, policy-makers, civil society organizations, and others involved in the alliance—to easily share information, collaborate on projects, and stay informed about the latest developments within the group (e.g. www.alianzasdeaprendizaje.org).

Collaboration toolkits are designed as prototypes, which different partner organizations are expected to adapt to suit individual needs and contexts. Partners undertake a review of existing practices and toolkits, noting relevant and existing knowledge, results, literature, institutional experience, and current work by partner organisations for improvements. The establishment of a joint platform with stakeholders, such as a multi-stakeholder platform facilitates collaborative innovation, knowledge sharing, and effective management of the complexities, given broad-based international alliances and potentially conflicting interests. Especially when the alliance has international partners digital means of learning and collaboration are critical (Moriarty et al., 2005).

Developing networks as critical resources

Learning alliances not only support the organisations in strengthening skills in research, training, and facilitation but also build up a network with communities and local authorities as well as with a number of national-level stakeholders and international organisations (Moriarty et al., 2005). Additionally, network connections between alliances can significantly affect resource sharing and the ability to take risks. The adoption of effective learning approaches is

essential for creating these critical networks, along with the necessary institutional structures and capacities. Sometimes these learning networks are involved in collaborative addressing local needs – such as water rural supply issues. These international networks of companies and other stakeholders learn by innovating solutions in collaboration with citizens (Tlemsan, et al., 2023).

2.3.2 The nature of reputation generated

The reputation generated from the above activities manifests in several ways.

- **Improved reputation as a learning organisation**

  By co-specializing and learning from national and international organizations with complementary assets, the alliance partners improve their reputation as a learning organization. The inter-organizational relationships aimed to acquire knowledge for achieving organizational development by allowing partners to obtain knowledge from each other showcases the capacity to identify, transform, and internalize the knowledge that resides with these partners (Schreiner et al. 2009), ultimately leading to the establishment of reputation as a learning organization (Haberberg & Rieple, 2001).

- **Competitive positioning and signalling as a member of a reputed alliance with other reputed members**

  Cooperative activities and effective and open communication among partners foster collaboration, enhancing competitive positioning and signalling membership in a reputed alliance internationally, regionally and nationally with shared values (Haberberg & Rieple, 2001; Lundy et al., 2005). For example, the EMPOWERS partnership, a successful learning alliance, facilitated by thirteen international organisations[2] funded by the European Commission, aims to improve water governance and long-term access to water in regions experiencing scarcity of water with a focus on capacity building in developing countries. The nature of the reputation generated from this international collaboration with reputed members strengthens the members of the learning alliance's competitive positioning in terms of the quality of innovation and consideration of the environmental sustainability of their organisation (Moriarty et al., 2005).

[2] Ministry of Agriculture - Water Department, Inter-Islamic Network on Water Resources Development and Management, and CARE Jordan (Jordan); Palestine Hydrological Group, Union of Agricultural Work Committees, and CARE West Bank/Gaza (Palestine); Development Research Technology & Planning Centre at Cairo University, Social Planning, Analysis and Administration Consultants, National Water Research Centre of the Ministry of Water Resources and Irrigation, Egyptian Water Partnership and CARE Egypt (Egypt); IRC (the Netherlands); and CARE International (USA, UK and NL).

- **Strengthen brand awareness and enhanced confidence in companies' innovation**

  Establishing learning platforms and building networks further strengthens brand awareness and boosts confidence in the alliance's and associated national and international member organizations' innovation capabilities for future international R&I collaborations, positioning them as leaders in collaborative learning and innovation. Network building in a learning alliance establishes a strong reputation by showcasing the ability of organisations to access financial, human, and intellectual resources essential for their innovation success. This in turn strengthens brand awareness and confidence in companies' innovation ability. Commitment to transparent and adaptive learning processes enhances the alliance's and associated member organizations' credibility and reputation as trustworthy and effective entities capable of navigating and collaboratively resolving complex challenges and successfully engaging in international R&I collaborations (Tlemsan, et al., 2023).

2.3.4 Impacts of generated reputation

Table 2. 3: Impacts of reputation generated through international strategic learning alliances

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Enhanced market share of companies Improved profit through new products, processes, services, and learning
2. **Relational Impact** - Improved useful and strategic networks and relationships	Increased opportunities for building international networks
3**. Resource Impacts** - Increased availability of resources	Increased opportunities to access resources and funding, and develop knowledge, skills, and capabilities
4. **Research and Innovation Impacts** - Increased research and innovation output	Innovation in products, services, processes and business models
5. **Social and environmental impacts** - Increased generation of social and environmental value	When the learning alliance innovates to address social/environmental challenges, its reputation further enhances such opportunities

Case Study: The Strategic Learning Alliance between Rolls-Royce and Singapore Airlines

The strategic learning alliance between Rolls-Royce, a UK-based engineering company, and Singapore Airlines is a prime example of how international strategic learning alliances aimed at enhancing learning through joint R&I activities can generate reputation. This alliance, established to develop and maintain advanced aircraft engines, leverages the strengths of both companies to drive technological advancements and operational excellence.

» *International R&I activities:*

Rolls-Royce and Singapore Airlines collaborate on various R&I activities, including the development of next-generation aircraft engines and the implementation of advanced maintenance, repair, and overhaul (MRO) technologies. The partnership involves joint international research projects, shared facilities, and cross-company teams working on innovative solutions to improve engine performance and efficiency. These activities are conducted across multiple locations, including Rolls-Royce's research centers in the UK and Singapore Airlines' engineering facilities in Singapore.

One significant outcome of this collaboration is the development of the Rolls-Royce Trent 1000 engine, which powers the Boeing 787 Dreamliner. This engine incorporates advanced materials and design features that enhance fuel efficiency and reduce environmental impact. The alliance also focuses on digital innovation, utilizing data analytics and predictive maintenance technologies to optimize engine performance and reduce operational costs

» *The nature of reputational impacts generated:*

The strategic learning alliance between Rolls-Royce and Singapore Airlines has generated substantial reputational benefits for both companies. For Rolls-Royce, the successful development and deployment of advanced aircraft engines have reinforced its reputation as a leader in aerospace engineering and innovation. The collaboration with Singapore Airlines has also highlighted Rolls-Royce's ability to work effectively with global partners, enhancing its credibility and attractiveness as a research collaborator.

Singapore Airlines, on the other hand, has benefited from the alliance by showcasing its commitment to operational excellence and innovation. The partnership with Rolls-Royce has positioned Singapore Airlines as a key player in the aviation industry, capable of driving significant technological advancements. This has not only enhanced Singapore Airlines' reputation but also attracted additional investment and partnerships from other leading aerospace companies.

The reputational impacts of this alliance extend beyond the immediate technological achievements. Both Rolls-Royce and Singapore Airlines have gained increased visibility and credibility in the global aerospace community, facilitating further international collaborations and attracting top talent. The alliance has demonstrated the effectiveness of combining engineering expertise with operational excellence to achieve groundbreaking results, setting a precedent for future strategic learning alliances in the aerospace sector.

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2.4. Company-focused international collaboration for Knowledge Intensive Business Service (KIBS) innovation

Firms in the knowledge-intensive business services (KIBS) that heavily rely on professional knowledge – such as those in legal services, information technology, consultancy, accounting and finance, and creative industries – engage with international ecosystem actors for service-based innovations. KIBS predominantly provides knowledge-intensive support for the business processes of other organizations (Miles, et al., 2018). Due to the specific nature of their innovation associated with specialized knowledge, the generation of reputational impacts through international R&I has a greater reliance on the reputation of individuals associated with KIBS (e.g. designers). Additionally, since the knowledge has to be highly contextualised to specific localities and scenarios, the international R&I of KIBS involves greater customisation of knowledge (Abecassis-Moedas et al., 2012; Rodríguez et al., 2018; Enkel and Heil, 2014; Gertler, 2003; Herrmann, Taks, and Moors, 2012). These unique features result in the pathways for reputation building being different from other forms of R&D collaborations discussed in section 2.1 of this report.

The rising demand for international collaboration for KIBS innovation is driven, in part, by the swiftly evolving technological landscape and the increasing complexity of scientific advancements, which demand service innovation (Zieba, 2013). International collaboration for KIBS innovation may involve collaborating on specialized professional knowledge for service innovation, establishing international offices for localized and customized service innovation, exporting creative processes through international collaborations, and competing in prestigious global innovation awards. These activities enhance the credibility of KIBS in delivering customized and culturally embedded innovative solutions. Such reputation building leads to financial, relational, and research and innovation impacts (Figure 2.4).

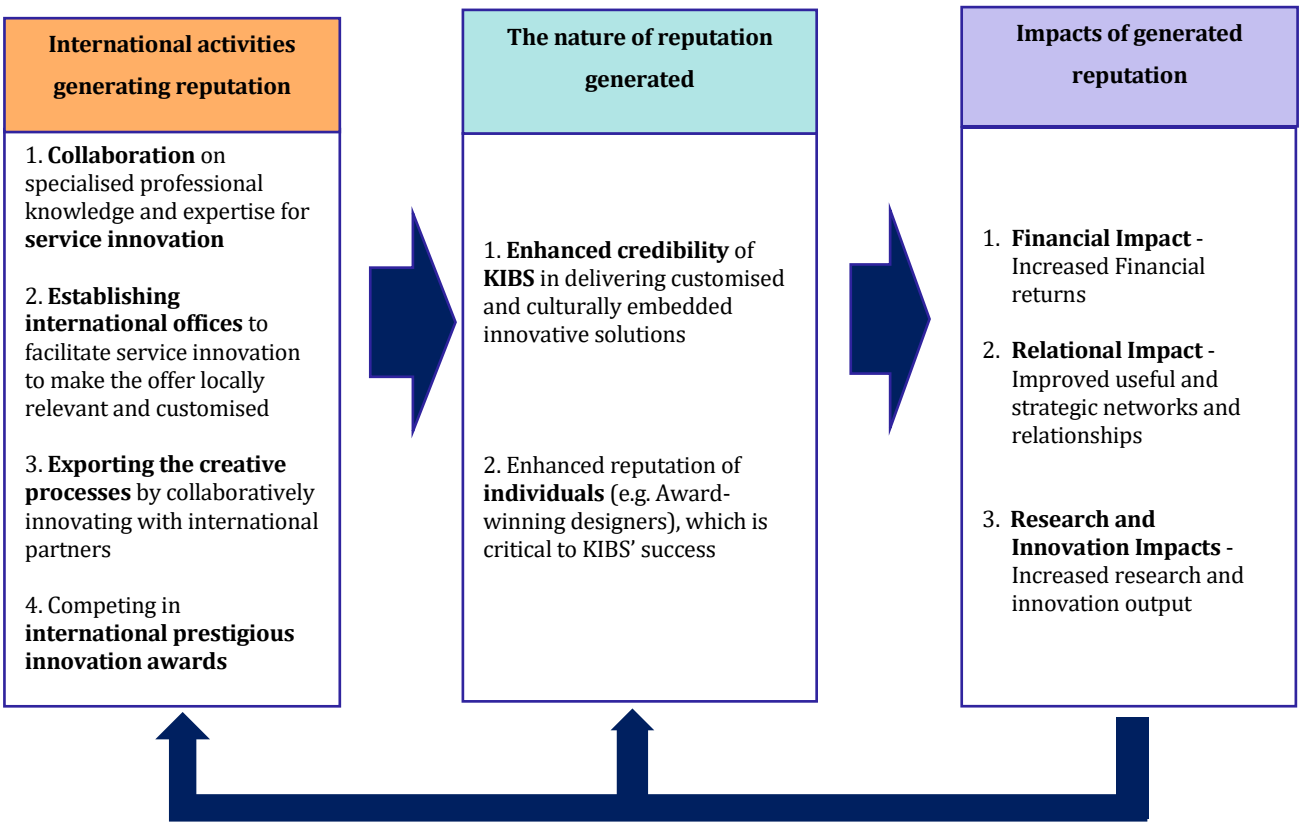

Figure 2.4. Company-focused international collaboration for KIBS innovation generating reputational impacts

2.4.1 International activities

Collaboration on specialized professional knowledge and expertise for service innovation

There is a strong link between KIBS and the overall economy's innovation and performance levels (Hipp, 1999; Tomlinson, 1999; Aslesen & Isaksen, 2007). There is a growing consensus that KIBS not only engages in innovation activities to support the service sector but also serves as "bridges of knowledge" or "innovation bridges," by collaborating with the science, manufacturing sector, and customers (Czarnitzki & Spielkamp, 2003). KIBS firms thus often engage in joint projects with other organizations to share and develop mutually valuable specialized expertise (Windrum and Tomlinson, 1999). Collaboration enables firms in non-service sectors to access resources and capabilities that are not available internally but are important for R&D success (Oxley and Sampson, 2004). Such collaborations have been demonstrated to positively impact the innovation performance of firms in both domestic

(Belderbos, Carree, and Lokshin, 2004; Faems, Van Looy, and Debackere, 2005) and international partnerships (Ebersberger and Herstad, 2013; Rodríguez and Nieto, 2012).

For example, Arm Holdings plc, a British semi-conductor and software design company, partnered with Intel, based in Silicon Valley, USA, in 2018 to share code for embedded systems through the Yocto Project. This is an open-source initiative that aims to create flexible, customizable, embedded, and specialized computing systems that are part of larger devices, such as automotive control systems, medical devices, and consumer electronics. In 2023, Arm Holdings partnered with Intel Foundry Services to bring Arm SoCs to Intel's 18A process, a fabrication technology and process node that is used to make chips (Intel.com).

Studio Marco Piva, an Italian architecture firm, developed specialized competencies and a strong reputation in managing large-scale architectural projects (Abecassis-Moedas et al., 2012). They have forged partnerships with engineering firms and architectural studios worldwide (see Case study D in the case study). By working with complementary experts Studio Marco Piva was able to innovate and provide advanced architectural solutions, by leveraging the specialized knowledge and skills of both their own team and their partners.

These collaborations are clear examples of KIBS firms engaging in international joint projects that involve the sharing and development of specialized expertise across borders. These international collaborations provide access to unique expertise that wouldn't be available domestically, thereby enhancing the overall effectiveness and innovation of the projects and their ability to innovate and provide advanced solutions (Abecassis-Moedas et al., 2012).

Establishing international offices that support KIBS internationalisation

Establishing international offices is a strategy employed by KIBS firms to innovate to enhance their ability to provide locally relevant and customized services (Rodríguez et al., 2018). The establishment of these offices is important for KIBS due to the nature of the individual level of engagement with their international partners and/or customers. This approach aligns with the finer points of international collaboration in those types of KIBS, where the "proximity" of the partner is emphasized as a decisive factor in their operating model (Enkel and Heil, 2014; Gertler, 2003; Herrmann, Taks, and Moors, 2012).

By opening branches in different countries, KIBS firms can reduce geographical distance and enhance their proximity to clients, enabling closer and more effective R&I collaboration. A better understanding of local market needs and preferences, opportunities for interactions and shared knowledge, and repertoire elements due to their operation in local contexts (Teixeira,

Santos, and Oliveira-Brochado, 2008) foster productive international R&I (Rodríguez et al. 2018). For example, when multiple potential clients are concentrated in the same geographical area and share similar cultural approaches, establishing international offices allows design consultancy companies to gain a deep understanding of the clients through frequent interactions and collaborations, which could be used for innovating customized services. This proximity also enables the consultancy to become well-acquainted with the client's market and better understand local codes and signals (Abecassis-Moedas, et al., 2012).

KIBS firms like PwC UK (PricewaterhouseCoopers UK) - which provides a wide range of professional services including auditing, consulting, tax advisory, technology consulting and, strategy consulting, structured design processes to serve global clients - involve meticulously organized teams, collaborating with local firms, governments and institutions in the countries where it operates. PwC's collaborations involve co-developing solutions and tailoring innovative services to ensure consistent and high-quality outcomes meeting the specific needs of local markets (see further example in case study B).

Exporting creative processes by collaboratively innovating with international partners

Certain KIBS firms can export their creative processes to international markets, not necessarily establishing international offices, but by collaboratively innovating with international partners. Unlike non-KIBS firms, due to the specific service nature of KIBS, these firms' export strategy involves collaboratively innovating with international partners. For instance, Jones Knowles Ritchie (JKR), a UK-based design company, exports their structured design processes to serve global clients (See Case study A). Their approach involves meticulously organized international teams for each project, overseen by an executive director ensuring consistent and high-quality outcomes across projects achieved through international R&I. This structured international R&I process allows them to handle numerous projects annually while maintaining quality, uniformity, and consistency across international countries. By effectively appropriating the benefits derived from creative R&I processes, the KIBS' internationalisation strategy entails exporting these processes while maintaining centralized operations to ensure uniformity and quality (Abecassis-Moedas et al., 2012).

Competing in international prestigious innovation awards

Another unique characteristic of KIBS is that a significant amount of knowledge is held by individual experts (Starbuck, 1992), who create bespoke innovations tailored to specific clients (Løwendahl, 2005), typically through face-to-face interactions during service delivery, making it context-specific (Blackler, 1995). A key activity facilitating such in-person international R&I is thus the credibility developed in international markets. Therefore, competing in prestigious

international awards is key for KIBS firms that rely on the reputed names of individuals such as designers. For example, the Massaud agency, founded by Jean-Marie Massaud, thrives on his individual ingenuity and renown as a globally acknowledged designer. His notable projects include furniture for Cappellini and Cassina, products for Lanvin and Yamaha Offshore, and architectural projects such as the Volcano Chivas Stadium in Guadalajara and the Life Reef condominium towers (Abecassis-Moedas et al., 2012). Participation in and winning prestigious awards, such as the Red Dot Design Award, enhances the reputation of individual designers and the firms they represent by showcasing their excellence and innovation in design, which is essential to collaboratively engaging in KIBS R&I.

2.4.2 The nature of reputation generated

- **Enhanced credibility of KIBS in delivering customised and culturally embedded innovative solutions**

  The reputation of KIBS for delivering customized and culturally embedded innovative solutions is significantly enhanced by their ability to navigate and integrate local cultural, regulatory, and organizational nuances into their services, achieved through international R&I. This is crucial, particularly in contexts where deep social and institutional proximity is required to build trust and effective communication with clients (Toivonen, 2004; Miles, 2005; Corrocher, Cusmano & Morrison, 2009). KIBS are renowned for their ability to balance global reach with local relevance and excel in interpreting socio-cultural trends and customizing their offerings to meet specific regional needs, especially in settings such as KIBS legal services, accounting, bookkeeping and tax consultancy services, management consultancy services such as KPMG and PwC, and architectural, design and engineering (Verganti, 2006). By doing so, KIBS build a strong reputation for delivering solutions that are not only innovative but also deeply embedded in the cultural context of the regions they serve (Abecassis-Moedas et al., 2012).

- **Enhanced reputation of individuals critical to KIBS' success**

  The reputation built by individual experts through international R&I and associated activities plays a pivotal role in the success of KIBS as a significant amount of knowledge within KIBS is possessed by these individual experts, who develop customized problem-solving techniques tailored to specific clients' needs (Abecassis-Moedas et al., 2012). Such accolades showcase their excellence and innovation on an international stage, which is crucial for KIBS as it helps in generating a global reputation.

2.4.3 Impacts of generated reputation

Table 2.4: Impacts of reputation generated through international collaboration for KIBS innovation

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Improved business profit through the internationalisation of KIBS and service innovation
2. **Relational Impact** - Improved useful and strategic networks and relationships	Improved relationships with service business-to-business clients Expanded useful international networks
3. **Research and Innovation Impacts** - Increased research and innovation output	Increased launching of new services in new markets Increased opportunities for collaboration in larger, international, profitable, and strategically relevant projects

Case Study: Three different models of international collaborations for KIBS Innovation: generating reputational impacts

Design consultancies, a type of KIBS firms, use diverse strategies to build and maintain their international reputation. The following three case studies discuss how two UK design consultancies JKR and Webb de Vlam, and a French design agency, Massaud generated reputational impacts through different models of KIBS international R&I.

›› *Case 1: International R&I teams managed through the UK headquarters:*

JKR, founded in 1990, is a leading UK design company specializing in consumer goods packaging. The firm employs a structured, formalized design process, managed by meticulously organized international and national teams and overseen by an executive creative director. Despite its global project scope, JKR operates solely from its UK headquarters to maintain process uniformity and high-quality outcomes, especially relevant to design-type KIBS innovation. JKR collaborates with a diverse range of international partners, including global consumer goods companies, leading academic institutions, and innovative technology firms. JKR has partnered with companies including Unilever, AB InBev and Kraft Heinz, through to disruptors like Hippeas, Ugly Drinks and The Gut Stuff to create work recognized by the industry's top events, award shows and publications. These partnerships enable JKR to stay at the forefront of design trends. For instance, JKR has worked with multinational corporations like Unilever and Mars, leveraging their extensive market reach and consumer insights to create impactful packaging designs. International R&I activities help JKR advance its designs by integrating the latest innovations and consumer preferences into its design processes.

›› *The nature of reputational impacts generated:*

These international collaborations and R&I activities significantly enhance JKR's reputation. Their ability to deliver high-quality, innovative designs consistently from a centralized location demonstrates their efficiency and expertise. JKR's consistent and high-quality output from centralized operations builds trust and enhances relationships with B2B clients. Especially this is because the KIBS offerings are central around specific knowledge-based capabilities, which are often difficult to replicate. This reputation for excellence attracts larger, international collaborations, as companies seek out JKR's proven track record and creative prowess. Furthermore, the ability to export its creative processes through international R&I allows JKR to introduce new services in various markets, expanding its global footprint and reinforcing its status as a leader in the design industries.

Sources: interview with Andy Knowles and Ian Ritchie from international brand agency Jones Knowles Ritchie (JKR); Jones Knowles Ritchie | Creative Lives in Progress; Abecassis-Moedas et al. (2012)

›› *Case 2: International R&I offices:*

Webb de Vlam, founded in 1992 [and later acquired by sgsco in 2016], is a UK-based strategic brand design design firm that has expanded its operations by establishing offices in the US and Australia. This international expansion strategy aims to enhance client relationships through frequent interactions and local market research. Establishing foreign offices has enabled Webb de Vlam to build close client relationships, foster collaborative innovation, and better understand local market needs, thereby fostering trust and long-term partnerships, essential for KIBS innovation. Unlike JKR, whose expertise lies in centralized design capabilities, Webb de Vlam's excellent relies more on its ability to offer customized brand building to different localities.

Webb de Vlam collaborates with a diverse range of international partners, including global consumer goods companies, leading academic institutions, and innovative technology firms. For instance, they have worked with multinational corporations such as Procter & Gamble, Kraft, and 3M, leveraging these partnerships to gain insights into global market trends and consumer preferences. These collaborations allow Webb de Vlam to integrate advanced technologies and innovative design solutions into their projects, ensuring that their products meet the highest standards of quality and innovation.

Case Study: Three different models of international collaborations for KIBS Innovation: generating reputational impacts (Cont…)

The nature of reputational impacts generated:

These international collaborations and R&I activities significantly enhance Webb de Vlam's reputation. Their ability to deliver high-quality, innovative designs consistently from multiple locations demonstrates their efficiency and expertise. The local offices facilitate better market penetration and customer intimacy, which are crucial for building credibility, trust, and reputation. This enhanced reputation translates into increased business profitability, as clients are more likely to engage with a firm known for its innovative solutions and reliable service. This reputation for excellence attracts larger, international collaborations, as companies seek out Webb de Vlam's proven track record and creative prowess. Furthermore, the ability to export their creative processes through international R&I offices allows Webb de Vlam to introduce new services in various markets, expanding their global footprint and reinforcing their status as a leader in the design industry.

Sources: Ronald de Vlam - Industrial Designers Society of America; Sgsco acquires global innovation and design agency Webb deVlam - WhatTheyThink; Abecassis-Moedas et al. (2012)

Case 3: International R&I relying on the personal reputation of the founder:

The Massaud agency, founded by Jean-Marie Massaud in 1996 in France, operates across various design fields, including furniture, industrial products, equipment, and architecture. The agency collaborates with high-profile brands such as B&B Italia, Axor Hansgrohe, Lancôme, and Renault. The agency's reliance on the personal reputation and creativity of Jean-Marie Massaud strengthens direct client relationships. This personal approach fosters trust and long-term partnerships with high-profile clients.

Massaud collaborates with a diverse range of international partners, including luxury brands, automotive companies, and leading manufacturers. For instance, their partnership with B&B Italia involves creating innovative and stylish furniture designs that blend functionality with aesthetic appeal. As presented in the B&B Italia website, the international collaboration attributes to the world-leading individua designers, including Jean-Marie Massaud. Collaborations with Axor Hansgrohe focus on developing cutting-edge bathroom fixtures that combine advanced technology with elegant design. The website of the Axor attributes the individual designer, Jean-Marie Massaud when marketing the AXOR Massaud new design product range.

The nature of reputational impacts generated:

These international collaborations and R&I activities significantly enhance Massaud's reputation. Here the reputation is often built through the individual, Jean-Marie Massaud. While his reputation enables him to engage in these international collaborative R&I, through the output of such projects, he further develops his reputation, which is crucial for building credibility, trust, and reputation of the company. The high profile of Massaud's projects attracts international clients seeking innovative and unique design solutions, leading to profitable and strategically relevant collaborations. The Massaud agency's strategy of leveraging the founder's individual reputation and creativity, combined with strategic international partnerships and R&I activities, has led to significant reputational building and associated business impacts.

Source : Abecassis-Moedas et al. (2012).

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2.5. Company-focused international R&I collaborations with social and environmental value

Companies integrate their collaborative R&I activities with social and environmental responsibility. This often occurs when there are international challenges that cannot be resolved or opportunities that cannot be seized through domestic collaboration. As a result, companies in collaboration with other international private and private sector organisations and communities engage in R&I activities (Hull & Rothenberg, 2008; Padgett & Galan 2010; Wagner, 2010; McWilliams & Siegel, 2000).

Coupling R&D with innovation that generates environmental and social impacts is evidenced to result in more positive corporate reputation and trust building among stakeholders, compared to only focusing on profit-oriented R&D initiatives. By positioning itself as a trusted R&D-intensive firm, the company enhances its competitive signalling across both national and international communities. This, in turn, bolsters its brand image as an innovative entity committed to creating value for society and the environment. Consequently, this leads to increased customer acceptance and confidence in its innovative products and services, as they are perceived to come from a socially and environmentally responsible company (Hull& Rothenberg, 2008; Padgett & Galan, 2010; De Silva et al 2024). Positive reputation thus generates financial, relational, research, innovation, social and environmental impacts [Figure 2.5]

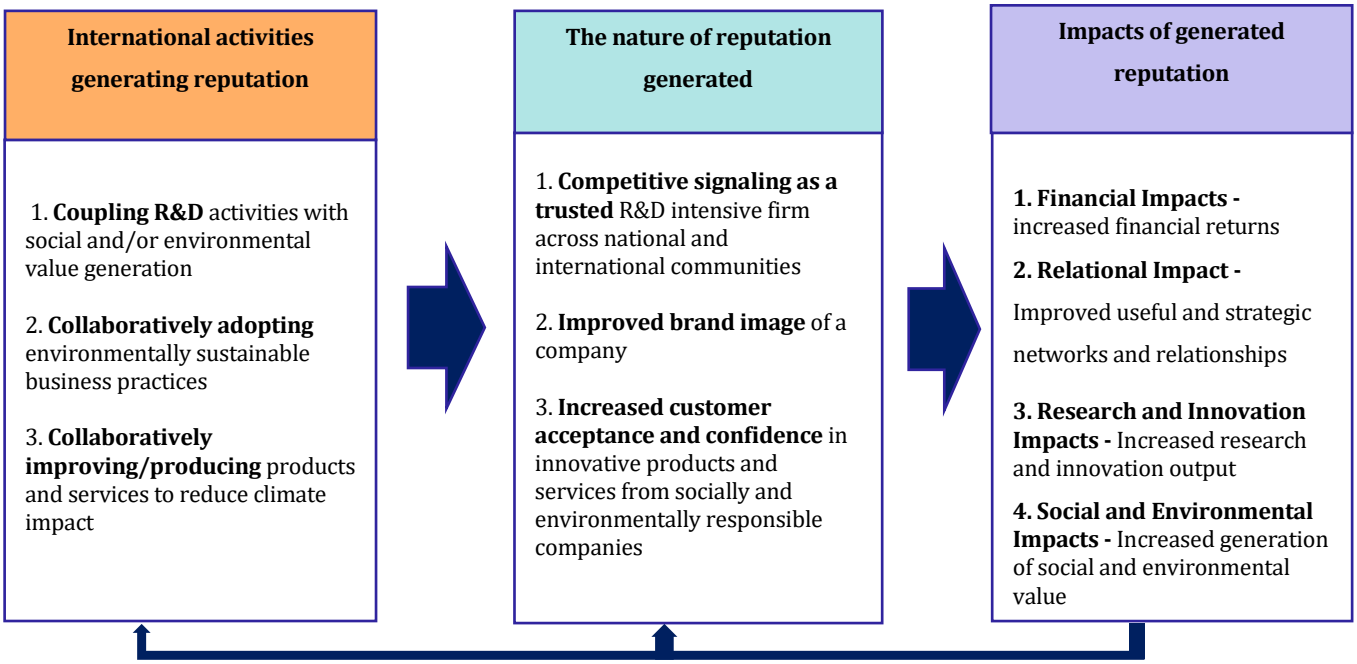

Figure 2.5: Company-focused international R&I collaborations with social and environmental value generating reputational impacts

2.5.1 International activities

Coupling R&D activities with social and/or environmental value generation

Research increasingly acknowledges that companies' social and environmental responsibility activities and R&D are complementary (Branco & Rodrigues, 2006; McWilliams & Siegel, 2000; Padgett & Galan, 2010), and integrating them when possible is more advantageous (Chun, 2006; Padgett & Moura-Leite, 2012). Innovations that generate high social benefits alongside private gains create a balance that motivates companies to innovate, leading to increased profits while contributing positively to society (Wagner, 2010). Especially since many social and environmental challenges are global, companies are engaged in international R&I for such coupling of diverse values.

The Tres Cantos Open Lab Foundation, where companies, universities, and public sector organisations collaborate to discover drugs for neglected diseases in the developing world, is an example of this nature. At the Tres Cantos Open Lab Foundation, GSK collaborates with researchers from the University of Helsinki, University of Minnesota, Sapienza University of Rome, Weill Cornell Medical College, Durham University, Liverpool University, London School of Hygiene and Tropical Medicine, New York University, Northeastern University, Omnia Molecular and Seattle Biomedical Research Institute, and Centre for Cooperative Research in Biosciences. In this collaboration, GSK aligns its profit generation objectives with a social mission in order to discover drugs for neglected diseases. The collaborators benefited from GSK's commercial expertise and resources and GSK benefited from other researchers advanced up to date knowledge and skills (De Silva et al 2019).

Collaboratively adopting environmentally sustainable business practices

Companies engage in international R&I to reduce greenhouse gas emissions, develop climate-resilient practices, and promote the use of renewable energy, in order to address climate change and related responsibilities (Hoffman, 2005; Kolk and Pinkse, 2004; Wittneben and Kiyar, 2009). Investing in climate-resilient and resource-efficient assets offers a significant advantage under global warming pressures (Gasbarro et al., 2016). Considering the global nature of environmental sustainability practices international R&I can lead to greener business operations, offering more opportunities for companies to collaboratively discuss, share knowledge, and resources and adopt green strategies and practices (Wittneben & Kiyar, 2009). An example of such integrations is companies engaging in international R&I to reduce greenhouse gas emissions (Gasbarro et al., 2017; Patenaude, 2010; 2011) and to find solutions to the business impacts of climate change such as disruption to their operations,

supply chains, and markets (Linnenluecke and Griffiths, 2010; Porter and Reinhardt, 2007; De Silva et al 2024).[3]

Collaboratively improving and/or producing products and services to reduce climate impact

While physical impacts from climate change pose major challenges to businesses, these challenges have also been transformed into business opportunities. Companies thus engage in international R&I to capitalize on climate-friendly market opportunities associated with green innovation (Pyke et al., 2012) and energy production methods (Gasbarro et al., 2016) can gain a competitive edge (Porter & Reinhardt, 2007). In recent years, many companies have invested in international R&I to develop new energy sources and production methods. UK-based energy companies such as ITM Power, BP and Octopus Energy are heavily involved in international R&I related to green hydrogen generation and renewable energy, engaging in multi-billion collaborative R&I projects globally. For example, BP, Aviva, Hastings Direct and Honda R&D Europe have developed a collaborative initiative in a shared research program to accelerate the evolution of future transport systems for smart cities (World Energy Investment 2020; Clean Energy Investment 2020).

By engaging in international R&I to align companies' products and services with climate-related market drivers and regulatory expectations, they can increase profit and mitigate the risks associated with negative environmental impacts (Hoffman, 2005; Kolk & Pinkse, 2004). This approach involves developing energy-efficient products and services (Wittneben & Kiyar, 2009). Improving the environmental performance of products and services can be achieved through cooperation with suppliers and customers (Zhu et al., 2008). By involving both international and national customers and suppliers in decision-making processes related to green issues, companies collaboratively innovate greener products and services (Teixeira et al., 2016).

2.5.1 The nature of the generated reputation

Competitive signalling as a trusted R&D-intensive firm across national and international communities

Reputation is recognised as one of the most significant intangible resources that grant a firm sustainable competitive advantage (Padgett & Moura-Leite, 2012). There is a broad consensus that corporate social performance significantly influences a firm's reputation

[3] https://www.bp.com/en_gb/united-kingdom/home/news/press-releases/aviva-bp-hastings-direct-and-honda-r-and-d-europe-unite-to-accelerate-the-evolution-of-future-transport-systems-for-smart-cities.html

(QuevedoPuente, et al. 2007). Additionally, research indicates a positive correlation between firms' socially responsible activities, profitability, and R&D intensity (Hull& Rothenberg, 2008; Padgett & Galan, 2010; Surroca, Tribó & Waddock, 2009; Orlitzky, Schmidt & Rynes, 2003; Wood, 2010; Wagner, 2010). Therefore, R&D activities that generate social benefits have a greater positive impact on corporate reputation, image, and trust building compared to those that solely deliver R&D output. This is because R&D activities that generate social and environmental value are noticed by wider national and international stakeholders, who focus on the purpose of companies, in addition to shareholders, who predominantly focus on profitability (Padgett & Moura-Leite, 2012; Iglesias et al (2020). Many firms emphasize integrating R&D activities with social and environmental value generation as important to managing their reputation and cultivating reliability, trust, and integrity of their R&D intensity (Davies & Miles, 1998).

Additionally, joining international environmental alliances for R&I can lead companies to position themselves alongside reputed greener companies, enhancing their credibility and market signalling of their R&D capabilities to work with reputed partners (Gasbarro et al., 2016). Making the supply chain greener through international R&I partnerships and alliances demonstrates a commitment to sustainability, bolstering the company's reputation in the market (Li et al., 2014; Akhavan and Beckmann, 2017). The reputation gained by aligning a firm's R&D activities with social and environmental values thus serves as a strong competitive signal as a credible international R&I collaborator (Mackey et al., 2007).

Improved brand image of a company

Collaboratively engaging in international R&I to implement strategies to address climate change, such as reducing greenhouse gas emissions, developing climate-resilient infrastructure, and promoting renewable energy, not only build the reputation of R&D strength of the firm, but also can significantly boost a company's public relations and brand image (Hoffman, 2005; Kolk & Pinkse, 2004; Wittneben & Kiyar, 2009). This ensures business continuity in an era of greater focus on the climate. By changing business operations and behaviour to become greener through international R&I, companies can collectively strengthen their brand loyalty (Lash and Wellington, 2007; Wittneben & Kiyar, 2009). Implementing strategies and sharing resources to address climate change, as well as improving products and services that align with regulatory expectations and market drivers enhance the company's image (Hoffman, 2005; Kolk and Pinkse, 2004; Wittneben and Kiyar, 2009).

When companies operate across borders, they are more likely to have an international network to combine social and business elements, and thus develop levels of trust in their operations. In relation to multinational enterprises, developing trust in their host countries is crucial for success. Often host countries have a negative perception of multinational enterprises believing that they exploit host country resources. Yet, combining social activities with their host country's R&D could help multinational enterprises (MNE) overcome such negative reception and develop the brand image as a company creating value for society and the environment (Zhang et al 2024). An example is Siemens, a multinational enterprise that has established significant R&D operations in China that generate social and environmental value. Siemens collaborates with local universities and research institutions to develop advanced technologies in automation and digitalization. This collaboration has helped Siemens build a strong reputation in China as an innovator and a valuable contributor to the local economy. MNEs can leverage R&D activities in host countries to enhance their reputation and brand image by addressing local needs and contributing to societal and environmental goals (Le and Morschett, 2023).

Increased customer acceptance and confidence in innovative products and services from socially and environmentally responsible companies

A firm's reputation is shaped by developing virtuous attributes (Chun 2006). A firm's socially beneficial R&D activities lead to greater acceptance by customers (Chun, 2006, Branco & Rodrigues, 2006; McWilliams & Siegel, 2000; Padgett & Galan, 2010). By integrating innovation activities and leveraging R&D knowledge with socially responsible attributes, firms differentiate themselves from competitors with greater appeal to customers (Ullah & Arslan, 2022; Fombrun & Shanley, 1990). Research shows that consumers prefer products with socially responsible characteristics. For example, the "Hybrid" version of Honda Accord- which has less negative environmental impact is more favored by consumers than the standard version (McWilliams, Siegel & Wright 2006). This highlights the significance of product differentiations based on social and environmental impacts in enhancing or maintaining the firm's reputation (McWilliams et al., 2006). High-reputation firms are seen as offering greater value, which often enables them to charge higher prices for their products, and their customers tend to be more loyal (Keh & Xie, 2008). Therefore, international R&I that integrates social and environmental value offers firms the opportunity to increase acceptance and confidence in innovative products and services (Ullah & Arslan, 2022).

2.5.3 Impacts of reputation generated

Table 2.5: Impacts of reputation generated through international R&I collaborations with social and environmental value

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Ensure business continuity in an era of greater focus on the climate Improved market valuation/ stock market price Increased availability of funding and other financial resources available for greener companies Reduced costs through the leveraging of increased opportunities for shared addressing of environmental challenges affecting the business
2. **Relational Impact** - Improved useful and strategic networks and relationships	Enhanced opportunities to access, strengthen, collaborate with, and develop new, useful networks Enhanced employee satisfaction Stronger relationships with stakeholders
3. **Research and Innovation Impacts** - Increased research and innovation output	Increased opportunities for collaboration
4. **Social and environmental impacts** - Increased generation of social and environmental value	Generating a stronger link between profit generation and social and environmental impacts leading to the simultaneous generation of business, social, and environmental value Increased opportunities for businesses to engage in policy-making and advisory roles

Case Study: H&M's Journey to Reputation Building through Sustainability Initiatives

Fast fashion brands – such as H&M, Zara, and Forever 21 – launch new styles weekly or even daily instead of releasing clothes only for four seasons. Increasing demand for affordable clothing led to brands relying on supply chains that produce large quantities of synthetic and petroleum-based garments in developing countries. These practices have resulted in increased levels of greenhouse gases (GHGs) and landfill waste. Following a series of controversies about the impact of fast fashion production in the early 2010s, industry leaders started adopting various sustainability initiatives to become more eco-friendly. Therefore, H&M engaged in international R&I to reduce its environmental impact and build a reputation as an eco-friendly and sustainable brand.

» *International R&I activities:*

H&M set ambitious goals for reducing greenhouse gas emissions by joining international R&I initiatives such as the Sustainable Apparel Coalition (SAC), SAC engages in international R&I by bringing together brands, retailers, manufacturers, NGOs, academics, and industry associations. This collective effort fosters the development of new materials, processes, and technologies that reduce environmental impact and improve working conditions.

Additionally, to become greener, H&M has re-evaluated and adjusted its business operations, and taken three measures including collaborating with industry leaders on R&I to comply with external sustainability standards, engaging in corporate social responsibility (CSR) projects within national and international communities, and enhancing transparency about their suppliers. H&M has adopted criteria for its suppliers that apply to its overall supply chain. H&M not only mandated suppliers to comply with the fundamental level defined for environmental consciousness, but H&M collaborated with international suppliers on R&I projects. H&M's Sustainable Impact Partnership Programme (SIPP), which rewards suppliers for sustainability compliance, fosters strong, collaborative relationships with its supply chain partners, ensuring mutual growth and sustainability. This collaboration often includes sharing best practices and innovations in sustainable production methods, which are developed through international R&I efforts.

H&M's commitment to sustainability through SIPP involves continuous research into new materials, processes, and technologies that can reduce environmental impact. H&M's international R&I initiatives include partnerships with research institutions and participation in global sustainability projects. These collaborations enable H&M to stay at the forefront of sustainable fashion innovation, ensuring that the company can continuously improve its practices and set new standards for the industry.

» *The nature of reputational impacts generated:*

H&M communicates its environmental effort through annual sustainability reports which highlight the company's progress in reducing its impact in various areas, such as a 21% reduction in CO2 emissions from its operations between 2017 and 2020. Moreover, consumer surveys and market analyses enhance engagement with customers and enhance its position as an environmentally friendly brand in the sector. By involving stakeholders in decision-making processes and demonstrating a commitment to ethical practices, H&M builds trust and loyalty, which are crucial for reputation building and long-term success.

Sources: Wren, B. (2022); Sustainable Apparel Coalition - Patagonia; Sustainable Apparel Coalition and Social & Labor Convergence Program Elevate Collaborative Work to Transform Global Supply Chains — Social & Labor Convergence Program; HM-Group-Sustainability-Disclosure-2021.pdf

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Chapter 3

Research Organisation-focused international R&I generating reputational impacts

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Research Organisations include universities and research organisations such as government and not-for-profit research organisations, Public Sector Research Establishments, National Academies, Government Departments, and Arm's-length bodies (ALB)[4]. These organisations engage in knowledge transfer, exchange, and co-creation with international actors and are involved in international research networks. Rankings, such as the international ranking of UK universities, consider the research reputation of these organisations among other criteria. These engagements enhance the reputation of UK research organisations as world-leading, neutral, and trusted experts in research, impact (economic, social, and environmental), and education, influencing the direction of the global research and higher education sector. A positive reputation results in increased financial, relational, research, innovation, social, and environmental impacts. This chapter discusses how each of the research organisation-focused international R&I activities generates reputational impacts, along with relevant case study examples.

Since there's extensive literature on universities, this chapter predominantly draws on such literature but the insights could equally apply to other research organisations. This chapter discusses how, using four different types of international R&I, UK research organisations generate reputational impacts for themselves, which in aggregate improve the UK's reputation. The categorises of activities are based on the review of literature conducted in this study.

[4] which is a specific category of central government public bodies that are administratively classified by the Cabinet Office

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3.1. Research Organisation-focused international R&D collaboration and co-creation

Research organisations collaborate with global partners, and in order to facilitate such collaborations, they implement required institutional changes, provide collaboration platforms, and create a conducive culture. As a result of these international activities for collaboration and co-creation, academics and researchers are perceived as having the ability to simultaneously generate research output and associated impacts. This has significantly enhanced the global standing of universities and research organizations. This world-leading expertise not only elevates their prestige but also solidifies their position as neutral and trusted co-creators within the ecosystem. Such reputation-building results in generating financial, relational, resource, research and innovation as well as social and environmental impacts (Figure 3.1).

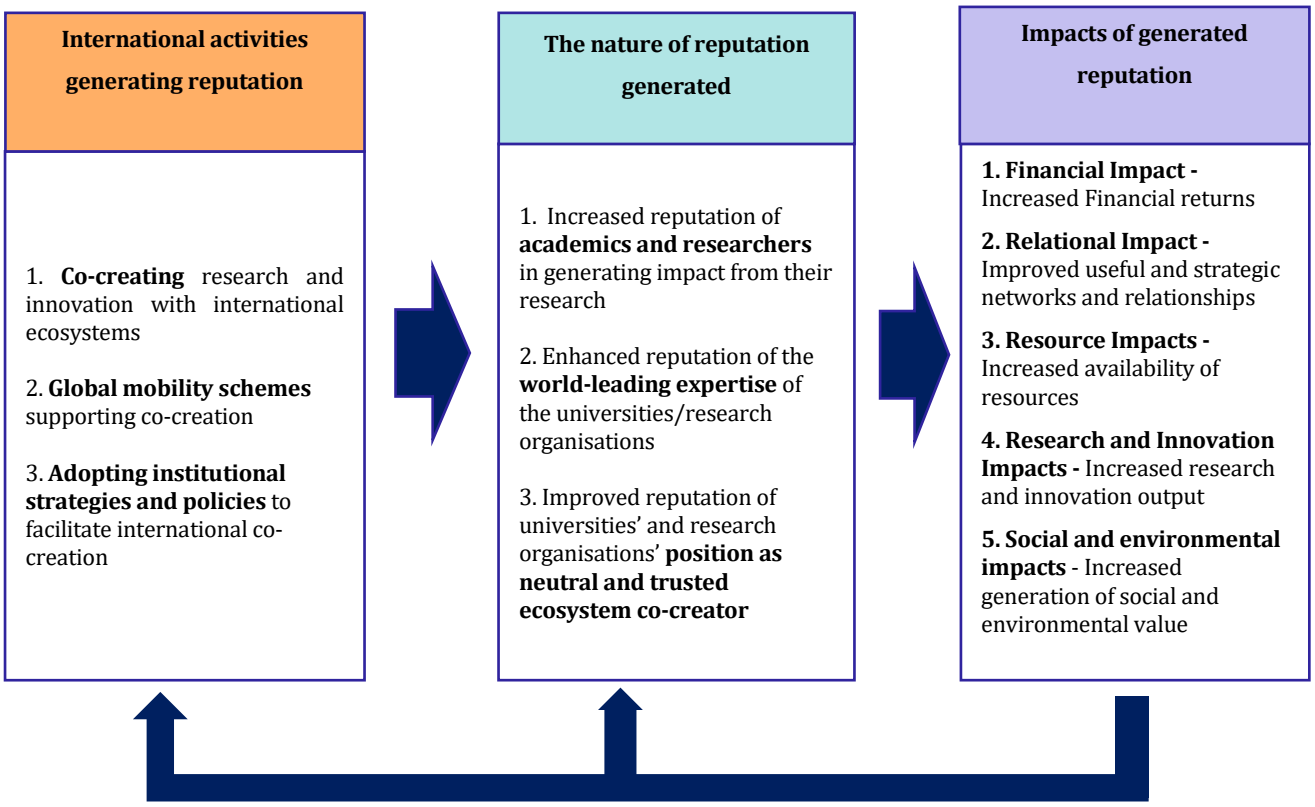

Figure 3.1: Research Organisation-focused international R&D collaboration and co-creation generating reputational impacts

3.1.1 International activities

Co-creating research and innovation with international ecosystems

Co-creation entails research organisations integrating their knowledge, skills, resources and networks with other actors of the international ecosystem in order to address a challenge or seize an opportunity that they are not able to within a single organisation. As a result, together they are able to simultaneously generate academic, business and social value (De Silva et al 2021). Such co-creation activities may entail traditional low TRL, ground-breaking international research projects collectively engage in with by research organisations as well as higher TRL projects research organisations engage in with closer to market partners. The former involves working with global partners on groundbreaking projects (Fulop & Couchman, 2006). The latter combines traditional academic activities with entrepreneurial and commercial approaches to simultaneously generate research output, impacts, commercialization and education. Considering the scale of global challenges and limitations of funding, co-creation by research organisations becomes more important (Ackerly at al., 2011). Also, considering funding constraints, co-creation offers a mechanism for research organisations and other actors to pool their resources to gain more access to funding to achieve mutually beneficial outcomes (Nieminen & Auranen, 2010). In the UK, universities work closely with international partners with over half of country's research resulting from international partnerships (Universities UK, 2017). For example, the University of Birmingham through a collaborative investment developed a co-creation partnership with Fraunhofer Institute for Environmental Safety and Energy Technology (UMSICHT) in Germany and Jiangsu Industrial Technology Research Institute (JITRI) in China, with a focus on Energy, Waste and Recycling. This initiative connects three countries to create a robust research and innovation pipeline, spanning from fundamental research to near-market innovations (UKRI.ORG).

Global mobility schemes supporting co-creation

The international mobility across academic, business and other organisations has been reported to be extremely useful to facilitate the co-creation among universities and other ecosystem actors for research, development and innovation. The UK government has introduced many schemes in support of international mobility that include the covering of the expenses of international co-investigators, funding UK researchers with overseas travel and vice versa, and funding overseas academics to spend time at a UK higher education or other research institution. The UK also offers funding and support to build international collaborations with governments, societies, enterprises, institutions, and people. These global mobility schemes and universities and other associated organization's support and encouragement for researchers to capitalise on these opportunities are reported to increase

opportunities to co-create new products, services, technologies and processes for local, national and global markets, in addition to traditional research ouput (MORE4 Europe 2021).

Adopting institutional strategies and policies to facilitate international co-creation

Adopting comprehensive institutional strategies and policies that facilitate, reward, and manage international partnerships is important to make co-creation initiatives successful. Research institutions should be prepared for the complexities of global partnerships and able to effectively navigate them (Fulop & Couchman, 2006).

Cross-sector international collaboration is considered high risk. Companies could pass on various forms of risk to public organizations, and thus it is important to ensure that their exposure is properly managed on a risk-and-return basis (Fulop & Couchman, 2006; Turpin et al., 2004). Also, when engaging in cross-sector international co-creation, the differences in IP strategies, institutional support mechanisms, and incentives could make the interaction further difficult (Yin and Jamali 2021). Since universities and public research organisations have a specific mission for research and education, their engagement in co-creation and associated social and commercial value creation should not be expected to be similar to that of profit-oriented R&D companies. Therefore, by adopting necessary institutional strategies and policies, universities and research organisations can effectively manage the complexities of cross-sector international collaborations (De Silva et al 2021).

These strategies should ensure that universities and research organisations manage financial, relational, and institutional risks, thereby maintaining their reputation as neutral[5] sources of expertise (De Silva et al., 2023). Trusted Research plays a crucial role in supporting the integrity of the UK's international research collaboration. Trusted Research helps secure international scientific collaboration, protecting intellectual property, sensitive research and personal information. It provides guidance on mitigating potential risks such as theft, misuse or exploitation of research outputs, and assists researchers, UK universities and industry partners in building trust in international collaborations and making informed decisions about potential risks (npsa-trusted-research). Research institutions should also develop their own strategies and policies when co-creating with diverse range of for-profit and not-for-profit actors.

[5] universities are seen as neutral entities because their core missions are the production and dissemination of knowledge and understanding, and preparing students for meaningful lives. This neutrality is essential for fostering an atmosphere of open inquiry and academic freedom (Shaw 2024). The position of universities is compared with the profit-driven motives of businesses and it has been argued that the neutrality is essential in maintaining an environment conducive to open inquiry and unbiased research (Post 2012).

3.1.2 Nature of reputation

Increased reputation of academics and researchers in generating impacts from their research

When academics and researchers engage in international co-creation, especially across diverse disciplines and institutions, it enhances their reputation as global experts. If managed appropriately, co-creation offers opportunities to enhance both academic output and impacts (De Silva 2016). For instance, participating in global research co-creation networks improves access to resources, funding, cutting-edge technologies, industrial-scale R&D facilities, and commercial insights that would not have been possible without co-creation (Bozeman & Gaughan, 2007). International co-creation initiatives enable academics to showcase the international reach of research and its impacts, which is important to demonstrate the value of academic research and thus enhance the researcher's reputation in both academic and non-academic communities (De Silva 2016; De Silva et al 2012). Access to data and resources further increases their ability to publish, and joint publications with international collaborators lead to higher citation impacts (Highman, 2018), indicating broader recognition and influence of their research findings within the academic community (Adams & Gurney, 2018).

Enhanced reputation of the world-leading expertise of universities/research organisations

UK research organisations and universities, owing to the reputation built through international co-creation and innovative research projects, position themselves as global leaders in research, impact, and education (Highman, 2018). This enhanced reputation stems from consistent contributions to global knowledge and cutting-edge advancements in research and innovation (Lepori et al., 2013). Activities such as co-creating research with international ecosystems elevate the global perception of UK research organisations and universities as centres of excellence. This prestigious standing attracts global talent, increases funding opportunities, and fosters partnerships with leading institutions worldwide (Altbach & Salmi, 2011)

Improved reputation of universities' and research organisations' position as neutral and trusted ecosystem co-creators

Research organisations and universities that effectively manage the complexities of international collaborations and adopt comprehensive strategies and policies to support these partnerships build a reputation as neutral and trusted co-creators. This involves demonstrating transparency, ethical standards, and a commitment to mutual benefits in their collaborations.

Such a reputation as a reliable and impartial partner assures stakeholders, including industry partners, citizens, and governmental bodies (Fulop & Couchman, 2007). This trust is crucial for sustained and productive partnerships, enhancing the role of research organisations and universities in fostering innovation and societal development.

3.1.3 Impacts of generated reputation

Table 3.1: Impacts of reputation generated through international R&D collaboration and co-creation

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Enhanced access to national and international funding
2. **Relational Impact** - Improved useful and strategic networks and relationships	Increased acceptance within the broader international scientific community Enhanced opportunities to access, strengthen, collaborate with, and develop new, useful networks Improved attractiveness to recruit and collaborate with high-profile academics Increased international student enrolment in UK universities
3. **Resource Impacts** - Increased availability of resources	Enhanced opportunities for UK universities and research organisations to access and jointly develop resources and infrastructure
4. **Research and Innovation Impacts** - Increased research and innovation output	Improved research output Increased willingness of international ecosystem actors to collaborate with UK research organisations Increased establishment of international (and often interdisciplinary) co-creation projects and associated centres
5. **Social and environmental impacts** - Increased generation of social and environmental value	Enhanced opportunities to generate impacts from research (i.e. economic, social and environmental value) Increased opportunities for academics and research organisations to engage in policy-making and advisory roles

Case Study: International collaboration between Manchester and Beijing in Genomic Medicine

The University of Manchester in partnership with Central Manchester University Hospitals NHS Foundation Trust embarked on a collaborative initiative with Peking University Health Science Centre (PUHSC), the most prestigious and oldest medical school in China.

» *International R&I activities:*

This collaboration fosters large-scale studies aimed at advancing research in genomic medicine, particularly in addressing diseases such as cancer, blindness, and inherited heart disorders. Genomic medicine involves studying DNA sequencing to understand the function and structure of genes that enable personalising treatments based on genetic information.

The partnership allows for the pooling of resources, expertise, and data for collaborative R&I. The Manchester-Peking Alliance also provides a platform to explore opportunities for international collaborations by establishing training programs for genetic counsellors, doctors, and diagnostic scientists in both Manchester and Beijing, along with regular knowledge exchanges. This collaboration coincides with the launch of the new Manchester Centre for Genomic Medicine by The University and The Trust, which unites internationally renowned researchers.

» *The nature of reputational impacts generated:*

The strategic partnership has significantly contributed to the institution's reputation by demonstrating its ability to transform healthcare using new technologies to personalise medicine, improve diagnosis and treat people based on their genetic make-up. It also underscores the world-leading expertise of UK universities as Professor Weigang Fang, Vice President for PUHSC, said: “The University and the Trust have the expertise, world-leading minds and the track record in medical education and training to be the ideal partner for PUHSC. We are particularly impressed with the strong partnership between clinicians and doctors in the Manchester Academic Health Science Centre who are working together to develop an effective strategy for the rapid translation of health research into practice.”

Not only institutional reputation it also enhances the reputation of academics and researchers in generating impacts of their research. For example, University of Manchester’s Professor Graeme Black’s research within this collaboration led to breakthroughs such as cost-effective genetic tests for patients with inherited blindness, which are now available in hospitals across the UK.

Source : https://www.manchester.ac.uk/about/news/health-experts-from-manchester-and-china-join-forces-on-genetic-research/

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3.2. Research Organisation-focused international knowledge transfer, exchange and networks

Research organisations engage with international ecosystem for knowledge transfer or exchange using mechanisms such as engaging with international research networks, publishing in academic and practitioner journals, exchanging knowledge at international conferences, commercializing (e.g. selling IP and licensing patents), providing international consultancy and advisory services and educating the international workforce.

Knowledge transfer or exchange, unlike co-creation, mostly involves the transfer of knowledge or resources from one organisation to the other rather than closely working together. Such engagements enhance the reputation of the UK's research organisations and universities as world-leading knowledge producers and influencers has significantly bolstered their standing as premier research hubs. This enhanced status not only highlights their expertise but also improves their legitimacy as key members of the global network, further solidifying their role in advancing knowledge and innovation. Such positive reputation building improves financial, relational, resource, research, and innovation as well as social and environmental impacts [Figure 3.2].

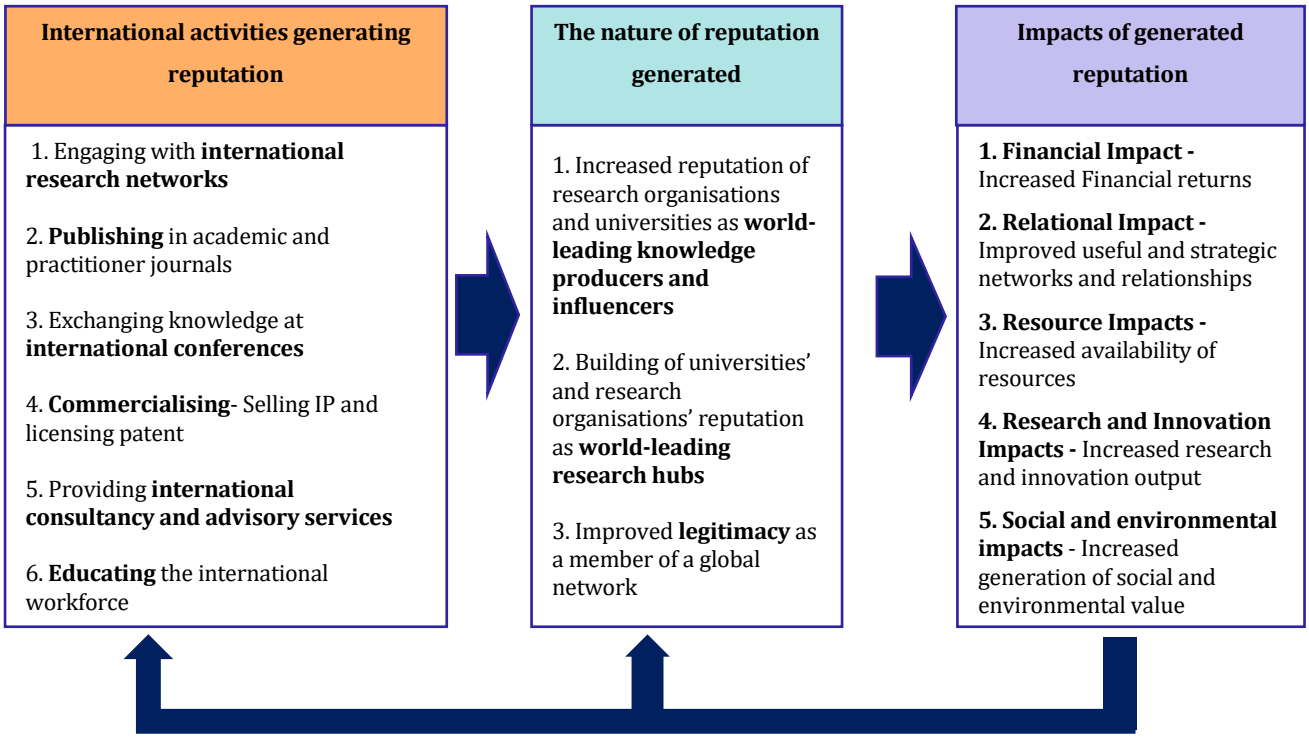

Figure 3.2: Research Organisation-focused international knowledge transfer, exchange and networks generating reputational impacts

3.2.1 International activities

Engaging with international research networks

The exchange of resources and individuals within an international research network is crucial in enhancing collaborative efforts and leveraging institutional strengths. Research networks are composed of various research organisations, often higher educational institutions, and are structured based on the exchange of research facilities, libraries, specialized equipment, and other resources as well as personnel including researchers and academic staff across organizations, independent of political, social, and geographical boundaries (Lepori et al., 2013; Seeber et al., 2012; Glänzel & Schubert, 2005; Jones et al. 2008; Heller-Schuh et al., 2011). This exchange enhances the collaborative potential and output of research organisations by pooling resources and expertise. It allows institutions to undertake more ambitious research projects and educational programs, which are visible indicators of institutional capability (Lepori et al., 2013). In the context of UK universities, collaborative initiatives within European networks have demonstrated how shared resources and joint research efforts can bolster the research and educational outcomes of participating institutions (Eurydice, 2020).

Publishing in academic and practitioner journals

Publications are a means of knowledge exchange with academic and non-academic communities. Geographical proximity is not necessarily required for accessing publications, which enhances the potential for international knowledge exchange. Since the evidence for some established economies suggests that publications with international co-authors have more than doubled over 30 years, these publications are likely to share new knowledge produced through international R&I and of relevance to more than one country. While the domestic research output (i.e. those with authors from a single country), including that of the UK (47,500 papers per year), Germany (45,000) and France (30,000), have not shown a dramatic change since the mid-1990s, their publications through international collaboration has increased more than ten-fold, further indicating the value of publications as a source of knowledge exchange of relevance to more than one economy (Adams & Gurney, 2018; Adams & Gurney, 2016).

Exchanging knowledge at international conferences

Another means used by research organisations to exchange knowledge with academic and non-academic communities are presenting at conferences and research seminars. International conferences and events enhance knowledge exchange and networking opportunities and increase visibility within the academic and non-academic communities (Lepori et al., 2013). In particular, these events offer a platform for institutions to present

their latest research findings and innovative projects, and discuss funding opportunities and the relevance of research to academic and non-academic communities (Glänzel & Schubert, 2005; Jones, Wuchty, & Uzzi, 2008; Dolmans et al., 2022). For instance, The International Congress of Immunology (IUIS) is an international conference in the field of immunology, bringing together immunologists from universities, health providers, independent research organisations and industry, each year. The congress aims to extend knowledge exchange among all attendees – from early-career professionals to globally recognized key opinion leaders (IUIS 2023). Another example is the University of Oxford's Innovation Forum Leaders Conference which attracts top national and international leaders from industry, academia, and government, as well as early-stage venture investors and researchers. The conference brings together over 1,300 delegates, stimulates conversations and catalyses numerous partnerships for the next generation of innovative technology. The conference provides a platform for Oxford's researchers to share their latest advancements in science, technology, and innovation.

Commercialising- Selling IP and licensing patent

Research commercialisation involves commercially exploiting intellectual property through market mechanisms, including patenting, licensing, and spin-outs (Siegel et.al., 2003; Siegel et.al., 2007; Siegel & Wright, 2015). A Europe-wide study demonstrated that patenting in universities is on the rise, although it remains heterogeneous across institutions and disciplines (Geuna and Nesta, 2006). In UK universities, IP-related income accounted for 2-3% of total income coming to the HE sector between 2003- 04 and 2012-13 (Source: HE-BCI Report 2014), and this is especially attributable to STEM disciplines (Moutinho et al., 2007; Owen-Smith & Powell, 2001; van Rijnsoever et al., 2008). Universities share their expertise by successfully selling and licensing patents, showcasing their ability to translate research into practical applications (Gong et al., 2020).

Providing international consultancy and advisory services

Universities and research organisations provide international consultancy services, leveraging their faculties and researchers' expertise to address global challenges. This positions the institution as a trusted advisor and opens collaborative opportunities across various sectors, enhancing its status as a thought leader (Perkmann et al., 2013). Organizations that engage with academia benefit from accessing cutting-edge scientific knowledge, innovative equipment, academic networks, and diverse perspectives on problem-solving (Guan & Zhao, 2013; Arza, 2010; Broström, 2012; Heidrick et al., 2005). These interactions can lead to significant technical, economic, input-related, and intangible improvements such as learning, training, and knowledge sharing (Nuñez-Sánchez, et al. 2012; Perkman et al., 2013).

Academics and researchers who secure industry grants and contracts are significantly more involved in industry-related activities and policy advisory roles compared to those without such funding. Those with industry grants are twice as likely to be approached for their research expertise by private industry and to be hired as paid consultants for industry projects as well as for policy-related roles (Bozeman & Gaughan, 2007). In a similar vein, universities participating in European projects like Horizon 2020 work together to shape research and innovation policies at the European level (Heller-Schuh et al., 2011). Universities positioned at the core of these networks have a greater influence on leading policy discussions due to their central role in the flow of information and resources (Borgatti & Everett, 1999).

Educating the international workforce

Universities and research organisations also offer education and training for industry and future workforce. Considering the UK universities' role as prominent international knowledge providers, many beneficiaries of these educational provisions are international. According to the latest data from HESA, international students make up a significant portion of the student population in UK universities. In the 2022/23 academic year, international students accounted for 26% of the total student population (Bolton et al 2024). The engagement by students in collaborative projects with industry offers an excellent opportunity for students to benefit from both academic rigour and industry applications. Similarly, universities offer numerous executive training programmes, the graduates of which are equipped with cutting-edge knowledge and skills. Universities also offer tailored training programmes to the industry. These educational activities enable universities and research organisations to share knowledge and skills with the international workforce (Guan & Zhao, 2013; Arza, 2010; Broström, 2012; Nuñez-Sánchez et al., 2012).

3.2.2 Nature of the generated reputation

Increased reputation of research organisations and universities as world-leading knowledge producers and influencers

Recognition through numerous knowledge exchange mechanisms establishes the university's and research organisation's status as leaders of global knowledge, enhancing their prestige and competitiveness (Ulrichsen, 2018; Ambos et al., 2008). Universities and research organisations known for cutting-edge research and staying in frontiers of various fields due to various knowledge exchange efforts, build a reputation for excellence and innovation. These engagements enhance visibility among stakeholders and reinforce the institution's global reputation as world-leading knowledge producers and influencers (Bozeman & Gaughan, 2007).

Building of universities' and research organisations' reputation as world-leading research hubs

Due to the engagement in knowledge exchange activities, recognised as neutral sources of expertise, universities and research organisations earn the trust of the general public, stakeholders, and partners of their research capabilities to address societal challenges and contribute to economic growth (Fulop & Couchman, 2006). Participation in knowledge exchange activities reinforces their status as global leaders in research (Lepori et al., 2013) of value to scholars, industry, governments, and the public, further improving their reputation as world-leading research hubs (Sengupta & Rossi, 2023).

Improved legitimacy as a member of a global network

Engagement in international knowledge exchange activities offers opportunities for universities and research organisations to be valuable members of global networks, which enhances the credibility and legitimacy of these organisations on the global stage, fostering trust with institutions worldwide (Lepori et al., 2013). Through the formation of ties during these knowledge exchange activities organisations build identity (i.e. belonging to the same social space) (Rivera et al., 2010), seek legitimacy (i.e. preferentially linking to high-status organizations) (Cattani et al., 2008), and facilitate resource mobilization (i.e. connecting with organizations that control a large share of resources) (Lepori et al., 2013).

3.2.3 Impacts of the generated reputation

Table 3.2: Impacts of reputation generated through international knowledge transfer, exchange and networks

Types of Impact	Specific Impacts
1. Financial Impact - Increased Financial returns	Increased opportunities to generate income through knowledge/technology transfer and exchange e.g. patents, commercialisation, training, and consultancy Enhanced access to funding
2. Relational Impact - Improved useful and strategic networks and relationships	Increased acceptance within the broader international scientific community Enhanced opportunities to access, strengthen, collaborate with, and develop new, useful networks Improved attractiveness to recruit and collaborate with high-profile academics Increased international student enrolments
3. Resource Impacts - Increased availability of resources	Enhanced opportunities to access and develop new national and international resources, funding, capabilities, knowledge, and networks
4. Research and Innovation Impacts - Increased research and innovation output	Enhanced opportunities to extend transfer/exchange to co-creation
5. Social and environmental impacts - Increased generation of social and environmental value	Increased generation of social value and impacts Increased opportunities for research organisations and academics to engage in policy-making and advisory roles

Case Study: Ten U- an international collaboration in research commercialization

TenU is an international network formed to capture effective practices in research commercialisation and enhance the societal impact of research and brings together leading HEIs in the UK, US and Belgium to develop and share best practices on research commercialisation.

International R&I activities:

TenU is engaged with International Research Networks of Higher Educational Institutes (HEIs) through its research commercialization offices of ten leading universities including Cambridge (UK), Oxford (UK), MIT(US), Columbia (USA), Leuven (Belgium), University College London (UK), and Stanford (US). TenU leverages collective knowledge and experience to promote innovation and economic growth through university-led research.

TenU has established itself as a leader in research commercialization through several key activities, including securing a £4 million grant from UKRI's Research England for funding for its programmes over five years. This funding supports TenU's mission to gather international evidence on best practices in ecosystem building and strengthen partnerships with investors, developers, and local communities. Through its partnership with Research England and its collaboration with top-tier universities, TenU acts as an advisor on best practices for research commercialization, intellectual property management, and ecosystem building. TenU's members provide consultancy to various stakeholders, including governments and private sector partners, on how to create resilient networks and support economic growth through university-led innovation. As Quoted by David Sweeney, then executive chair of Research England: "I am pleased to provide Research England funding to support TenU's ambitious international collaboration which is already leveraging its combined knowledge of research commercialization to inform the UK and wider policy and practice. We look forward to working further with TenU in the future, building on its insights on international best practices in university intellectual property management, as well as sharing experiences across continents on building ecosystems and developing talent."

The TenU members have a strong track record of successfully commercializing their research outputs. For instance, Oxford University's partnership with AstraZeneca led to the rapid development and global rollout of a COVID-19 vaccine, which has reached 180 countries and accounted for over 25% of COVID vaccinations worldwide. Other examples include innovations like rapid whole genome sequencing (Cambridge), fiber optics (Imperial), and the page rank algorithm technology (Stanford).

TenU strives to expand its initiatives such as organizing training programmes, and sharing effective practices across cultures internationally. Through its collaborative efforts and strong relationships with governmental bodies, such as the UK Department for Science, Innovation, and Technology [DSIT], TenU actively contributes to shaping policies that support research commercialization.

The nature of reputational impacts generated:

By participating in TenU, universities demonstrate their commitment to global collaboration and innovation. This enhances their reputation as leaders in research and technology transfer, attracting top-tier faculty, researchers, and students from around the world. Sharing of best practices helps them improve their own processes and outcomes, further enhancing their reputation for excellence in research and innovation. Being part of an influential network like TenU provides universities with greater visibility and recognition in the global academic and research communities. This can lead to increased funding opportunities, partnerships, and influence in shaping research policies. The UK's involvement in TenU highlights its leadership in research commercialization and innovation. This strengthens the country's reputation as a hub for cutting-edge research and technology transfer. TenU's activities and insights influence national and international research policies. The UK's active participation in shaping these policies through TenU reinforces its role as a key player in the global research landscape

SOURCES: TenU ; https://techfundingnews.com/tenu-with-members-from-top-global-universities-gains-4m/; Introducing TenU, a new international tech transfer collaboration — TenU

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3.3. International ranking of UK universities

There are different global indices – such as the Times Higher Education ranking, Guardian Ranking, and QS Ranking - that rank universities based on their engagement in teaching, research, and third-stream activities. Even though these rankings are subjective and sometimes criticised for the lack of consideration of the unique characteristics of certain universities and the difficulties in measuring many areas in which universities make a contribution, the rankings are generally perceived by potential students and their employers, potential collaborators and employees of universities, and other stakeholders as a measure of reputation. Unlike other mechanisms discussed so far, ranking does not involve international R&I but ranking does generate reputational impacts, such as financial, relational, resource, research and innovation, which are discussed in this section of the report [Figure 3.3].

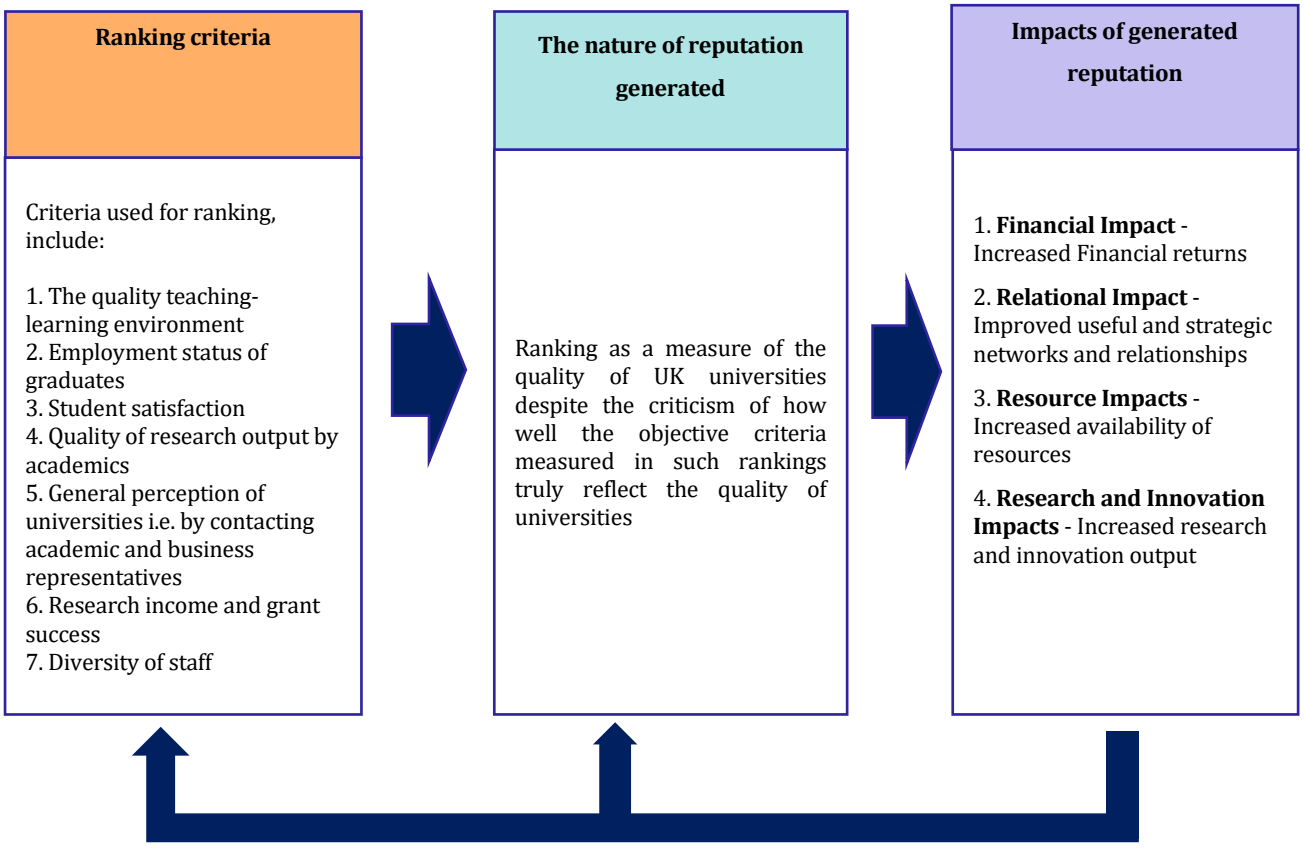

Figure 3.3: International ranking of UK universities generating reputational impacts

3.3.1. Reputational Impacts of UK University Ranking

The UK has built a robust reputation for its Higher Education Institutions (HEIs) by excelling in various global ranking criteria that highlight the quality and effectiveness of teaching and research rigour and enhance their competitiveness to establish themselves as esteemed centres of learning and research. Numerous agencies undertake the ranking of institutions using various criteria, fostering healthy competition and helping identify premier institutions for prospective learners (Aithal & Kumar, 2020). This reputation through ranking has been built on several key factors including the quality of the teaching-learning environment, employment status of graduates, student satisfaction, quality of research output by academics, general perception by academic and business representatives, research income and grant success, and the diversity of staff (Times Higher Education ranking, Guardian Ranking, and QS Ranking).

The UK's reputation as a leading destination for international students is reflected in its ranking as the world's second most popular destination for international students, following the US (Hubble & Bolton, 2021). During the academic year 2019/20, non-European Union international students comprised 22 per cent of the total student body in UK universities, marking a threefold increase since the start of the twenty-first century (HESA 2021; Universities UK, 2022). Yet, after Brexit since EU students were considered international and required to pay international fees, there was a significant drop in EU students. In the 2022/23 academic year, EU students made up approximately 3.2% of the total student population in UK universities (HESA 2024).

Both ranking and long-term perception of the prestige of universities seem to have a collective influence on reputation (Hazelkorn 2015). Despite annual fluctuations in rankings, reputational prestige has an anchoring effect, suggesting that longstanding reputations continue to influence student enrolment (Bastedo & Bowman, 2011; Taylor & Braddock, 2007). While the long-term prestige affects national student attraction, the perception of quality and prestige attached to high rankings attracts international students, who lack knowledge of prestige and local perception (Soysal, et al., 2024). High-quality academics tend to join institutions with better rankings for strong research outputs and reputational prestige (Enders, 2015; Taylor & Braddock, 2007), which, in turn, enhances the quality of the university's academic environment and research capabilities and leads to maintaining a higher ranking and competitive advantage for UK universities. Highly-ranked universities such as Oxford, Cambridge, and Imperial College are often seen as the most desirable partners for international collaborations, which further enhance their global influence and reputation (Mamrginson, 2014).

Data from the Complete University Guide (CUG) indicates that while rankings influence international student mobility, the role of ranking may be overestimated, implying that other factors such as general

perception of universities are also crucial (Soysal, et al., 2024). As a proxy for reputation, rankings have become an integral part of 'status culture' (Mamrginson, 2014).

Table 3.3: Impacts of reputation generated through international ranking of UK universities

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Improved student enrollment and research collaboration opportunities, positively associated with rankings, increase income of universities and research centres
2. **Relational Impact** - Improved useful and strategic networks and relationships	International student enrolment is significantly positively associated with university ranking Better ranking attracts international, high-quality academics to respective universities
3. **Resource Impacts** - Increased availability of resources	Global university rankings are used by collaborators when inviting for joint infrastructure development
4. **Research and Innovation Impacts** - Increased research and innovation output	Global university rankings are used when identifying universities invited for collaborations

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Chapter 4

National enablement of international R&I generating reputational impacts

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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].

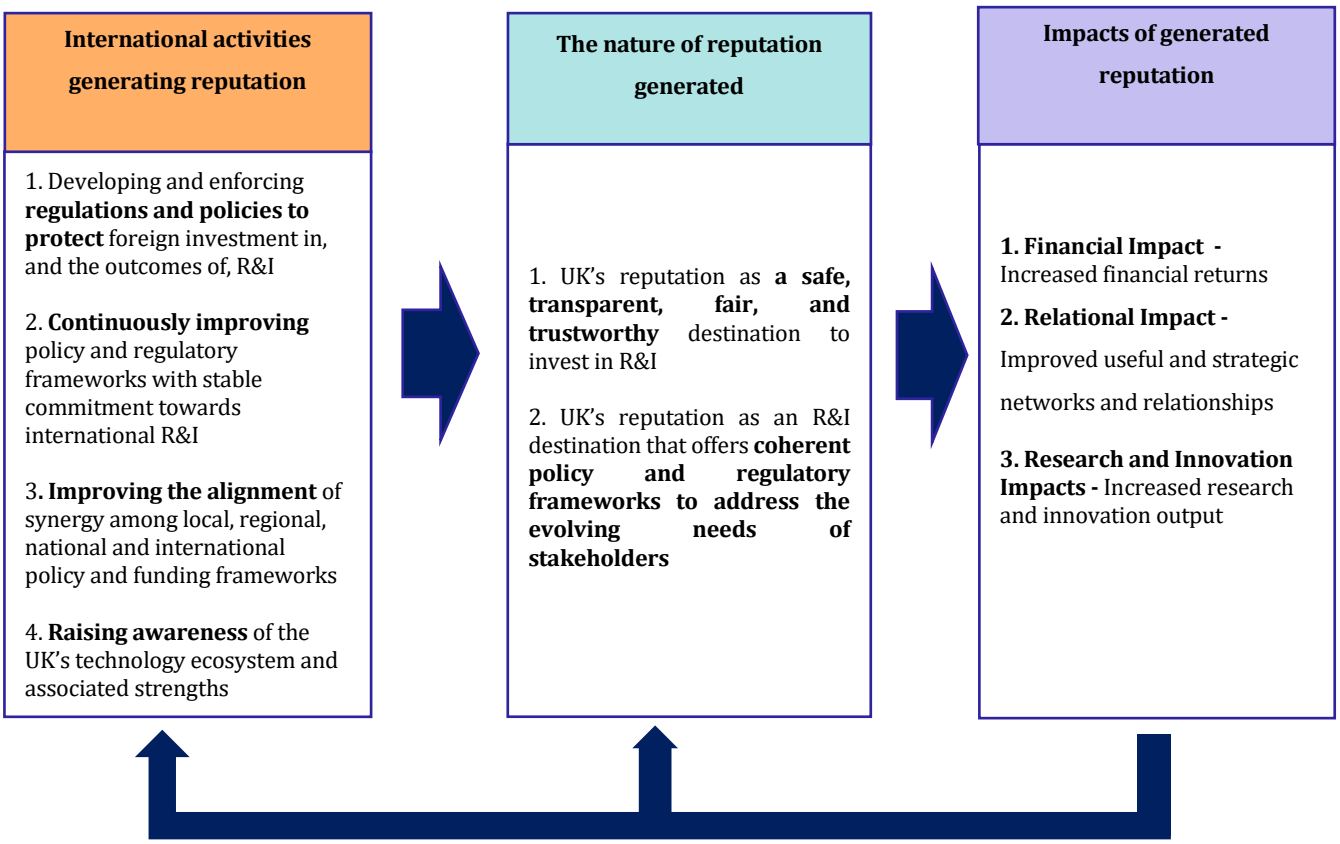

Figure 4.1: UK's regulatory and policy framework facilitating international R&I generating reputational impacts

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].

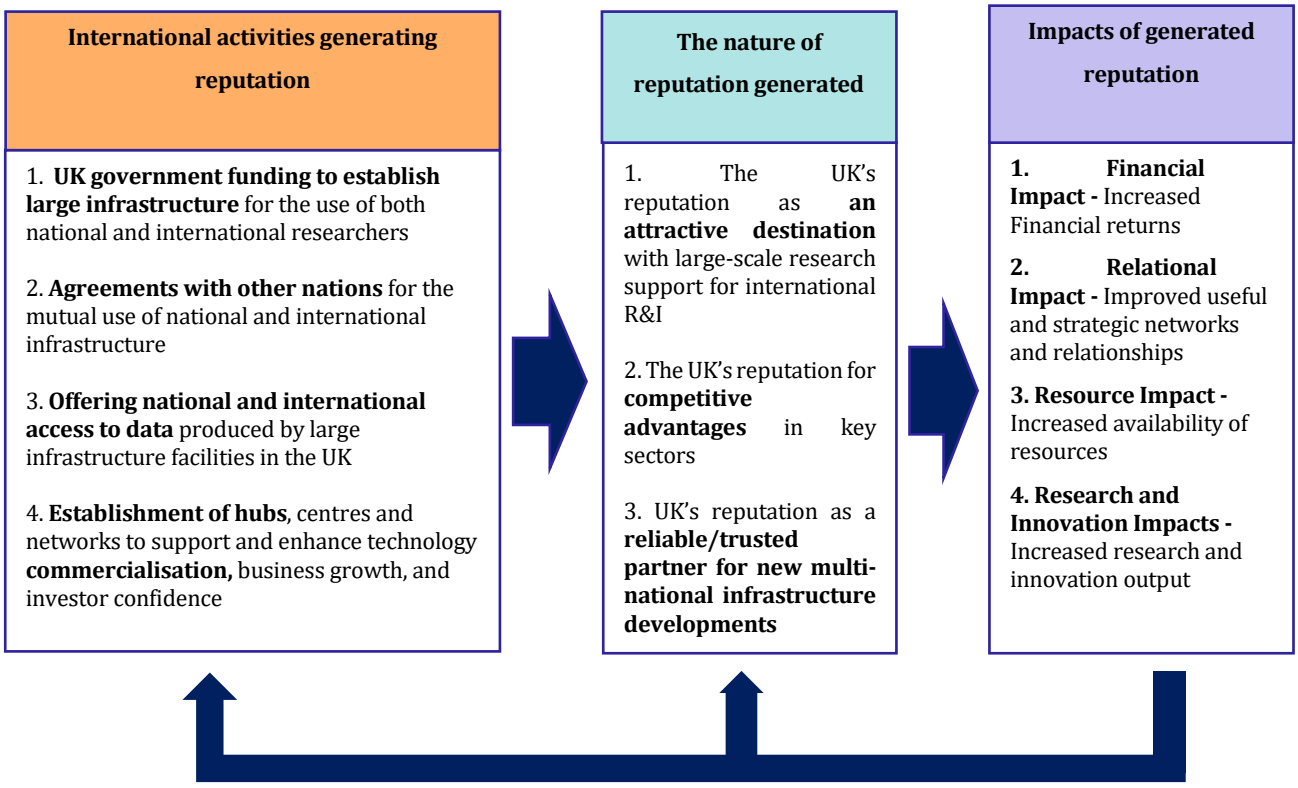

Figure 4.2: UK's large-scale infrastructure facilitating international R&I generating reputational impacts

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. The 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).

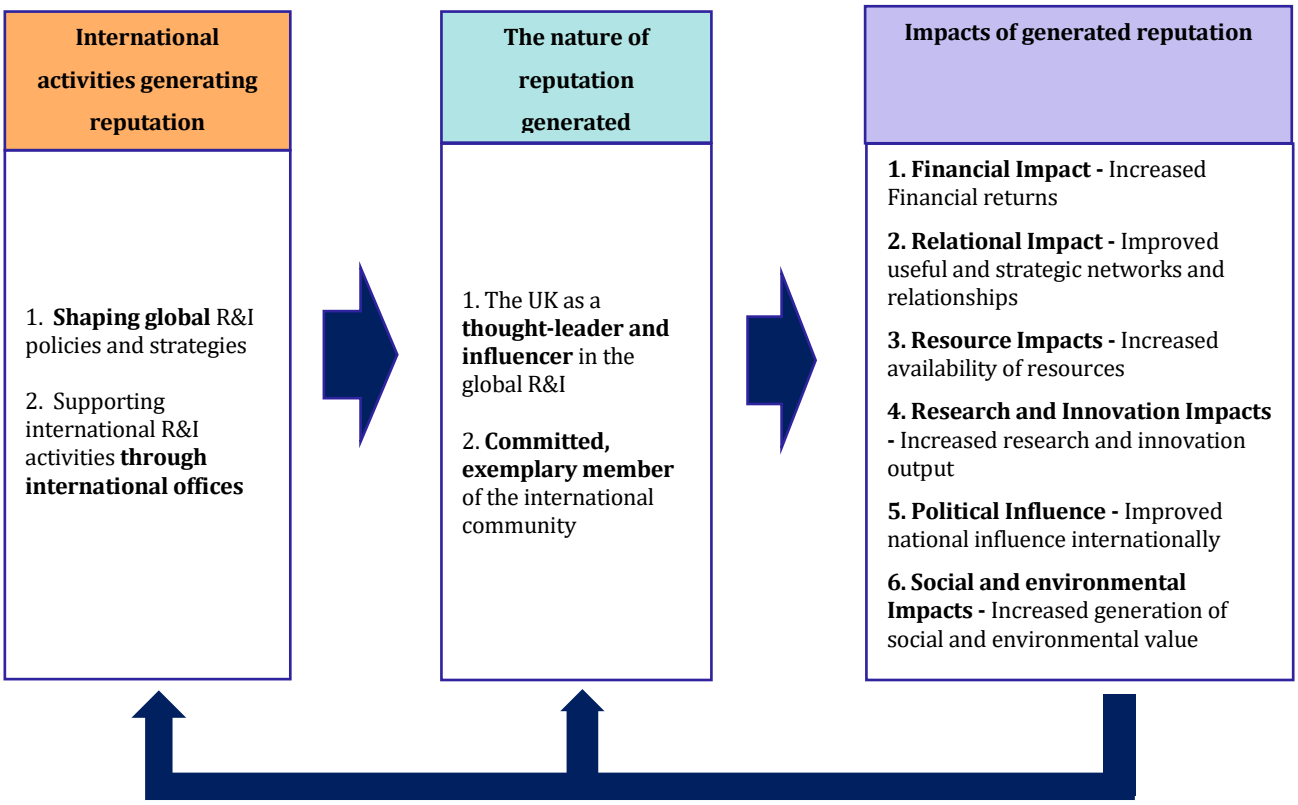

Figure 4.3: UK's interactions with global R&I forums generating reputational impacts

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.

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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].

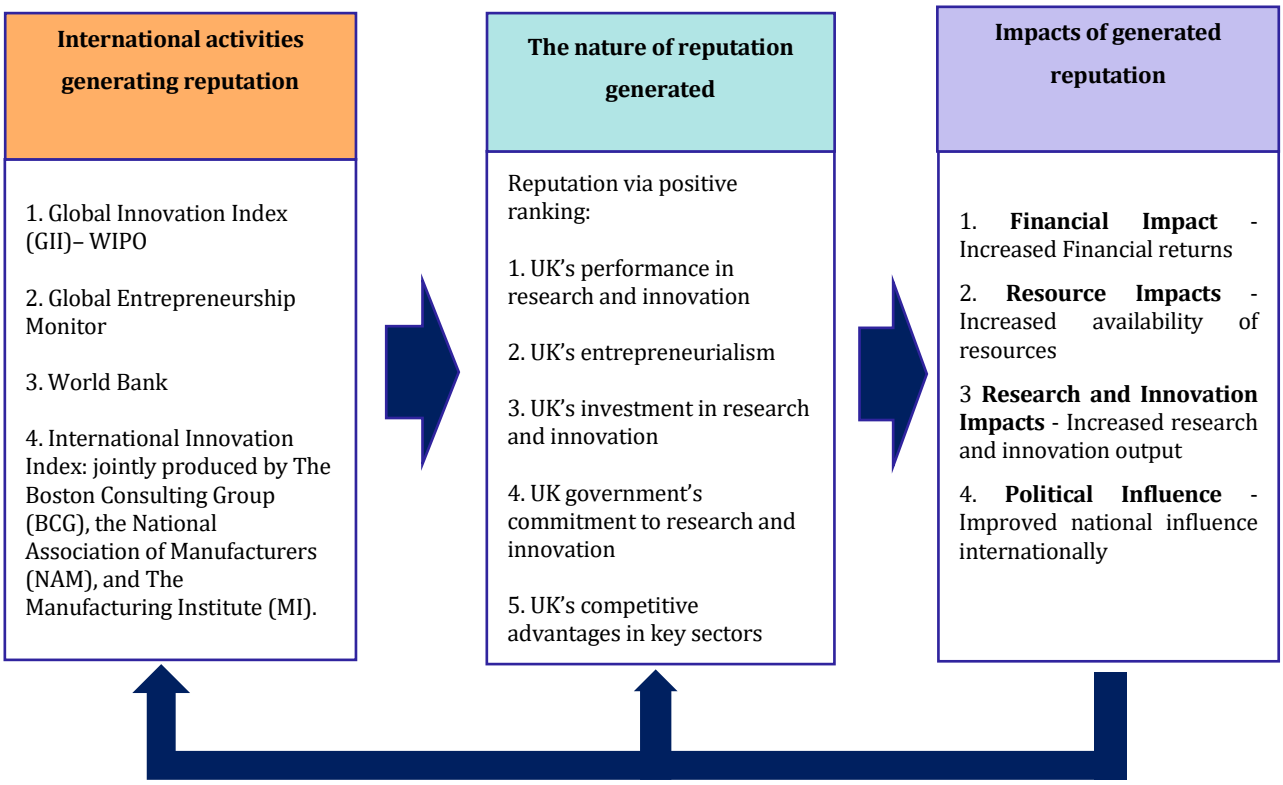

Figure 4.4: UK's ranking in global research and innovation indices generating reputational impacts

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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Chapter 5

UK Funding Programmes for International R&I generating reputational impacts

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UK Funding Programmes for international R&I include bilateral, multilateral, international development, and unilateral funding. These investments enhance the UK's reputation as a global leader in generating research, innovation, social, economic, and environmental outcomes across national, EU, and international levels. They also position the UK as an attractive destination for conducting international R&I and as a global leader in directing the international funding landscape, cross-country collaboration, policy, and practice. This reputational building could lead to improved financial, relational, research, innovation, resource, political, social, and environmental impacts. This chapter discusses how each funding programme supporting international R&I generates reputational impacts, along with relevant case study examples. The discussion of the activities that generate a reputation for the UK R&I, the nature of the generated reputation and the related impacts are based on the review of literature conducted in this project.

Click here to download subsection 5.1

5.1. UK's bilateral funding programmes

The UK generates a strong reputation for collaborative R&I through its strategic bilateral funding agreements with countries such as Australia, Brazil, Canada, Germany, Japan, Luxembourg, Norway, South Africa, South Korea, Switzerland and the USA. Government, funding agencies, and other related stakeholders are developing mechanisms to enhance bilateral collaboration. The agreements facilitate the exchange of knowledge and expertise through forums, specialist workshops, and conferences. They are also focusing on the bilateral development of new products, services, technological processes, business development opportunities, and societal value. Additionally, independent impact assessment agencies are being commissioned to conduct evidence-based assessments of bilateral agreements. These bilateral agreements result in enhancing the reputation of the UK as a trusted and reliable partner for co-funding, and a leader in bilateral collaboration for research, technology, and innovation, driving technological advancements, economic growth, entrepreneurialism, and addressing global challenges. The generated reputation results in financial, relational, resource, research, innovation, political, social and environmental impacts [Figure 5.1].

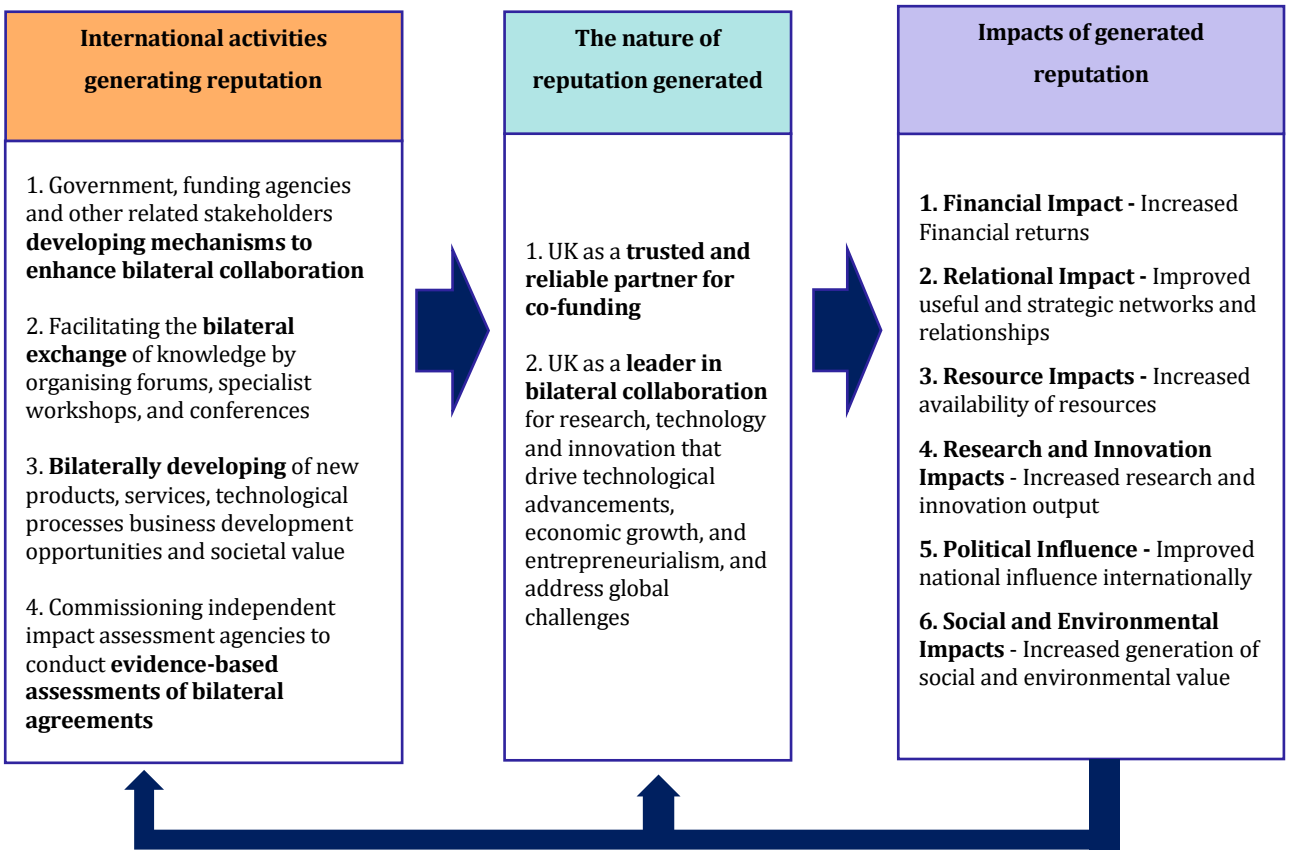

Figure 5.1: UK's bilateral funding programmes generating reputational impacts

5.1.1 International activities

Government, funding agencies and other related stakeholders developing mechanisms to enhance collaboration

Through bilateral agreements, the UK and UKRI engage in discussions with various international actors to improve funder-to-funder partnerships. These international partnerships allow UKRI to develop collaborative research and innovation funding programmes addressing global challenges and boosting economic growth. Examples of such international collaborations include Lead agency agreements with Sao Paulo Research Foundation, Luxembourg and Science Foundation Irland. UKRI's Arts and Humanities Research Council (AHRC) is collaborating on eighteen projects with the German Research Foundation (DFG), supported by a £6 million joint-fund. UKIR supports international collaboration teams under the Lead Agency Agreements providing a framework for joint peer review of proposals by two funding agencies in different countries. For example, the National Science Foundation (NSF) in the US and the Engineering and Physical Sciences Research Council (EPSRC) of UKRI in pursuit of their international collaboration and through the NSF-EPSRC Lead Agency Agreement, aim to promote transatlantic collaborative research by creating mechanisms that reduce barriers researchers may encounter when conducting international research.

Facilitating the exchange of knowledge by organising forums, specialist workshops and conferences

Depending on the focus, bilateral agreements aim to foster knowledge exchange among companies and research organisations in the countries involved. Since these bilateral agreements consider the unique strengths and characteristics of businesses, research organisations and other stakeholders of both countries, greater complementarity is achieved. Another key aim of bilateral agreements is to facilitate the exchange of knowledge and expertise by organising forums, specialist workshops, and conferences. For instance, the UKRI's collaboration with North America includes organizing talent and mobility opportunities, such as exchanges and networking schemes for doctoral students and researchers. This fosters the exchange of knowledge and expertise between UK and North American institutions, enhancing the research capabilities of both regions.

Developing new products, services, technological processes, business opportunities and societal value

Bilateral agreements also support the joint development of new products, services, processes and commercial output. For instance, the UK-China collaboration has resulted in the development of rapid COVID-19 testing solutions and research to reduce antibiotic-resistant

diseases. Additionally, UKRI-supported projects in China have produced over 100 intellectual property outputs and created 24 UK spinout companies, demonstrating the tangible commercial outputs of these collaborations. Projects funded under the SNSF-UKRI partnership include developing a new tool for eye imaging and sustainable solutions for circular plastics, showcasing innovation and commercial output.

UKRI's collaboration with the US and Canada has led to investments of over £3 billion, opening doors to new collaborations and leveraging funding from outside the UK. These collaborations have not only supported the development of new technologies but have also contributed to economic growth and societal benefits in both regions. Bilateral relationships between UKRI and Brazilian National Councils have been strengthened through significant projects such as a flagship climate science initiative in the Amazon region and research expeditions aimed at enhancing understanding of the Amazon's biodiversity and socio-cultural diversity. Other examples of funder-to-funder collaborations include UKRI's collaborations with the Swedish Research Council, the Wallenberg Foundations and a number of universities, as well as the Research Council of Norway (RCN). These efforts aim to enhance collaborations in addressing global challenges.

These collaborations empower researchers to conduct studies on topics of international significance, spanning a diverse range from land ownership and post-industrial marginalization to new insights in fields such as computing, medical sciences, and poetry responding to historical scientific developments. Additionally, other projects address emerging strategic challenges, such as promoting international justice through historical exploration and learning.

Commissioning independent impact assessment agencies to conduct evidence-based assessments of agreements

The outcomes of these agreements are often reviewed independently. Such reviews are important to further improve the relationship. UKRI India's impact on enhancing the UK-India research and innovation relationship has been independently evaluated by Elsevier. The assessment highlights the significant outcomes of UKRI India-funded projects, including their contribution to publications, development of technical products, and overall enhancement of the research ecosystem in both countries. These reviews offer recommendations for enabling funding, developing partnerships, deepening R&I, and ensuring the effectiveness of UKRI's international collaborations with the aim of maximizing the value of public funding, demonstrating the economic, technological, and societal impacts of UKRI's bilateral collaborations.

5.1.2 The nature of the generated reputation

UK as a trusted and reliable partner for co-funding

Successful engagement and delivery of these bilateral agreements have proven the UK to be a trusted and reliable partner in multi-million collaborative R&I projects worldwide. UKRI's partnerships with funding agencies in Sweden, and its partnership with India- supporting 260 projects and funded by fifteen funding agencies are just a few examples that demonstrate the UK's strong reputation as a trusted co-funder of international projects addressing the mutual interests of countries and common global challenges.

UK as a leader in bilateral collaboration for research, technology and innovation that drive technological advancements, economic growth, and entrepreneurialism and address global challenges

The joint efforts in multiple bilateral agreements with countries with complementary knowledge, skills, resources and networks further demonstrate the UK's commitment to tackling global issues through collaborative R&I. The broad range of international projects with a specific focus on country-specific strengths, social and economic needs, aspirations, and impacts underscore the UK's commitment to driving economic prosperity, social well-being, technological advancement, and competitiveness both at national and international levels. Successful collaborations and the development of new technologies and products highlight the UK's supportive environment for innovation and entrepreneurship.

For instance, the UKRI - India agreement has facilitated funding commitments of close to £400 million, supporting over 260 projects. These projects have generated an additional £450 million in further funding, mainly from public bodies, non-profit organizations, and commercial entities. The willingness of other funders to invest shows how the enhanced reputation of the UK and associated partners owing to the bilateral collaborations, developed trust and confidence, a reflection of the UK as a leader in international collaboration for developing R&I.

5.1.3 The impacts of the generated reputation

Table 5.1: Impacts of reputation generated through UK's bilateral funding programmes

Types of Impact	Specific Impacts
1. Financial Impact - Increased Financial returns	Enhanced business developmental opportunities for businesses of all sizes Enhanced access to funding and foreign investment
2. Relational Impact - Improved useful and strategic networks and relationships	Enhanced opportunities to access, strengthen, collaborate with, and/or develop new, useful local, regional, national and international networks
3. **Resource Impacts** - Increased availability of resources	Improved access to, and/or develop new, knowledge, expertise and resources
4. **Research and Innovation Impacts** - Increased research and innovation output	Improved opportunities to engage in larger international projects to innovatively develop new products, services and technologies for local and global markets
5. Political Influence - Improved national influence internationally	Strengthened bilateral relationships and trust between the UK and other nations, improving the UK's political influence
6. Social and Environmental Impacts - Increased generation of social and environmental value	Enhanced opportunities to jointly address mutual social and/or environmental challenges through bilateral R&I

Case Study: UKRI in North America Bilateral Funding Agreement

The UKRI in North America Bilateral Funding Agreement facilitates collaborative research and innovation projects between the UK and North American partners, leveraging mutual strengths to address global challenges and drive scientific advancements.

International R&I activities:

The breadth and scale of UK partnerships with North America have played a vital role in advancing institutional and individual research and innovation, from foundational partnerships to transatlantic careers. Since 2015, UKRI has funded around 3000 awards involving collaboration with North America, with over £3bn of investment which has opened doors to new knowledge and leveraged funding from outside the UK. UKRI has a crucial role to play in ensuring these valuable connections and collaborations can flourish.

The UKRI North America Office developed the first MoU on Research Cooperation with the US National Science Foundation in 2013. This MoU created the underpinning conditions for increasing collaboration between the two agencies, including Lead Agency opportunities, with a simpler application process enabling hundreds of talented researchers to collaborate on cutting-edge fundamental research. The UKRI North America Office, with staff based in Washington, DC, and Ottawa, plays a pivotal role in catalyzing and connecting to ensure partnerships deliver ever-increasing impact. Often drawing on UKRI NA Office networks, to date there have been around 100 collaborative research programmes supporting many research awards worth hundreds of millions of pounds, providing UK and US researchers with funding to address shared priorities across a vast range of research topics.

Over the past 15 years, the UKRI NA Office has enabled collaborations with over 50 funding partners across the US and Canada, and by extension with hundreds of US and UK universities. This network includes but is not limited to Federal Government departments, funding agencies, research institutes, and laboratories with hundreds of millions of dollars (US and Canadian) in annual budgets and hundreds of thousands of employees.

UKRI continues to engage across all disciplines and sectors in outstanding programmes with North American partners.

The activities associated with the joint agreement range from a longstanding collaboration on the Ecology and Evolution of Infectious Diseases, especially pertinent given the COVID-19 pandemic, to creating the conditions for future connections and emerging research areas such as International Summer Schools on quantum technologies. The joint agreement continues to scale up strategic engagement in global challenge areas, supporting UK government priorities. By building on this successful bilateral engagement, the UKRI recently joined US and Canadian partners in two major multilateral initiatives on clean energy and climate change, with a total of ~£25m UK investment, alongside an additional ~£60m from North American partners.

The nature of reputational impacts generated:

This bilateral agreement has increased trusted research partnerships. The reputation developed through the agreement and associated activities of the mutual understanding of each other results in a significant and long-term investment of time and resources in creating new streamlined, flexible, and responsive models for transatlantic research, through a combination of core funding, the Lead Agency mechanism and additional funding streams. The physical presence of the UKRI NA Office has resulted in in-person interactions essential for deep networks in both North America and the UK, and a deep understanding and trust of the research landscape and funding mechanisms across jurisdictions, essential for UK's reputation building as a reliable partner for co-funding.

Source: https://www.ukri.org/wp-content/uploads/2023/06/UKRI-09062023-Digital-9266-North-America-Impact-Assessment-TC-V4.pdf

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5.2. UK's multilateral funding programmes

The UK's engagement in multilateral funding programmes such as EU Horizon Europe plays a crucial role in enhancing its reputation in research and innovation globally. Politicians and stakeholders take a proactive role in negotiating bespoke deals with improved financial terms to ensure that UK scientists have access to the world's largest research collaboration programmes and international researchers benefit from the UK's strengths. Additionally, these funding programmes foster global research collaborations by creating opportunities for UK researchers and businesses to collaborate with international counterparts. These programmes also offer access to unique resources and infrastructure further enhancing these efforts, and promoting a robust and interconnected research environment. These programmes thus improve the UK' reputation as a proactive and influential leader in international collaborative research, innovation, and technology advancement. These activities also reinforce the UK's leading role in global R&I, complemented by the demonstration of the UK's dedication to driving economic prosperity and social well-being at both national and international levels. The enhanced reputation generates financial, relational, resource, research, innovation, political, social, and environmental value [Figure 5.2].

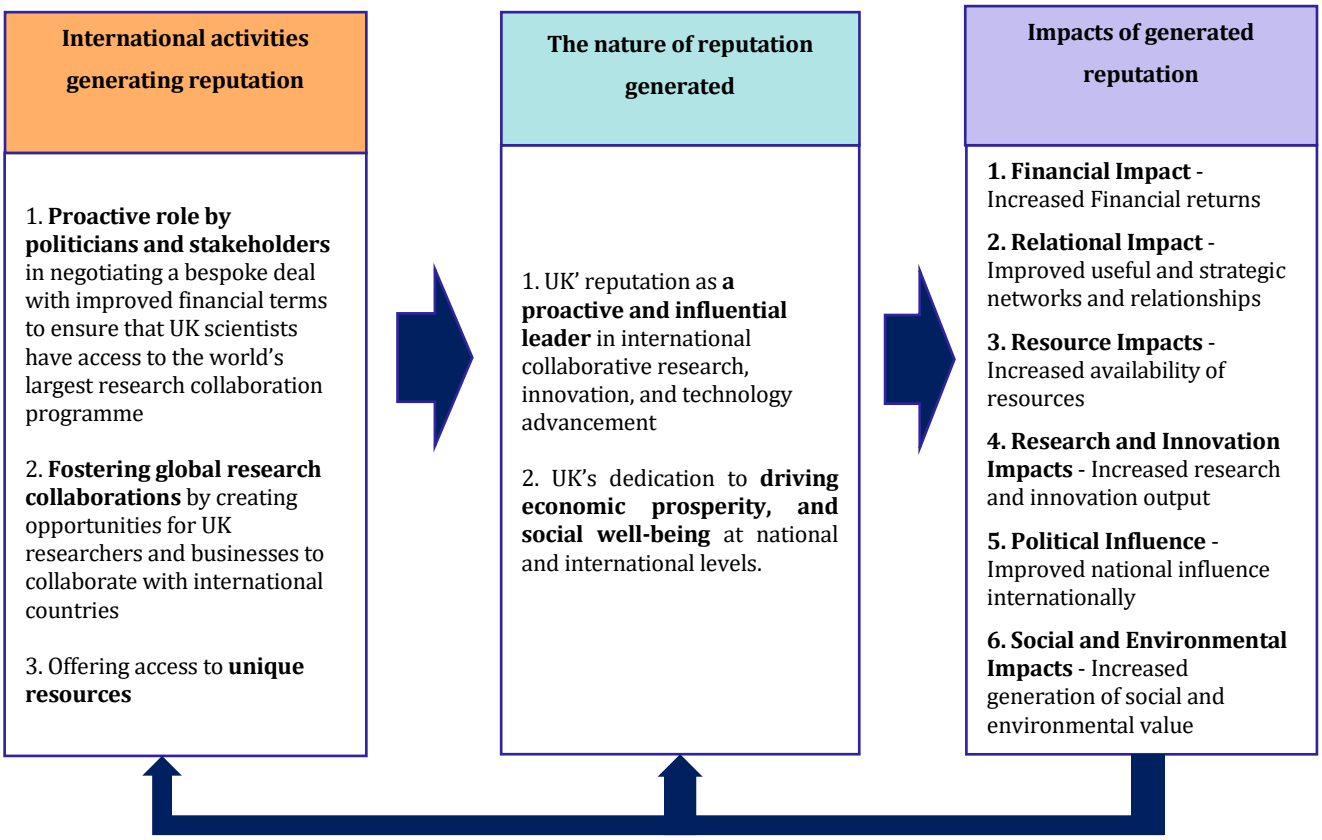

Figure 5.2: UK's multilateral funding programmes generating reputational impacts

5.2.1 International activities

Proactive negotiation for bespoke deals in multilateral funding programmes

The UK government and stakeholders negotiate a bespoke deal for the UK's association in multilateral funding programmes. For instance, such negotiation has occurred concerning the UK's association with Horizon Europe, ensuring favourable financial terms and equal participation rights for UK scientists. By securing a tailored agreement, UK leaders showcased a proactive commitment to strengthening collaborative relationships with European and global partners in association with Horizon Europe in 2023. These negotiations not only benefit the UK but are also of significant value to partner countries, which immensely benefit from the UK's strong research, innovation, and associated resources and infrastructure.

The Horizon Europe agreement solidified its commitment to collaborative research, enabling UK-based entities to participate fully in the program alongside EU counterparts. This negotiation emphasized the UK's dedication to maintaining its leadership in global research and innovation efforts despite Brexit uncertainties. This proactive approach assures UK researchers of ongoing access to significant funding opportunities and collaborative networks and enables UK researchers to lead consortia in cutting-edge projects across fields like health and artificial intelligence. Moreover, inclusion in Horizon Europe's governance enhances the UK's influence and role in shaping collaborative research agendas, driving economic growth, and cementing its role as a leading force in global science and technology.

Fostering global research collaborations

Through active participation in multilateral funding programs, the UK expands the breadth and influence of its research endeavours, exemplifying leadership in establishing global research networks. In initiatives like the Trans-Atlantic Platform for Social Sciences and Humanities (T-AP), the UK underscores its dedication to global collaboration in research and innovation, fostering substantial partnerships extending beyond European borders. The UK contributes to the excellence of the European Research Area (ERA) along with non-EU European countries, such as Norway, Iceland, and Switzerland. Canada's participation in Horizon Europe exemplifies this commitment, enhancing collaborative efforts between Canada and the UK and reinforcing transatlantic research alliances, thereby promoting research, innovation, and knowledge exchange. For instance, Canada's affiliation with Horizon Europe expands collaborative ventures between Canada and the UK and strengthens transatlantic research alliances, promoting innovation and the exchange of knowledge.

Another example is the Human Frontier Science Program (HFSP), established in 1989, which has granted over 7000 awards to researchers from more than 70 countries, and 28

HFSP awardees have later received the Nobel Prize for their scientific contributions. The program encourages interdisciplinary collaboration across fields such as physics, mathematics, chemistry, computer science, bioinformatics, nanoscience, engineering, and biology to advance our understanding of complex biological systems. Similarly, The Belmont Forum, established in 2009, to advance transdisciplinary science related to global environmental change has by 2020 awarded over €150 million in funding, benefiting 132 projects and more than 2,000 scientists worldwide.

The UKRI also announced the first projects under the £110 million Climate Adaptation and Resilience research programme at the Africa Climate Summit and UN High-Level Political Forum, supporting groundbreaking research in 26 African and Indo-Pacific countries. Moreover, the £337 million International Science Partnerships Fund (ISPF) offers UK researchers and innovators access to global talent, large-scale facilities, and diverse research ecosystems. This includes Global Centres for Clean Energy programme in collaboration with the US, Canada, and Australia, and a partnership with Japan to develop new technology for nuclear waste disposal.

Participation in programs like Copernicus, the European Earth Observation program, provides UK researchers access to state-of-the-art Earth observation data and services. Access to unique resources such as Copernicus enhances the UK's research capabilities in areas requiring extensive data and infrastructure. Through Copernicus, UK researchers can access high-resolution satellite imagery, real-time data on atmospheric composition, and comprehensive climate change indicators. The ability to leverage such advanced data attracts international collaborators seeking to utilize the UK's expertise in environmental monitoring and data analysis. Thus, the UK strengthens its innovative skills and showcases its scientific capabilities in fields such as environmental science, climate change, and space technology. This access not only supports the UK's scientific endeavours but also positions it as a preferred partner for global research initiatives.

These multilateral funding programmes underscore the UK's capacity to engage with leading global research entities, reinforcing its status as a centre for pioneering research and innovative advancements at an international scale.

5.2.2 The nature of reputation generated

- **UK's reputation as a proactive and influential leader in international research collaborations, innovation, and technology advancement**

  Engagement in these multilateral funding programmes significantly enhances the UK's reputation and commitment to international research, collaboration, innovation, and technology advancement. This leadership demonstrates the UK's strategic vision and reliability in maintaining its position at the forefront of global research and innovation. The UK solidifies its role in shaping collaborative research agendas and establishes itself as a leading force in global science and technology.

- **UK's dedication to driving economic prosperity, and social well-being at national, EU, and international levels**

  By fostering global research collaborations, the UK exemplifies its dedication to expanding the breadth and influence of its research endeavour in driving economic prosperity, and social well-being at national, EU, and international levels. Engaging in multilateral funding programs and initiatives enables the UK to collaborate with international countries on addressing common social-economic challenges, demonstrating the UK's dedication to driving economic prosperity, and social well-being at national, EU, and international levels.

5.2.3 Impacts of generated reputation

Table 5.2: Impacts of reputation generated through UK's multilateral funding programmes

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Enhanced business developmental opportunities for businesses of all sizes Enhanced access to funding and foreign investment
2. **Relational Impact** - Improved useful and strategic networks and relationships	Enhanced opportunities to access, strengthen, collaborate with, and/or develop new, useful local, regional, national and international networks
3. **Resource Impacts** - Increased availability of resources	Improved access to knowledge, expertise and resources Enhanced opportunities to access new national and international infrastructure and/or engage in national and international infrastructure development Enhanced perceiving of the UK as a resource for future R&I
4. **Research and Innovation Impacts** - Increased research and innovation output	Opportunities to engage in larger international profitable, and strategically relevant projects
5. **Political Influence** - Improved national influence internationally	Strengthened international relationships and trust between the UK and other nations, improving the UK's political influence
6. **Social and Environmental Impacts** - Increased generation of social and environmental value	Enhanced opportunities to collaboratively address global challenges

Case Study: UK's multilateral agreement in Copernicus

Copernicus is the Earth observation component of the European Union's Space Programme, dedicated to monitoring our planet and its environment for the benefit of all European citizens. It provides information services that utilize data from satellite Earth observation and in-situ (non-space) sources.

International R&I activities:

The European Commission oversees the programme, which is implemented in collaboration with Member States, the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU Agencies, Mercator Océan, the European Environment Agency (EEA), and the Joint Research Center (JRC).

Since rejoining Copernicus as a full participating state from January 1, 2024, the United Kingdom has significantly broadened its engagement and opportunities within the Copernicus Space Component, leveraging its reputation as a proactive and influential leader in international research collaborations, innovation, and technology advancement.

For instance, UK-based companies are actively participating in ESA's procurement processes via the ESA-STAR portal, which grants access to Invitations to Tender (ITTs) and enables companies to express interest well ahead of tender deadlines. The European Space Agency (ESA) coordinates the delivery of data from upwards of 30 satellites. This proactive involvement enhances their competitiveness in securing contracts for constructing, launching, and operating Copernicus Sentinels. Moreover, UK entities have the opportunity to apply to join the pool of Copernicus Contributing Missions (CCM) through ESA's Dynamic Purchasing System, thereby contributing supplementary data to the Copernicus services and expanding their engagement in the program.

European Earth observation data providers also play a crucial role in Copernicus as contributing missions, enhancing the program's capabilities to meet Earth observation needs across Europe. Companies seeking to join the pool of commercial data providers can submit applications via ESA's Dynamic Purchasing System, accessible through a simple registration process in ESA's procurement system, ESA-star portal. This participation fosters collaboration among commercial providers, advancing Europe's Earth observation objectives by complementing Sentinel data with very high-resolution data. The ongoing CCM procurement process, managed by ESA, aims to integrate advancements in commercial remote sensing technology to meet current and future demands of the Copernicus services, benefiting European citizens with free and open access to Sentinel data and Copernicus services.

The nature of reputational impacts generated:

Through these initiatives, the UK reinforces its reputation as a capable user of unique data and consolidates its position as a leading force in global Earth observation and space technology. Moreover, the UK's enhanced role in Copernicus underscores its capability to contribute to cutting-edge solutions in environmental monitoring and disaster management, thereby bolstering its global standing in space technology and Earth observation science. This reputation not only facilitates technological innovation within Europe but also strengthens international collaborations aimed at addressing global challenges through advanced satellite data and analytics.

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5.3. UK International development funding programmes

The UK generates a strong reputation for collaborative R&I through its international developmental funding programmes. International developmental programmes enable the UK to build reputation as a leader and an influencer of international R&I collaboration, technology, and innovation that drive technological advancements to address global challenges. Especially, the UK's commitment to addressing the challenges of emerging and developing nations enables the UK to develop reputation as a nation committed to global prosperity and a leader in directing the international funding landscape, policy, and practice. The impacts generated from the UK's reputation as a global leader in international research and innovation are rooted in its strategic approach to leveraging strengths in science and innovation, fostering academic links, developing expertise in global challenges, strengthening soft power and diplomacy, and ensuring sustainable engagement through equitable partnerships. These activities underpin the UK's influential role in directing international funding and collaborating across borders to address complex global challenges and promote socio-economic development worldwide. The reputation generated by engaging in international developmental funding programmes generates financial, relational, resources, research, innovation, political, social, and environmental impacts [Figure 5.3].

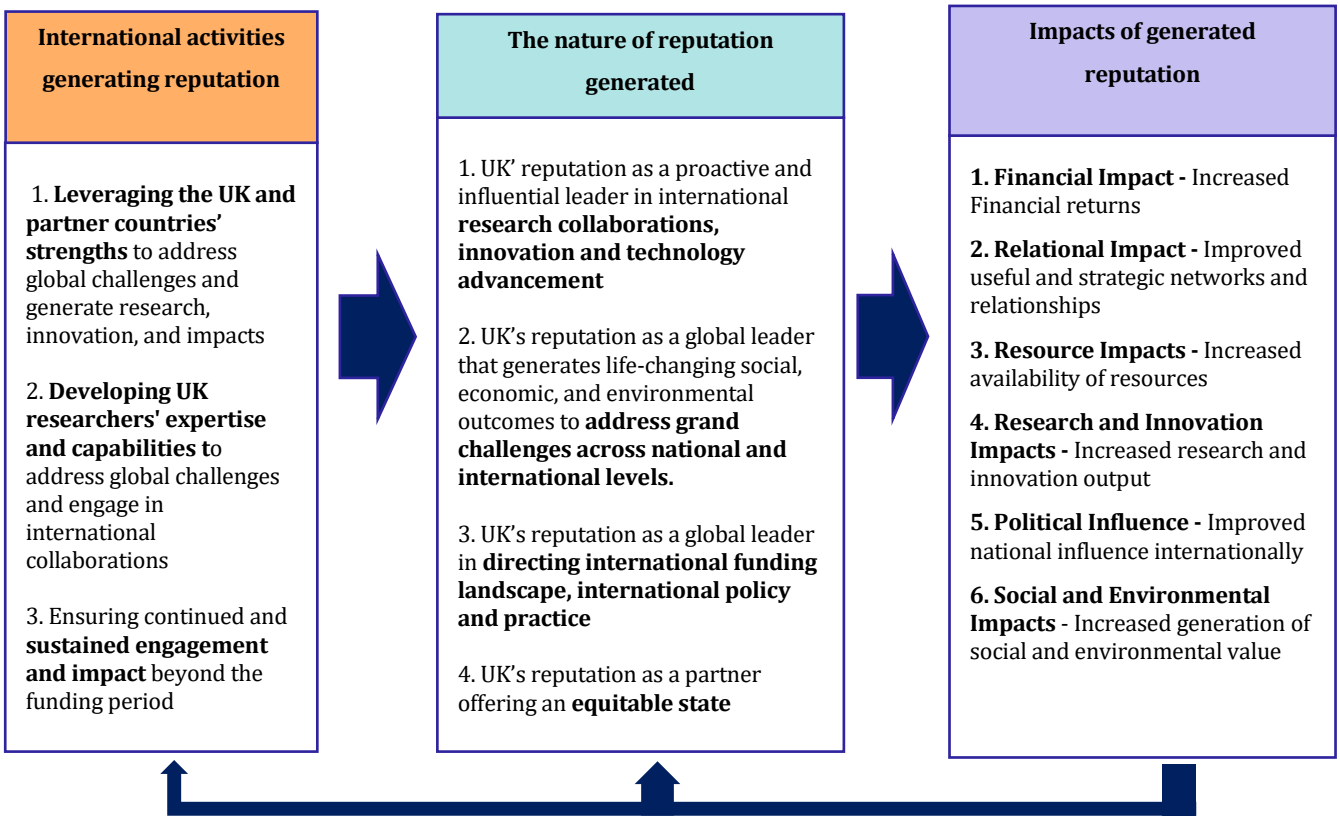

Figure 5.3: UK International development funding programmes generating reputational impacts

5.3.1 International activities

Leveraging the UK and partner countries' strengths to address global challenges and generate research, innovation, and impacts

The UK's international development programmes such as the Newton Fund effectively utilized the UK's strong science and innovation ecosystem to establish partnerships with emerging research leaders globally. This initiative not only showcases UK research excellence but also promotes knowledge sharing and capacity building in partner countries.

Between 2014 and 2021, the Newton Fund supported bilateral science partnerships with 16 developing countries across Africa, Asia, and Latin America, with a budget of £735 million. The UK researchers have been able to collaborate closely with partners in countries like Brazil and India, through projects funded by the Newton Fund, focusing on critical issues such as public health and sustainable development. In countries like the Philippines and Jordan, the Newton Fund facilitated systematic collaboration and cultural bridging, laying the groundwork for deeper and more efficient joint efforts. This framework proved instrumental in transforming existing links into platforms for broader scientific cooperation. International development funding, which focuses on the needs of developing countries, thus fosters the UK's standing and political influence in the globe as well as offers invaluable opportunities for UK researchers to capitalize on the strengths of the UK and international partners for the advancements in R&I and associated impacts.

Initiatives under the Global Challenges Research Fund (GCRF) and Newton Fund focus on fostering deep academic collaborations that yield impactful research outputs. By tapping into partner country expertise, these collaborations aim to address complex global challenges through interdisciplinary approaches. Collaborative projects on climate change adaptation funded through GCRF have integrated UK climate science with local knowledge systems in countries like Bangladesh and Kenya. This approach not only enhances research outcomes but also builds resilient partnerships capable of addressing shared environmental challenges. Such funds thus result in showcasing the UK's commitment to collaboratively address global challenges by integrating the unique strengths of partner countries with that of the UK. The Newton Fund and GCRF emphasize equitable partnerships and joint ownership of priorities, that foster trust and cooperation between UK institutions and their counterparts in partner countries. This approach fosters a sense of co-ownership and enhances the UK's reputation as a trustworthy and collaborative research partner. In the Philippines, stakeholders noted that the UK's approach to the Newton Fund stood out by establishing genuine partnerships, unlike common practices in the country. Funding for Global Collaborations such as initiatives like the

£337 million International Science Partnerships Fund (ISPF) provides UK researchers with access to global talent and large-scale facilities, reinforcing the UK's reputation in supporting large-scale research.

Developing UK researchers' expertise and capabilities to address global challenges and engage in international collaborations

There are different schemes introduced by the UKRI that enable the development of UK researchers' expertise and capabilities to address global challenges and engage in international collaborations. For instance, AHRC's and ESRC's International Placement Scheme, funds eligible PhD students and early career researchers to complete a research fellowship at an international institution in US or Japan for 2 to 6 months.

UK researchers gain firsthand experience working on research projects in regions like Southeast Asia and Latin America. The AHRC's support for these international placements and collaborative research initiatives aims to develop the skills and capabilities of UK scientists necessary to effectively engage in global challenges. This includes developing expertise in global challenge topics and fostering cultural competence.

The Newton Fund's bilateral science partnerships with 16 developing countries across Africa, Asia, and Latin America supported the mobilisation of UK science and research expertise to work with partner countries. Additionally, the Newton Fund initiatives played a crucial role in capacity building and skill development among UK researchers. This includes fostering the capability to navigate diverse cultural settings and engage in collaborative research that addresses pressing global issues, which is important to strengthen international research networks, and foster long-term partnerships and mutual understanding.

Ensuring continued and sustained engagement and impact beyond the funding period

Beyond the initial funding phase, initiatives supported by the Newton Fund and GCRF aim to sustain long-term partnerships and maximize their impact on global research and innovation. This involves nurturing relationships and exploring avenues for ongoing collaboration. Additionally, during the funding period, the exploration and adoption of long-term and sustainable models are encouraged. Projects initiated through the Newton Fund have transitioned into sustainable partnerships that continue to produce research outputs and influence policy decisions. For instance, collaborations in healthcare innovation have led to the development of new medical technologies, benefiting both UK industries and partner countries' healthcare systems.

5.3.2 The nature of the generated reputation

- **UK's reputation as a proactive and influential leader in international research collaborations, innovation, and technology advancement**

  By leveraging the UK's robust science and innovation ecosystem, the Newton Fund has built relationships with emerging research leaders globally, positioning the UK as a proactive and influential leader in international research collaborations, innovation, and technology advancement. The fund has facilitated the production of high-quality research outputs and tapped into partner country expertise, enhancing the reputation of the UK as an R&I influencer. This proactive approach demonstrates the UK's commitment to fostering international cooperation and advancing the global research and innovation agenda.

- **UK's reputation as a global leader generating life-changing social, economic, and environmental outcomes**

  The UK's emphasis on impactful research has solidified its reputation as a global leader in generating significant social, economic, and environmental benefits. For instance, through the Newton Fund, the UK has enhanced researchers' expertise in global challenge topics and influenced policy and practice in partner countries, making substantial contributions to sustainable development goals and societal well-being. Newton Fund has also built the capacity to commercialize innovations and develop solutions to address socio-economic challenges in partner countries. These contributions have enhanced the UK's reputation as a global leader in generating life-changing social, economic, and environmental outcomes.

- **The UK's reputation as a global leader in directing the international funding landscape, policy, and practice**

  Due to its involvement in international development grants, the UK is recognized globally for its leadership in directing international funding and fostering cross-country collaboration, supporting strategic investments that promote economic development, sustainable practices, and social welfare in partner countries. For instance, the Global Challenges Research Fund (GCRF), supports cutting-edge research to address the challenges faced by developing countries, and funds international collaboration, which enhances the UK's ability to build new, and strengthen existing global partnerships.

  Newton Fund-supported activities have shown early signs of influencing policy and practice in partner countries. For example, in China, research funded under the Newton Fund on antimicrobial resistance contributed to a government decision to ban the use of colistin as a food additive in the agricultural industry. This demonstrates the impactful outcomes of UK-led

research collaborations in influencing regulatory policies at an international level. In India, for instance, the development of the CRADLE maternal care vital signs alert device, supported by Newton Fund research, has potentially influenced routine maternal healthcare practices across several countries. This innovation highlights the direct impact of UK-led research on improving healthcare outcomes globally.

While many Newton Fund projects are still in the early stages of dissemination and uptake, there are promising signs of their influence at policy and practice levels. Projects in India, Chile, and China have demonstrated how UK-led research can catalyze significant changes in healthcare practices, regulatory frameworks, and educational strategies, illustrating the lasting impact of these collaborative efforts beyond their initial phases.

Newton Fund's positive impact on government and diplomatic relationships, emphasizing its role as a significant source of 'soft power' for the UK. It has successfully helped establish new relationships in regions where ties were limited, such as Southeast Asia, and strengthened existing partnerships, like those with Brazil. Stakeholders noted that the Newton Fund positioned the UK favourably as a science and innovation partner of choice. For instance, initiatives in Kenya facilitated engagement with policymakers through bilateral Science Boards, enhancing diplomatic ties and facilitating broader international collaboration and perceptions of the UK as a global R&I collaborator.

UK’s reputation as a partner offering an equitable state

The Newton Fund and GCRF emphasize equitable partnerships and joint ownership of priorities, that foster trust and cooperation between UK institutions and their counterparts in partner countries. This approach fosters a sense of co-ownership and enhances the UK's reputation as a trustworthy and collaborative research partner. In the Philippines, stakeholders noted that the UK's approach to the Newton Fund stood out by establishing genuine equitable partnerships, unlike common practices in the country. This proactive stance was believed to give the UK a reputational advantage over international competitors in gaining attention and fostering deeper equitable collaborations.

5.3.4 The impacts generated by reputation

Table 5.3: Impacts of reputation generated through UK International development funding programmes

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Enhanced business developmental opportunities for businesses of all sizes
2. **Relational Impact** - Improved useful and strategic networks and relationships	Strategic and successful country-level partnerships
3. **Resource Impacts** - Increased availability of resources	Improved access to resources, large infrastructure, knowledge, funding, foreign investment, expertise, and networks
4. **Research and Innovation Impacts** - Increased research and innovation output	Improved international collaboration among countries leading to academic, economic, social, and environmental value creation
5. **Political Influence** - Improved national influence internationally	Enhanced opportunities to influence global and national policy, funding landscape, and practice
6. **Social and Environmental Impacts** - Increased generation of social and environmental value	Enhanced opportunities to simultaneously generate business, academic, social, and/or environmental value

Case Study: Efficiency NUE management: UK & Brazil project funded by Newton Fund

The NUCLEUS project, funded by the Newton Fund, aimed to enhance Nitrogen Use Efficiency (NUE) in agricultural systems through an interdisciplinary approach involving 12 institutions from the UK and Brazil.

International R&I activities:

The project, led by the University of Nottingham and São Paulo State University, aimed to address nitrogen loss from synthetic fertilizers, which impacts productivity and the environment. By integrating soil-plant systems, it sought to improve nitrogen use efficiency (NUE), reduce pollution, and support sustainable food production. Over 30 scientists from various fields participated, producing research publications with recommendations for different agricultural contexts.

Built on prior collaborations and supported by the Newton Fund, the project showcased the UK's leadership in international research. It included the development of a nitrogen sensor by Bangor University and the John Innes Institute, and engagement with Brazilian expertise in crop sensors and drone techniques.

Field days and demonstrations in Brazil attracted local engagement and presentations at international conferences. The project involved training early-career researchers and students, fostering future scientific leaders. It also established lasting relationships, leading to further collaborations and exchanges.

The collaboration enhanced academic ties between UK and Brazilian institutions, resulting in Memorandums of Understanding (MoUs) and student exchanges. UK researchers gained exposure to advanced Brazilian agricultural practices, improving understanding of global agricultural systems.

Success in securing follow-on funding through the Newton Fund Impact Scheme highlighted the project's value. The collaboration opened doors for UK institutions to participate in other international research initiatives.

The project's practical recommendations and technological innovations influenced agricultural practices, particularly in Brazil, demonstrating the UK's commitment to addressing environmental challenges through applied research.

The nature of reputational impacts generated:

The UK's ability to lead complex, interdisciplinary projects was solidified, showcasing its strengths in project management, scientific innovation, and international collaboration. The project highlighted the UK’s collaborative approach, integrating local expertise and fostering mutual benefits. The engagement with Brazilian agricultural practices and innovations demonstrated the UK's openness to learning and adopting global best practices.

The focus on improving NUE and reducing environmental pollution underscored the UK's dedication to sustainable agricultural practices and environmental conservation. The involvement of numerous early-career researchers and students from both countries emphasized the UK’s role in nurturing future scientific talent and fostering an international academic community.

In conclusion, the NUCLEUS project significantly enhanced the reputation of the UK’s research and innovation sector by demonstrating leadership in international collaboration, fostering technological and scientific advancements, and committing to sustainable agricultural practices. This reputation not only strengthened academic networks and increased research capabilities but also positioned the UK as a key player in global efforts to address environmental and food security challenges.

Source: UK Secondary Benefits Study The Newton Fund (2022)

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5.4. UK's unilateral support for international collaboration

The UK builds a strong reputation through unilateral grants that support both UK and international individual researchers and research groups to engage in international R&I that are not necessarily be part of bilateral, multilateral, or international development grant programmes discussed in the previous three sections of Chapter 5. These grants allow for overseas collaborators to be included as co-investigators and enable international academics to visit the UK for a limited timespan to develop collaborative projects with UK researchers. Depending on the nature of the grants, they are designed to cover part or all of the full economic costs (FEC) of cutting-edge research projects and international travel expenses. These initiatives demonstrate the UK's commitment to boost its reputation as a global leader and collaborator in supporting research and innovation. This section will discuss the activities that bolster the UK's reputation in international R&I, the nature of the reputation generated from these activities and the impacts of the UK's reputation as a global leader in R&I, and how the impacts further reinforce the UK's reputation [Figure 5.4].

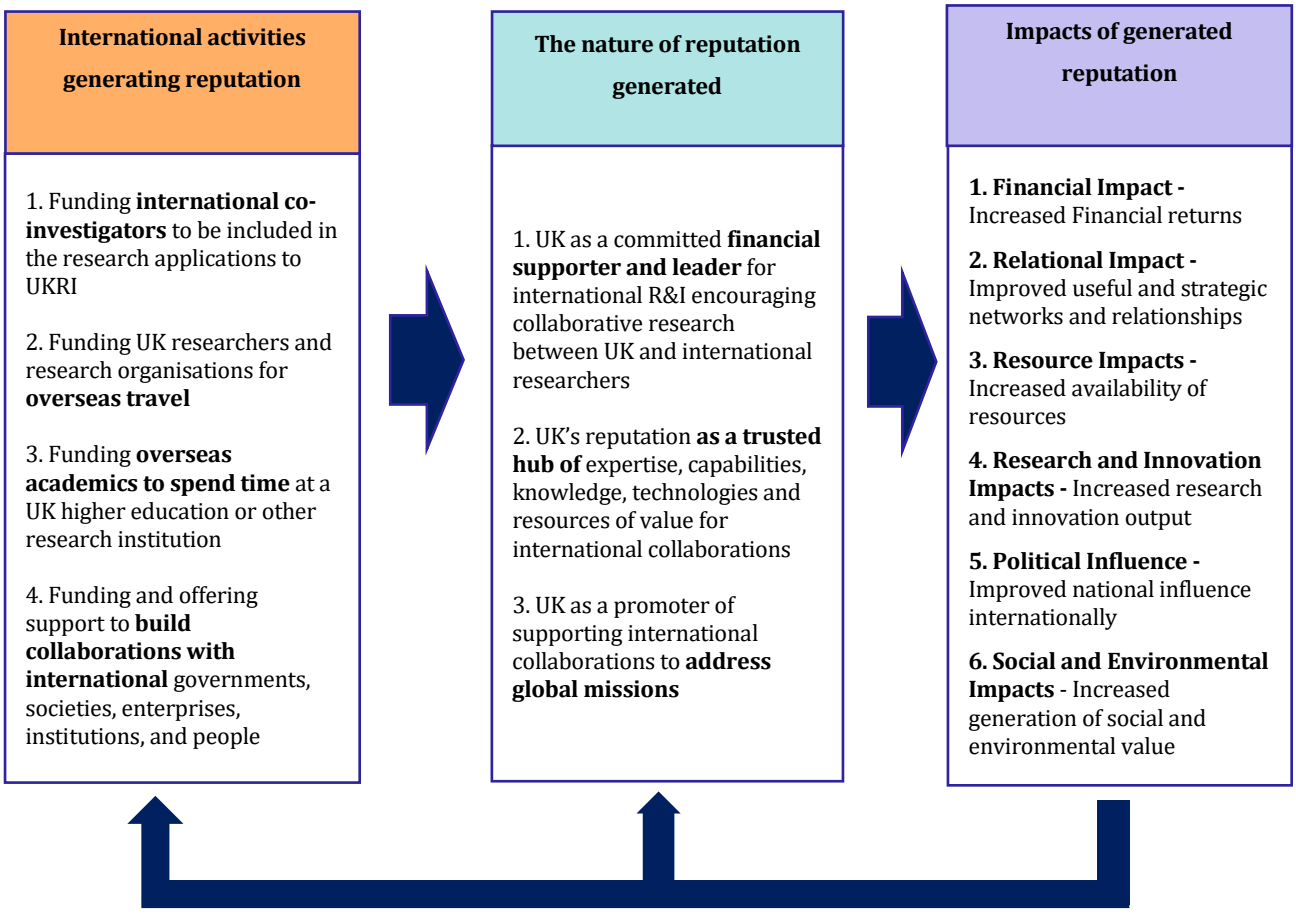

Figure 5.4: UK's unilateral support for international collaboration generating reputational impacts

5.4.1 International Activities

Funding international co-investigators to be included in the research applications to UKRI

The international co-investigator policy allows overseas collaborators to be included as co-investigators on applications to UK Research and Innovation (UKRI) research funding opportunities. The international Co-I funding covers the Co-I costs depending on the specific international project. The Co-I funding policy emphasises that international collaboration is inherently critical for UKRI and its research councils such as Arts and Humanities Research Council (AHRC), Economic and Social Research Council (ESRC), and Medical Research Council (MRC) as it serves as a fundamental underpinning of a broader international initiative. It facilitates UK-based researchers to collaborate with their peers worldwide enhancing the quality and impact of their research, particularly in the fields that are new to UK-based researchers. For instance, the International Co-I supports' research in areas such as social science focusing on populations not based in the UK, or in health space, where global collaboration is needed to understand global health, diseases not present in the UK, or rare conditions with few patients in any one country (Review of the International Co-Investigator Policy, 2023).

For example, UKIR's Metascience Research grants support collaborative research with international organisations. This includes project co-leads based in non-UK research organisation that can be included in research grants available for international activities and international partner organisations, committed to achieving equality of opportunity for all funding applicants. This also enhances opportunities for both UK and international researchers to address challenges or seize opportunities that are not possible within a single country.

Funding UK researchers and research organizations for overseas travel

Funding UK researchers and research organizations for overseas travel facilitates international collaborations, accessing unique resources and expertise, and building a competitive edge.

International travel awards provided by the Biotechnology and Biological Sciences Research Council (BBSRC) support researchers with their visits abroad to establish initial contacts with international partners or prepare proposals for international programs, for up to one month, or attend European consortia-building events. It also aims to support researchers' stays of up to one month at facilities not available in the UK to conduct specific work or access techniques and materials beneficial to BBSRC research projects or research teams. Similarly, the

Engineering and Physical Sciences Research Council (EPSRC) offers overseas travel grants, up to 80% of the full economic cost (FEC) of the project in any area within the remit of EPSRC to UK-based researchers to acquire new techniques or establish and develop international collaborations.

Funding overseas academics to spend time at a UK higher education or other research organisations

UK offers funding for overseas academics to spend time at UK higher education or research institutions through funding programmes such as the British Academy's Visiting Fellowship. This programme attracts global talents by inviting academics from around the world to visit the UK for up to six months and develop collaborative projects regardless of their career stage or discipline within the humanities and social sciences. It helps build new links and foster future partnerships between international scholars and UK researchers to strengthen global collaboration. This collaborative effort highlights the UK's role in fostering international research networks and partnerships. By enabling overseas academics to engage in research and professional development at UK institutions, the programme contributes to the development of high-quality research outputs in the humanities and social sciences and further exchange of knowledge showcasing the UK's capacity to produce impactful and innovative research outcomes. The Visiting Fellowship programmes underscores the British Academy's dedication to international engagement and creating a welcoming research environment for global academics.

Funding and offering support to build collaborations with international governments, societies, enterprises, institutions, and people

In addition to academically focused unilateral funding programmes, the UK also offers funding and support to build collaborations with international governments, societies, enterprises, institutions, and people. For example, the Global Expert Missions (GEM), funded by Innovate UK fund and foster international collaboration with governments, societies, enterprises, institutions, and individuals worldwide. Aimed at addressing global challenges from international perspectives, the GEM programme supports the UK government's ambitions to become the international partner of choice and a global hub for innovation. It highlights the best of the british technology, research, and expertise, and enhances the UK's innovation partnership with global economies. The GEM programme's global collaboration with multiple stakeholders has been well-evidenced in examples such as Innovate UK's collaboration with industry leaders and sector experts, and leading public and private sector organisations in Australia to explore developments in Critical Materials for Electrification. Also, Innovate UKs GEM programme in partnership with UKRI India, WRAP collaborated with industry leaders

and sector experts to explore development in Sustainable Plastic Packaging (Sustainable Plastic Packaging in India 2023). A 5-day GEM mission, comprising of seven UK delegates active in the UK Advanced Manufacturing industry was conducted in three separate locations in Türkiye. This mission was carried out in collaboration with key stakeholders from both private and public sector organisations, focusing on the ways materials and manufacturing organisations can be more sustainable and resource-efficient, leading to increased resilience and/or technological advancement (Advanced Manufacturing and Materials in Turkey 2022). All these activities showcase the UK's commitment to supporting international R&I collaborations and addressing global challenges, benefiting the affected stakeholder groups.

Other impactful examples are Innovate UK's Global Business Innovation Programme, Global Incubator Programme, and Business Growth Programmes, which further enable UK businesses to grow by engaging in impactful international collaborations and driving innovation across borders. These programs support UK companies in expanding globally and fostering partnerships with international researchers, SMEs, and academic institutions. Another example is the UKRI's Engineering and Physical Sciences Research Council (EPSRC) international Centre-to-Centre research collaboration call, which funded twelve partnerships in various fields including quantum computing and electric vehicles, enabling leading UK research groups to collaborate with top international researchers on their projects.

5.4.2 The nature of the generated reputation

- **UK as a committed financial supporter and leader for international R&I encouraging collaborative research between UK and international researchers**

  The international co-investigator policy for overseas collaborators, UKIR's Metascience Research grants, and the Global Expert Missions (GEM) programme exemplify the UK's commitment and contribution to global R&I, including nurturing both UK and international researchers and their collaborations.

  The UK's reputation as a considerate, supportive, and inclusive research environment is reflected in several key practices including, encouraging funding applications from a diverse range of researchers, supporting flexible working arrangements tailored to individual researchers' personal circumstances, providing support for career breaks, offering assistance for people with caring responsibilities, and promoting alternative working patterns. The British Academy's Visiting Fellowship programme particularly encourages applications from historically and/or structurally disadvantaged groups, low-income countries, and female researchers. The UK has built a reputation for offering international

researchers transparent and merit-based career progression, outperforming other European countries in terms of the career opportunities available to academics (MORE4 study), underscoring the UK's dedication to creating and accommodating equitable research environment for international researchers

- **UK's reputation as a hub of expertise, capabilities, knowledge, technologies, and resources of value for international collaborations**

  UK has built reputation as the go-to research partner of choice and enhanced its domestic research by attracting increased foreign investment and talent (The UK's role in global research: how the UK can live up to its place in the world). Global Expert Missions (GEM) advance the UK's vision of becoming a global hub for UK innovation, by showcasing the best of British technology, research, technology and expertise and establishing the UK as the trusted partner of choice for innovation collaborations. To align with the UK's R&D ambitions, the UK has to maintain and enhance its status and reputation as a preferred collaborator and destination (R&D People and Culture strategy). These reputational ambitions have been fulfilled by UK's international mobility for both countries and research organisations. The UK has established a prestigious reputation as a hub of expertise, knowledge, and technologies with its research organisations playing a significant role in attracting international researchers (Highly skilled migration and the negotiation of immigration policy: non-EEA postgraduate students and academic staff at English universities), along with the highly skilled technician workforce that provides essential support to research (Impact of Brexit on the technical workforce at Russell Group universities).

- **UK as a promoter of supporting international collaborations to address global missions**

  The UK's reputation as a promoter of supporting international collaborations to address global missions is reinforced through its commitment as a financial supporter and innovative partner. Programs like the Global Expert Missions (GEM), illustrate this commitment by fostering international collaboration with governments, societies, enterprises, institutions, and individuals worldwide, by addressing global challenges from an international perspective.

5.4.3 The impacts of the generated reputation

Table 5.4: Impacts of reputation generated through UK's unilateral support for international collaboration

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Increased foreign investment in UK R&I.
2. **Relational Impact** - Improved useful and strategic networks and relationships	Enhanced opportunities to develop strategic and successful partnerships among institutions and individuals.
3. **Resource Impacts** - Increased availability of resources	Enhanced access to, and/or develop new national and international resources, funding, capabilities, infrastructure, knowledge and networks
4. **Research and Innovation Impacts** - Increased research and innovation output	Increased opportunities to collaboratively develop new products, services, technologies and processes for local, national and global markets. Long-term commitments from international stakeholders on UK R&I
5. **Political Influence** - Improved national influence internationally	Increased "Soft" influence of the UK globally
6. **Social and Environmental Impacts** - Increased generation of social and environmental value	Enhanced opportunities to simultaneously generate business, academic, social, and/or environmental value

Case Study: Global Expert Mission (GEM) programme on XR and Mental Health Technologies in the US

The Global Expert Mission (GEM) programme on XR and Mental Health Technologies in the US 2023 was funded by Innovate UK. This programme supports the UK's Industrial Strategy by building strategic international partnerships and providing deep insights into opportunities for UK innovation.

International R&I activities:

The Global Expert Mission to the US in March 2023 aimed to gain a deeper understanding of the XR and mental health technologies ecosystem and identify opportunities for collaboration based on findings from the Northeast Coast of the United States. The challenges were specific to the US healthcare system, such as waiting times for diagnosis, costs of in-hospital care, mental health awareness, and the need for at-home care solutions, education and empathy training for healthcare professionals, remote collaboration between healthcare professionals and patient diagnosis. Despite the nascent stage of XR technology in both the UK and the US, the mission provided valuable insights into overcoming regulatory barriers, market access issues, and ethical and accessibility challenges.

The mission included various activities such as site visits to leading XR technology companies, workshops with healthcare providers, and meetings with regulatory bodies. These activities helped participants gain a comprehensive view of the current landscape and the potential for future innovations. Additionally, the mission facilitated networking opportunities, enabling UK and US experts to establish connections that could lead to future collaborative projects.

The nature of reputational impacts generated:

This understanding not only fosters collaboration but also offers reputational advantages by positioning the UK as a key player in advancing mental health technologies and influencing global healthcare practices. By addressing these challenges and engaging in these activities, the mission not only enhanced the UK's reputation in the field of mental health technologies but also demonstrated its commitment to leveraging cutting-edge technology to improve healthcare outcomes globally. This strategic positioning is crucial for influencing global healthcare practices and ensuring that the UK remains at the forefront of technological advancements in mental health care.

Source: https://iuk.ktn-uk.org/projects/global-expert-missions/xr-and-mental-health-technologies-in-the-us-2023/; Follow Global Alliance on the latest Global Expert Mission in AI in Construction to Switzerland - Innovate UK Business Connect

Appendix 1: Methodology

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An extensive review of literature was conducted to understand how the UK's international R&I collaborations generate reputational impacts. This study aims to understand the definition of "reputation", and its impact, and the pathways through which international R&I interventions generate reputational impacts for the UK. Following a structured approach (Macpherson & Holt, 2007; Tranfield et al. 2003), the review was conducted in three stages: (A) searching; (B) screening and discarding/inclusion and (C) extraction and synthesis.

Stage 1: Searching

The Scopus database was selected as the primary source of literature due to its extensive coverage of peer-reviewed journals, articles, book chapters, and conference papers. To capture the diverse implications and contexts of reputation in international R&I, several keyword combinations were used. The search was restricted to publications from 1999 to 2025 to ensure relevance and currency. A total of 450 papers were retrieved using the following combinations. These papers included journal articles, reviews, book chapters, and conference proceedings.

Search Keywords:

- "reputation*" AND "impact*" AND "Research*" AND "innovation*"
- "reputation*" AND "impact*" AND "national policy*"
- "reputation*" AND "impact*" AND "Policy intervention*"
- "international*" AND "research*" AND "innovation*" AND "Policy intervention*"
- "UK*" AND "Innovation*" AND "Reputation*"
- "reputation*" AND "influence*" AND "Policy intervention*"
- "UK" AND "R&D collaboration" AND "reputation*"
- "UK*" AND "Innovation*" AND "Reputation*" AND "international*"

Stage 2: Screening and Discarding/Inclusion

A concept analysis approach was adopted to systematically examine and explore the concept of "reputation" within various contexts. This approach aimed to gain a deeper understanding of its meaning and characteristics. The abstracts of all 450 retrieved papers were reviewed to determine their relevance in relation to international R&I and to the benefits that could be classified as reputational building and associated impact generation. After applying this screening criterion, a refined set of relevant documents was selected for further analysis. This process involved several stages of analysis and conceptualization to derive meaningful

findings. More importantly, it was iterative mainly due to the lack of publications that have explicitly discussed the reputational impacts of international R&I collaborations. Once a type of R&I collaboration that seems to be leading to reputational impacts is identified, more literature was reviewed to develop a detailed understanding of reputational impacts specific to the type.

Stage 3: Extraction and Synthesis

Content analysis was conducted on the selected papers to extract definitions and understandings of "reputation" and "impact". This analysis aimed to organize the extracted data into relevant categories and units of analysis. The literature review provided insights into the various aspects of reputation and its impact on international R&I collaborations. The iterative process of reviewing the literature involves below:

- Definition and impact of reputation: The definition of reputation and its impact vary by the type of international R&I collaboration.
- The unit of analysis in collaborations: While the unit of analysis was international R&I collaboration, in relation to reputational impacts, it was evident that these could be generated at individual, organizational, and national levels. It was also clear that individual and organizational level reputation in aggregation leads to national level reputation. For instance, in relation to international R&I collaborations in knowledge-intensive business services, the individual experts seem to be the centre of reputation building, whose reputation in aggregation enhances the reputation of the knowledge-intensive businesses. Such businesses in aggregation enhance the reputation of the nation. Therefore, when relevant, the review involves such cross-level analysis.
- Reputational impact pathways: The review explored different pathways of reputational impacts generated by international R&I collaborations and their complex feedback loops since reputation building was not linear.

We conceptually derived different activities related to each type of international R&I that led to the generation of reputational impacts. This approach was necessary because our review did not identify any papers that directly address the reputational impacts generated from international R&I. Therefore, we used papers that discussed various international R&I activities and their associated benefits to identify which of these benefits are likely to represent "reputation."

In order to conceptualise “reputation” using the literature that has discussed the benefits of international R&I (or in some instances R&I in general), we reviewed streams of literature on reputation, including corporate reputation, brand building, social and psychological

dimensions of reputation, and the effects of organizational reputation on employee morale and performance. It became evident that some benefits of international R&I activities are achieved through the development of reputation as a mediator. In other words, the reputation built as a result of international R&I engagement further enhances certain benefits.

Consequently, we differentiated between the benefits directly associated with reputation and those likely resulting from reputation. We termed the latter as “impacts” and the former as “reputation generated through international R&I”. We then grouped international R&I activities that involve generating similar types of reputation and associated impacts into specific categories (i.e., four categories) and sub-categories (i.e., activities within each category).

Thus, the discussion predominantly integrates various concepts to outline the reputational impacts of international R&I.

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