Department for
Business, Energy
& Industrial Strategy

Partner Country Case Study: Chile

Final Evaluation of The Newton Fund

February 2022

TETRA TECH
International Development

Acknowledgements

The evaluation team would like to thank the Department for Business, Energy and Industrial Strategy staff who participated in the Study, for sharing their time and thoughtful reflections, the Newton Fund In-Country Team, Delivery Partners and the Newton Fund Award Holders for their patience, cooperation and contribution of data; and finally, the individuals from across HMG who gave their time.

Disclaimer

The views expressed in this report are those of the evaluators. They do not represent those of the Department for Business, Energy and Industrial Strategy, the Newton Fund or of any of the individuals and organisations referred to in the report.

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Abbreviations

AH	Award Holder
AI	Artificial Intelligence
ANID	Agencia Nacional de Investigación y Desarrollo (National Agency for Research & Development)
BEIS	Department for Business, Energy, and Industrial Strategy
BGS	British Geological Survey
BIM	Building Information Modelling
COCHILCO	Comisión Chilena del Cobre (Chilean Copper Commission)
CONICYT	Comisión Nacional de Investigación Científica y Tecnológica (National Commission for Science & Technology Research)
CORFO	Corporación de Fomento de la Producción (Chile's economic development agency)
DAC	OECD Development Assistance Committee
DP	Delivery Partner
ECOS	Évaluation Orientation de la Coopération Scientifique
ESRC	Economic & Social Research Council
ENAMI	Empresa Nacional de Minería (National Mining Company)
FAO	Food & Agriculture Organisation
FCO	Foreign and Commonwealth Office
FONDAP	Funding Fund for Research Centres in Priority Areas
FONDECYT	Fondo Nacional de Desarrollo Científico y Tecnológico (National Fund for Scientific and Technological Development)
FONDEF	Fondo al Fomento de Desarrollo Científico y Tecnológico (Fund for Promoting Science & Technology)
FONDEQUIP	Scientific and Technological Equipment Program
FONTEC	National Productivity and Technological Development fund
FDI	Foreign Direct Investment

GDP	Gross domestic product
GNI	Gross National Income
GROW	Graduate Research Opportunities Worldwide
HSSE	Health, Safety, Security and Environment
IAEA	International Atomic Energy Agency
NERC	Natural Environment Research Council
ICT	Newton Fund in-country team
ICT	Information and communications technology
M&E	Monitoring and evaluation
ODA	Official Development Assistance
RCUK	Research Councils UK
R&D	Research and development
SAC	Satellite Applications Catapult
SDGs	Sustainable Development Goals
SERNAGEOMIN	Secretaria Nacional de Geología y Minería (National Secretariat for Geology & Mining)
SMEs	Small and medium-sized enterprises
ToC	Theory of Change
TVET	Technical and Vocational Education and Training
UKRI	UK Research & Innovation
SIN	UK Science & Innovation Network
VFR	Virtual Field Reconnaissance

Executive Summary

Newton-Picarte Fund in Chile at a glance

- The three-year Newton-Picarte Fund ran from 2014 to 2017 before Chile graduated from the Development Assistance Committee (DAC) list and became ineligible to receive Official Development Assistance (ODA) funds.
- The wide-ranging programme covered energy, water, minerals, urbanisation, health, economic development, social welfare, environment, and climate change.
- It focussed on areas seen as being high priority by both the UK and Chile.
- In its final year, this focus broadened to regional and global challenges.
- In each of the three years of the programme, annual UK Newton funding was £4 million, plus £2.5 million annual Chilean match funding.

The case study

Tetra Tech International Development produced this Chile Partner Country Case Study to inform the Final Evaluation Report of the Newton Fund.[1] It is one of 11 Partner Country Case Studies that investigates the Fund's implementation and its results. It serves as a deep dive into the development, relevance, additionality, and results of (a) the programme activities; and (b) their success factors and barriers that affected their implementation.

The case study sampled three calls under the Newton -Picarte Fund, and from each a project was selected for in-depth analysis:

- **Governing the educational and labour market trajectories of secondary Technical and Vocational Education and Training (TVET) graduates in Chile** set out to review TVET provision in Chile and to influence policy on promoting employment and well-being for disadvantaged young people. It was jointly implemented by researchers from the Universidad Alberto Hurtado and Glasgow University. It delivered a number of policy and academic research outputs and researchers gained close access to senior decision-makers in Chile.
- **Making soil erosion understandable and governable at the river basin scale for food, water, and hydropower sustainability in Latin America** set out to prove the concept for an innovative approach for addressing soil erosion at a regional level. It was implemented through a collaboration between the University of Plymouth and the Universidad Austral de Chile. It built on UK capabilities in the field of radioisotopes in measuring soil erosion and applying participatory planning to complex environmental and developmental issues.
- **Project Hephaestus – sustainable economic development of medium-sized mineral extraction companies in Chile** demonstrated how the UK's satellite data expertise could

[1] In this report, 'the Newton-Picarte Fund' refers to the joint UK-Chile initiative through which funding calls were issued. 'The Newton Fund' refers to the broader UK programme financing activities in 17 countries, including Chile. The Newton-Picarte Fund was financed both by Newton Fund contributions and those from Chile funding partners.

be used by Chilean small and medium-sized enterprises (SMEs). It created a pilot software application showing how satellite data could be used to assess environmental and supply chain issues in the mining sector – bridging expertise from across the public and private sector. The project was implemented by ENAMI - Chile's National Mining Company and the UK's Satellite Applications Catapult (SAC) with input from the British Geological Survey (BGS).

The research was carried out by reviewing documents at project and fund-level and carrying out interviews in November and December 2020 with 16 people from United Kingdom (UK) and Chilean institutions. Interviewees came from agencies, universities, the British Embassy and BEIS.

The case study is a self-contained investigation and its findings are not intended to be generalised to the entire Newton Fund in country. Case studies were limited to three projects per case study, which were conducted remotely owing to the Covid-19 pandemic. In some projects, the added logistical challenge of remote research limited the number and range of stakeholders consulted. The case study findings reflect the data provided by each project and available information online. The volume of documentation provided varied by project, thus limiting the possibility of triangulating findings. In terms of total Newton Fund expenditure, the projects selected represent a very small fraction of all expenditure across 5,400 projects. The case study is therefore not representative of all Newton Fund activities. Whereas it provides valuable depth and illustration of Newton Fund activities, the case study alone does not provide generalisable evidence.

Key Findings

Effectiveness

- **The Newton-Picarte Fund projects sampled have delivered results and the Fund is considered successful on this basis.** Strong partnerships characterised with shared objectives and good working relationships allowed the three sampled projects to make good progress towards objectives. Projects were able to deliver all intended outputs which suggests there is a good basis for all three projects to achieve their intended outcomes and promote stronger economic growth, welfare, and lower levels of poverty over the long-term.
- **The evidence suggests that the Newton-Picarte Fund was managed effectively.** Despite minor issues with aligning financials between UK and Chile counterparts at the start of partnership, the Fund's administration processes became more efficient over time, reflecting effective management.

Emerging impacts

- **The Newton-Picarte Fund has delivered early benefits for Chile**. These include contributing to the country's research budget, access to UK researchers and facilities, and improved networks and opportunities for future collaboration. The sampled projects brought individual benefits: access to advanced technology to upgrade Chile's mining sector; development of new approaches to managing soil erosion at a regional level, and a significantly improved policy framework for technical and vocational education.

- **Prospects for the longer-term sustainability of the various achievements of the Fund would have depended on ongoing investment.** The Fund was not replaced by any initiative on the scale required to achieve this.
- **The Training and Vocational Education (TVET) project positively influenced Chile's new national strategy for science, knowledge, and innovation.** It drew on the UK's science and technology policy during a period when Chile was establishing a separate Ministry of Science, Knowledge, and Innovation in 2017.
- **The Newton-Picarte Fund created positive impacts for the UK.** These include networking opportunities with researchers from Chile and other countries, access to ideas and information, and the opportunity to work in new environments. Project Hephaestus generated several million pounds of income from the sale of UK services and grants. All the projects helped sustain a trend of Chilean post-graduates coming to study in the UK. The Fund also supported the UK's bilateral relationship with Chile more broadly.

Sustainability

- Although the Fund achieved substantial benefits during its lifetime, **it is unlikely the high level of cooperation established during this period will be sustained over time due to the lack of post-ODA funding made available.** While there are likely to be ongoing benefits from ongoing cooperation for both sides, these are likely to be significantly lower than during the Fund period itself.
- **There are, however, some areas where the Newton-Picarte Fund is likely to have a legacy**. In particular, the Fund developed substantial goodwill, which will support ongoing government-to-government cooperation. It is also likely that the academic networks established at a project-level will persist. Notably, the partnerships for two of three of the projects reviewed for this study will continue working together and applying for further research funds.

Lessons learned

Lessons for the Newton-Picarte Fund

- Chile graduated from the OECD-DAC eligibility list in 2017 and remains a Newton Fund partner on regional initiatives. The Newton-Picarte Fund experience **highlights the risk to sustainability of ongoing science and innovation collaboration when a funding scheme comes to an end.** A higher degree of sustainability might be achieved through identifying alternative sources of UK funding to continue some activities or beginning the transition period earlier to allow more time for academic partners to find alternative (e.g., non-ODA) sources of funding.
- **The match funding model was a strength of the Newton-Picarte Fund**. It was regarded by Chilean partners as a partnership of equals that enabled them to play a strong role in evaluating and selecting projects which were relevant to Chile's development priorities.
- **Once collaborative relationships are established, they are likely to endure beyond the project's timescale**. This is particularly the case where individuals or groups of academics share mutual interests and know that they can work together. This also creates a strong asset from which to form new partnerships in future. For instance, at the outset of the Newton-Picarte Fund, the Chilean funding agency, the National Commission for Science & Technology Research (CONICYT), expected the process of identifying relevant collaborators

and forming partnerships at project level to be difficult and slow. However, it turned out to be significantly easier in practice – in large part because a significant number of Chilean academics already had some contact with UK counterparts.

- It is **helpful for project partners to anticipate there will be a learning process for working successfully with their counterparts**. It may take time, for instance, to appreciate the constraints and imperatives faced by the other side. For example, the TVET project revealed a strong need for UK academics to publish to contribute to their Research Assessment Exercise scores. There was no corresponding pressure on the Chilean side. This led to tensions in determining project priorities - though ultimately, these were overcome.
- **Smooth running of the Fund requires clear explanation of its administrative rules and provision of detailed information.** The embassy was praised for facilitating learning and discussion of fund administration issues, for example, by holding events for partners in Chile.

Lessons for monitoring and evaluation

- There were some **significant gaps in the availability of monitoring and evaluation data** for Newton Picarte Fund projects. Future initiatives should ensure the following information is recorded, at a minimum: the UK funding partner, with named contact and job title; the level of funding, from both the UK and overseas partner; project application form; a final project report, documenting with evidence the participants' views on project achievements and the extent to which original objectives had been met.
- There is a **trade-off between leaving sufficient time for impacts to emerge after the end of a project and being able to trace project staff who can assess and comment upon these impacts**. The assessments for Project Hephaestus were made four years after the project ended. Although this time lag allowed for an assessment of long-term effects by UK partners, Chilean partners were harder to reach.

1 Introduction

1.1. Aim and purpose of the case study

This report presents our findings for our country case study of Newton Fund activities under the Newton-Picarte Fund in Chile. While these findings will inform the Newton Fund's final evaluation, they are specific to the country under investigation and not to be generalised to the broader Fund. The strength of evidence (Section 1.5) for this case study should guide the reading of the results set out in Sections 3- 6. Remote research in Chile was carried out in November and December 2020.

The purpose of the case study is to examine:

- the relevance of the country-level work to Newton Fund's theory of change, including the ways in which funded projects have supported the Newton Fund to achieve its stated outputs and outcomes.
- the effects of Newton funding in terms of the scale and type of results delivered by the sampled projects, and their potential impact on the socio-economic challenges identified in the country and more widely.
- the likely sustainability of the activities and results of the sampled projects and by the Newton Fund.

We also aim to better understand the overarching significance and impact of the Newton-Picarte Fund in Chile, such as on the internationalisation of research institutions, the relationship between the partner country and the UK, and in the sharing of best practice between the two countries.

1.2. Research scope

This country case study focussed on the activities under the Newton-Picarte Fund in Chile. Specifically, it assessed the following:

- the **development of each activity** – examining its origins, how engagement with the Newton Fund occurred, and an overview of the process of securing Newton funding.
- the **relevance of each activity** to Chile's development needs and to Newton Fund and Official Development Assistance (ODA) goals.
- the **additionality of each activity.**[2]
- the **results of each activity** in terms of the outputs, outcomes and impacts generated to strengthen the science and knowledge base, innovation capacity and policy influence in Chile and beyond.

[2] In the context of the Newton Fund, additionality aims to assess whether a given call or project could have happened in the absence of the Newton Fund (for example, through funding for similar activities provided by other programmes).

- the **success factors (and barriers) which affected each activity**, as well as the potential benefits from each activity that might be expected to arise in the future.

The case study included a mix of ongoing and completed activities. When assessing these activities' results, we considered their ambitions as well as early signs of achieving impacts recognising that impacts of research and innovation take time.

To understand how sustainable solutions to economic development and poverty reduction have emerged from Newton Fund activities, our enquiry focussed on the factors that facilitate specific research activities, increase the quality of research outputs, enhance international collaboration for higher-level education and translate research into innovative practices.

1.3. Case study selection

As part of our sampling methodology for the Partner Country Case Studies, we shortlisted case study calls for each country based on three measures: size, pillar, and sector (see Annex 2 for details). Project selection considered thematic areas of focus, aiming to include priority areas for the Newton Fund in each country. We also sought to achieve a spread of Delivery Partners (DPs) and activity types across the countries in our sample. Following consultations with in-country teams (ICTs), DPs and the Newton Fund Central Team, we selected **three calls per country**. This selection allowed us to include a call under each of the Newton Fund's core activity pillars: People, Research, and Translation.

The next step to the case study selection is the sampling of one specific project from each of these three calls to ensure as broad geographical and partner coverage within the country case study's short timeframe. We also considered the relevance of their specific research areas to the Newton Fund's priorities in Chile when the projects were selected.

The sampled calls and projects analysed in depth in this report are:

Calls	Projects
RCUK/ CONICYT Research Partnerships Call 2016	Governing the educational and labour market trajectories of secondary TVET graduates in Chile
Chile-UK Experimental Development Call	Project Hephaestus: Sustainable Economic Development of Medium-Sized Mineral Extraction Companies in Chile
UK-Chile Broadening Impact Call	Making soil erosion understandable and governable at the river basin scale for food, water and hydropower sustainability in Latin America

1.4. Methodology

The research for the country case studies included desk-based review documentation and remote key informant interviews (see Annex 1). For the Chile case study, we consulted 14 UK and Chile stakeholders such as Delivery Partners in both countries, Award Holders (AHs), senior staff from partner organisations as well as the programme team and UK Embassy staff.

Due to COVID-19-related travel restrictions, we had to switch to a purely remote approach. We assured the quality of our interviews by building rapport with stakeholders by email prior to the interviews, reviewing documents thoroughly to identify the most important gaps to keep the sessions brief amongst other steps. Details of the limitations of this approach and our mitigation actions are set out further in Annex 1.

1.5. Strength of evidence assessment

Tetra Tech used a traffic light system to assess the case study's strength of evidence '(see figure 1 below).[3] The rating assesses the evidence supporting the conclusions reached given the methodological limitations outlined in Annex 1. Table 1 details the main sources of evidence used for this case study and the rating assigned to it.

Figure 1 Strength of evidence ratings

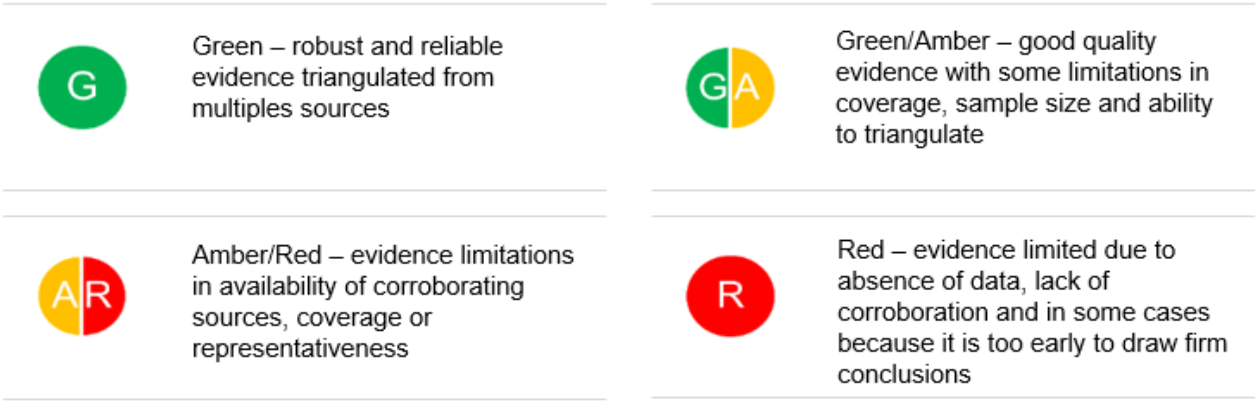


Table 1: Strength of Evidence for the Newton-Picarte Fund case study

Strength of Evidence	
Green/ Amber GA	There are gaps in the evidence, which limited the assessment of relevance, effectiveness, emerging signs of impact and sustainability. This is due to the relatively small sample of interviews conducted which limits the extent to which it is possible to assess if the Newton-Picarte Programme has produced results and benefited its intended recipients. In addition, the extent, type and

[3] Our aim was to achieve a sufficient degree of confidence about the extent to which outcomes have occurred, Newton Fund's level of contribution to the outcomes and our theory about how the Newton Fund has contributed or failed to contribute. Confidence is affected by the extent of triangulation across sources and the position, knowledge, analytical capacity, and potential biases of primary informants. The ratings are not designed to be a rigid framework, but rather a way to ensure evaluative judgements were made systematically across the Evaluation Questions.

	structure of monitoring data and documentation varied across DPs, limiting the extent to which outputs and outcomes can be reviewed and triangulated.

1.6. Report structure

The report is structured as follows:

- **Section 2** introduces the context of Chile, including political and economic developments and trends in the R&I landscape.
- **Section 3** discusses high-level emerging results of the Newton Fund in Chile based on findings from the three sampled projects and broader consultations undertaken with the programme team.
- **Sections 4 to 6** analyse three specific projects more in-depth, providing an assessment of the relevance, effectiveness, emerging impact, and sustainability of the sampled activities.

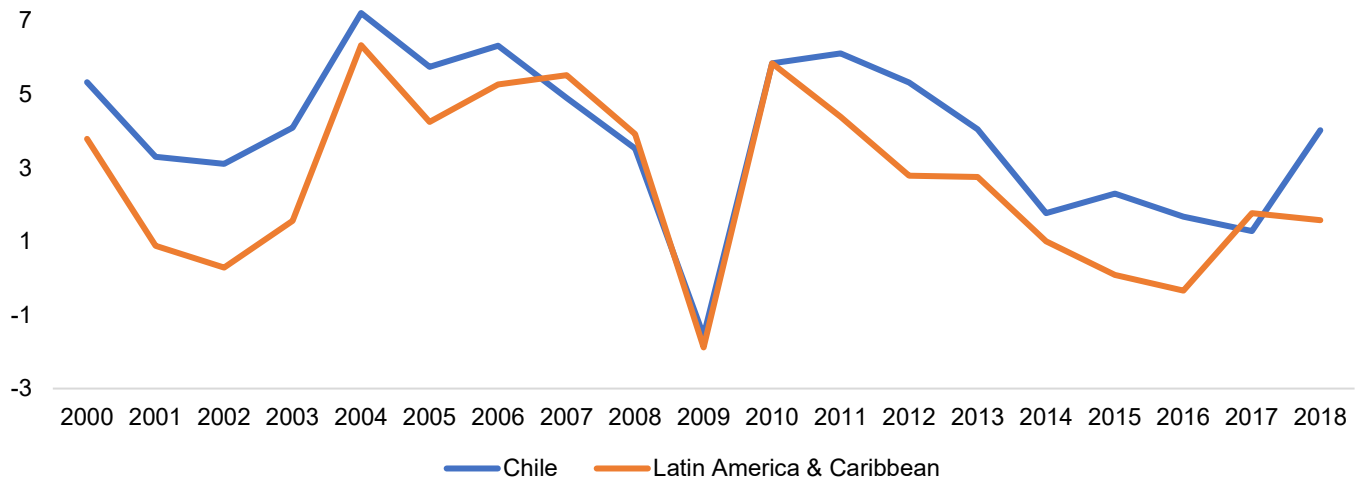
2 Chile in context

2.1. Political and economic context

Chile is considered a stable economy, characterised by competitive and open markets and a strong financial system. The country has a population of 18.8 million, with a population growth rate of 1.8%.[4] Chile is a constitutional republic, which has been led by the centre-right *Chile Vamos* coalition under President Sebastián Piñera since 2018, succeeding the left-wing coalition under Michelle Bachelet, which was in power from 2014.

Economic growth has been almost consistently positive over the past couple of decades, partly driven by the wider global commodity boom. The growth rate slowed considerably between 2012 and 2017, although it recovered in 2018, with changes attributed to fluctuations in commodity prices and the volume of private investment.[5] Growth slowed in 2019 due to a confluence of external factors and civil unrest and is expected to slow considerably and potentially contract in 2020 due to the COVID-19 pandemic (which is expected to trigger a wider regional recession).

Figure 2 GDP growth in Chile and the Latin America & Caribbean region, 2000-2018



Source: World Bank

As a result of decades of strong growth, the number of people living in poverty has fallen from 36% of the population in 2000 to 8.6% in 2017. During the same period, Gross National Income (GNI) per capita rose from USD $5,060 to $13,290.[6] Chile became the first South American member of the OECD (Organisation for Economic Cooperation & Development) in 2010 and graduated from the OECD DAC list of permitted ODA recipients in 2018.[7] Despite this,

[4] OECD (2020), Population (indicator). doi: 10.1787/d434f82b-en.
[5] Tvevad, J. (2019). Chile: the government struggles to implement its reform programme. Report for the European Parliament. Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2019/571495/EXPO_STU(2019)571495_EN.pdf
[6] World Bank (2020). GNI per capita, Atlas method (current US$) (indicator). Available at: https://data.worldbank.org/country/chile
[7] OECD (n.d.), 'DAC List of ODA Recipients Effective for reporting on 2014, 2015, 2016 and 2017 flows'. Available at: https://www.oecd.org/dac/financing-sustainable-development/

inequality remains high: the GINI coefficient – a measure of income inequality – was 0.46% in 2017, the highest among OECD countries, with significant disparities between urban and rural areas.[8] Unemployment in 2018 was recorded at 7% of the labour force.[9]

Chile's economy relies heavily on basic commodities, in particular on the copper mining sector (comprising 45% of all exports in 2017, primarily in raw ore form).[10] Other major export sectors include agricultural products, wood products and gold, and a nascent lithium mining sector (for which it has the world's largest reserves by a significant margin). Despite the mining sector's size, there has been little investment in downstream added-value activities or technology, with the majority of copper and lithium exported in a raw form. However, the development of associated and knowledge-intensive activities has been identified as a key priority for the sector.[11]

This has left the Chilean economy vulnerable to decreases in commodity prices. Flows of foreign direct investment (FDI) have traditionally been an important factor in Chilean economic growth, peaking at 11.3% of gross domestic product (GDP) in 2012 (compared to the regional average of 3.7%). FDI flows have declined markedly since 2015 to the current level of 2% of GDP, bringing it in line with other high-income countries.[12] Chile's socio-economic challenges also include relatively low levels of educational performance compared to other OECD countries and low productivity.

Chile has seen a significant expansion of internet access in recent years, rising from just 19.7% of all households in 2006 to 87.5% in 2017, placing it significantly above fellow Newton Fund countries Brazil (60.8%), Colombia (52.7%, 2018 figure) and Mexico (50.9%). However, access remains restricted in some rural areas.[13]

Anti-government protests focused on inequality, pension structures, and living cost resulted in the imposition of a state of emergency in October 2019. Periodic unrest has continued into 2020, although at the time of writing, protests have halted in light of COVID-19 response measures. Other prominent social and political issues which emerged in recent years include controversial reforms to the pension system, the socio-economic position and rights of the Mapuche indigenous community, the regional response to disputed elections in Venezuela, and inward migration flows (primarily from Venezuela and Central America).[14]

2.2. Science and innovation landscape

In recent years, developing the science and innovation landscape in Chile has become a government priority, which has introduced some new initiatives during the evaluation period.

[8] OECD/UN (2018), Production Transformation Policy Review of Chile: Reaping the Benefits of New Frontiers, OECD Development Pathways, OECD Publishing, Paris, https://doi.org/10.1787/9789264288379-en.
[9] OECD (2020), Unemployment rate (indicator). doi: 10.1787/52570002-en.
[10] Observatory for Economic Complexity (2020). Available at: https://oec.world/en/profile/country/chl/
[11] The Commission for Mining and Development of Chile / National Council of Innovation and Competitiveness (2014). Mining: A Platform for Chile's Future. Available at: http://www.cnid.cl/wp-content/uploads/2015/06/Mining_a_platform_for_chilean_future.pdf
[12] The World Bank, 'Foreign direct investment, net inflows (% of GDP)' Available at: https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS?end=2018&locations=CL-XD-ZJ-XT&start=2000
[13] OECD (2020), Internet access (indicator). doi: 10.1787/69c2b997-en
[14] Tvevad, J. (2019) op cit; Reuters (2019), 'About 200 mostly Venezuelan migrants stuck at Chile-Peru border'. Reuters [online], 21 June 2019. Available at: https://www.reuters.com/article/us-chile-venezuela-immigration/about-200-mostly-venezuelan-migrants-stuck-at-chile-peru-border-idUSKCN1TL320

Given its relatively low technological base**, Chile's development strategy has to date relied primarily on foreign technology acquisition**. In order to reduce the vulnerability of the economy to commodity price fluctuations, in recent years, the government has focused on developing other areas of the economy and promoting Chile as an investment destination, including through the launch of the Invest Chile agency in 2016.

This has included a focus on **encouraging innovation and technology development in strategic fields, including measures to promote research and development (R&D), technological capacity and human capital development[15] and a specific 2016 strategy to develop technological capabilities and services for the mining sector**. More recently, the government strategy for the 2018 to 2022 period has acknowledged Chile's relatively low rates of R&D investment, patenting activity and researchers per capita. In response, it set out plans for a number of specific initiatives in relation to science and technology, including the creation of a dedicated Ministry for Science (see below), investment in science and technology capacity, initiatives to strengthen science and technology education and investment by business, and new international research collaboration initiatives.

Despite this, **R&D expenditure in Chile remains relatively low** at 0.36% of GDP in 2016, compared to an average of 2.56% for other OECD members and higher rates of expenditure in fellow Newton Fund countries Brazil (1.26%) and Mexico (0.49%).[16] Since 2008, Chile has sought to encourage R&D among private firms by using a prominent tax credit scheme for businesses. As a result, the tax support that firms can receive for increased R&D is among the highest in OECD countries, although direct government funding of private R&D remains low at 0.016% of GDP in 2017 (up from 0.012% in 2014 but below the 2010 rate of 0.024%).[17]

In a review of Chile's production capacity, the OECD highlighted 4 key areas to advance innovation: the need to bridge the skills gap in technical sectors, including vocational training, the leveraging of mining technology as an opportunity to boost wider competitiveness, the promotion of technological convergence between different fields, including the solar energy sector, and the strengthening of regional and global cooperation in research and supply chain development.[18]

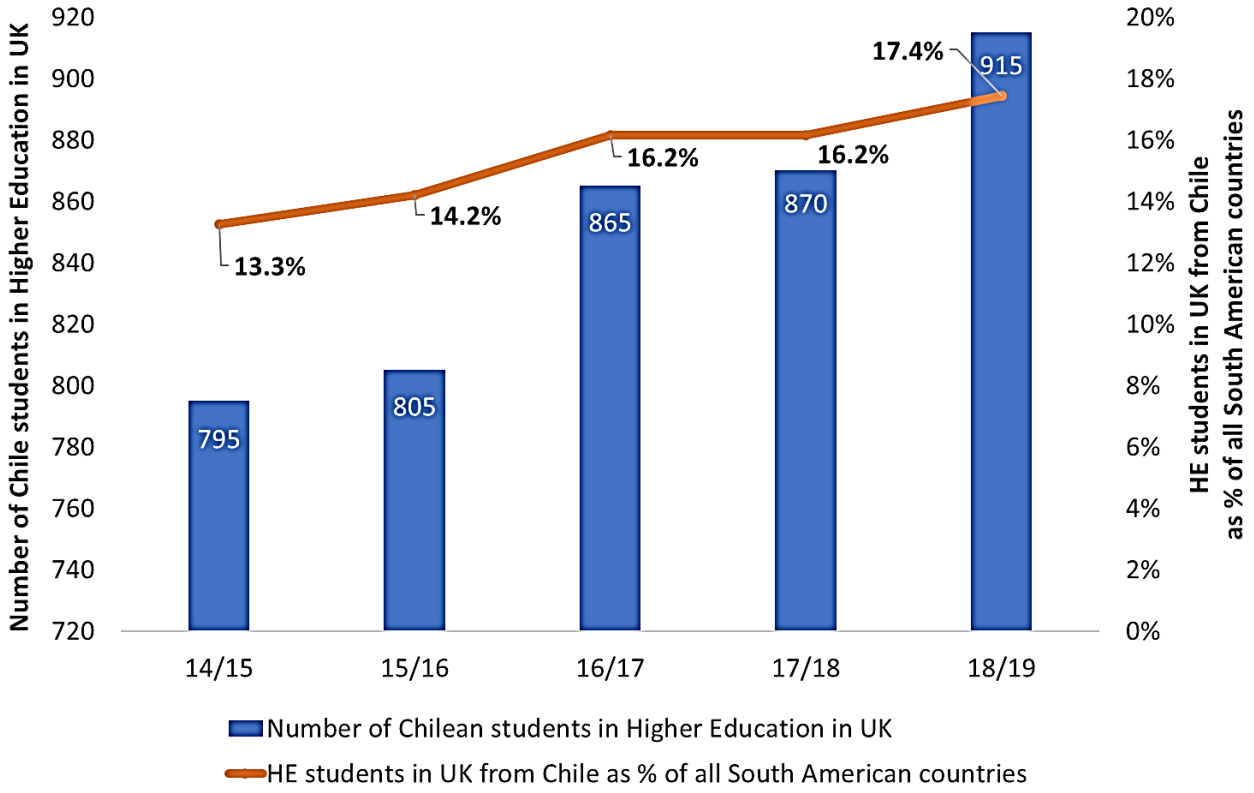
Chile's graduation from tertiary education rate (59.7% in 2017, up from 51.7% in 2013) is among the highest of OECD countries.[19] Chile boasts the top university in Latin America in the QS 2020 world rankings (Pontificia Universidad Católica de Chile, UC), although just three Chilean universities feature in the top 20 institutions in Latin America (compared to 4 for Colombia and 5 for each of Brazil and Argentina), with none in the global top 100.[20] The Higher Education Quality Improvement Program, financed by a series of World Bank loans, has since 1998 sought to increase the effectiveness of the tertiary education system through funding for improvement projects and quality assurance activities.

Figure 3 shows that the number of Chilean students coming to the UK has risen consistently during the Newton-Picarte Fund period, rising to 915 students in 2018/19. The share of students

[15] OECD/UN (2018) op. cit.
[16] World Bank (2020). Research and development expenditure (% of GDP) (indicator). Available at: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS
[17] OECD (2020). Indicator: R&D tax expenditure and direct government funding of BERD. Available at: https://stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB
[18] OECD/UN (2018) op. cit.
[19] OECD (2020), Tertiary graduation rate (indicator). doi: 10.1787/15c523d3-en
[20] QS (2020). QS World University Rankings 2020. Available at: https://www.topuniversities.com/university-rankings/world-university-rankings/2020

from Chile among those from South America as a whole has also risen consistently, reaching 17.4% of the total in 2018/19. It is notable that in terms of sending students to the UK, Chile is substantially over-represented in South America (as it only accounts for 4.5% of continent's population) and also that its student numbers have been growing faster than the other countries combined.

Figure 3 Number of Chilean students in higher education in the UK and growth rates for Chile compared to all other South American countries, 2014/15 – 2018/19



Source: Higher Education Statistics Agency

OECD data on the mobility of scientific authors shows a net inflow of around 1,330 authors between 2002 and 2016, although the number of people employed in research fields (1 per 1,000 people) remained significantly below the OECD average of 8 per 1,000.[21] Another challenge that has been highlighted in relation to the Chilean academic sector is limited knowledge relating to patenting.[22]

As shown in Table 2, Chile's research output is highly specialised in agricultural science, biology and biomedical sciences, natural resources and conservation, geosciences, social sciences and maths. Chile's specialisation rate in astronomy is the highest in the world. Meanwhile, Chile's specialisation rate in information and communications technology (ICT), chemistry, engineering and especially materials is significantly below the global average, although health sciences account for the highest overall annual publications in Chile. Chile's specialisation score for maths, physics, social sciences, and psychology has increased during the evaluation period.

[21] OECD (2017). Highlights from the OECD Science, Technology, and Industry Scoreboard 2017 - The Digital Transformation: Chile. Available at: https://www.oecd.org/chile/sti-scoreboard-2017-chile.pdf
[22] Bajak, A (2017). Op. cit

Table 2: Extent of specialisation of articles across selected research fields

	2013	2014	2015	2016	2017	2018
Agricultural Science	1.74	1.51	1.63	1.71	1.66	1.44
Astronomy	5.17	5.65	5.41	4.93	5.00	5.49
Biology and Biomed	1.53	1.44	1.49	1.39	1.42	1.43
Chemistry	0.79	0.64	0.58	0.67	0.60	0.66
Geosciences, atmospheric, and ocean sciences	1.65	1.76	1.69	1.47	1.58	1.55
ICT	0.63	0.66	0.62	0.70	0.61	0.66
Engineering	0.55	0.63	0.60	0.68	0.60	0.59
Health Services	0.88	0.88	0.84	0.80	0.87	0.86
Materials	0.24	0.25	0.22	0.22	0.28	0.23
Math's	1.41	1.36	1.53	1.50	1.52	1.59
Physics	0.69	0.74	0.79	0.81	0.79	0.86
National Resources and Conservation	1.66	1.37	1.51	1.51	1.49	1.43
Psychology	1.07	1.06	1.50	1.22	1.35	1.35
Social Sciences	2.14	2.22	2.24	2.43	2.55	2.54

Source: Scopus (data sourced from U.S. National Science Foundation).
Note: the figure represents a measure of concentration of a country's publications in a field by dividing the fraction of publications in a country that are in a certain field by the equivalent global fraction. A score higher than 1 shows that the country is more specialised than the global average, and a score lower than 1 shows that the country is less specialised.

The Chile government has highlighted Chile's striking geographical diversity as a 'natural laboratory' opportunity for environmental and physical sciences research. Notably, as a result of night sky conditions in the Atacama Desert region, Chile has developed a significant astronomy and astrophysics research cluster. This includes hosting the European Southern Observatory

and the EUR 1 billion European Extremely Large Telescope, currently under construction (including a £88 million UK investment). Due to its proximity to Antarctica, Chile also has an Antarctic research cluster through the *Instituto Antártico Chileno*, which collaborates with the British Antarctic Survey. Chile also hosts a burgeoning solar energy sector and is the largest solar energy producer in Latin America.

2.3. Overview of research and innovation funding structure

There has been a reorganisation of the funding structure during the evaluation period, although many funding schemes are well-established.

Since 2018, the coordination of science, technology and innovation policy in Chile has been under the remit of the new Ministry of Science, Technology, Knowledge, and Innovation. This ministry's responsibilities include designing public policy, building human, infrastructural, and institutional capital, and developing joint public-private sector initiatives. Other key stakeholders in Chile's research and innovation ecosystem include:

- the National Commission for Scientific and Technological Research (CONICYT), replaced by the National Agency for Research and Development (ANID) in 2020 (see below).
- the Chilean National Council of Innovation for Development, established in 2005, which publishes a national innovation strategy. The most recent of these – published in 2017 – places emphasis on innovation for development, including public-private partnerships and the need for coordinated policies.
- a national economic development agency, CORFO, which encourages investment to and within Chile, including analysis of technological development and dedicated innovation financing for firms and entrepreneurs.
- Fundación Chile, an innovation agency (functioning as a public-private partnership), which focuses on innovation to encourage progress towards the Sustainable Development Goals (SDGs) in Chile.

Until 2020, the main government agency for higher education funding was CONICYT, which also had executive responsibility for the National Innovation System. CONICYT was subsequently replaced with ANID, which announced 5 strategic priorities in January 2020:

1. Development of human capital, including through researcher and student mobility and scholarships.
2. Coordination of a system of national centres in specific research areas, building on existing research and regional centres, including through the FONDAP fund (see below).
3. Strengthening of industry – academia – public sector networks.
4. Administration of research funds and funding initiatives, notably through the FONDECYT fund.
5. Funding of applied research, notably through the FONDEF fund (see below).

Chile administers a range of national research funds, including:

- **FONDECYT** (National Fund for Scientific and Technological Development), which has acted as a general fund for scientific and technology research grants since 1981.

- **FONDEF** (Fund for the Promotion of Scientific and Technological Development), one of the country's major research funds, which since 1991 has provided grant funding for academic research and technology projects run jointly by universities, technology institutes and the private sector, to facilitate collaboration and spill overs across the R&D system.
- **FONDAP** (Funding Fund for Research Centres in Priority Areas), which since 1997 has provided funding for dedicated research centres in specific areas.
- **FONDEQUIP** (Scientific and Technological Equipment Program), created in 2011, which funds the acquisition of scientific and technological equipment for research.
- Additional programmes include dedicated funds to promote access to scientific information, build regional Science, Technology and Innovation (STI) capacity, promote the internationalisation of Chilean research, a postgraduate scholarship programme, providing funding for studies within and outside Chile, and a programme to attract overseas research talent to Chile.
- In addition, CORFO provides dedicated innovation financing for firms through its FONTEC (National Productivity and Technological Development) fund.[23]

A distinctive feature of the Newton Fund is the requirement for matched effort from partner countries, which usually equates to matched funding or in-kind contributions. Matched effort is expected to help jointly accelerate the impact of the Fund's work through the joint agreement of funding priorities and mutual interests, which differentiates it from traditional bilateral development assistance.

2.4. International collaboration

Chile is considered a strategic partner in the Latin American region, given its proximity to the UK's interests in the Falkland Islands and Antarctica. There have been no major changes in the UK-Chile relationship during the evaluation period.

The UK and Chile have a long trading relationship, although the relative value of trade with the UK is small. The UK was the destination for 0.95% of Chilean exports in 2017 (totalling USD $669 million, primarily agricultural and wood products), while the UK supplied 1.3% of Chilean imports (totalling USD $791 million, primarily high technology goods and vehicles, medicines, chemical products and crude).[24] Chile's main trading partner is China, comprising a quarter of all imports and exports, with large volumes of trade with the United States, Japan and Brazil. In Europe, Spain, Germany, Italy, and France have higher trading volumes with Chile than the UK.

Chile has long-standing bilateral cooperation agreements with a number of countries, some of which have launched calls for collaboration during the evaluation period. Details from a selection of international funding initiatives in science and technology are provided in Table 3 below. At the time of writing, the Newton-Picarte Fund was the only international collaboration initiative with a dedicated page on the ANID website.

Table 3: Summary of major funding initiatives similar to the Newton-Picarte Fund

Funding initiative	Description of activity

[23] Crespi, G., Garone, L. F., Maffioli, A, and Stein, E. (2019). Op. cit.
[24] Observatory for Economic Complexity (2020). Available at: https://oec.world/en/profile/country/chl/

Graduate Research Opportunities Worldwide (GROW) programme	The flagship initiative of the US government's National Science Foundation for coordinating research between countries internationally. Chile is one of the countries in the initiative since 2013, with 10 other countries. As of 2018, applications for GROW have been suspended.
Pacific Alliance student exchange and researcher mobility programme	Student exchange and researcher mobility programme launched in 2012 by the 4 Pacific Alliance countries (Chile, Colombia, Mexico, and Peru). This is a reciprocal programme that provides undergraduate and doctoral scholarships for each country.
ECOS (Évaluation Orientation de la Coopération Scientifique)	Partnership between France and 6 Latin American countries (Colombia, Mexico, Venezuela, Argentina, Chile, and Uruguay) to develop collaboration in scientific fields. Chile was the first partner country, beginning in 1992.
AMSUD Pasteur programme	Partnership between France and South American countries since 2001 to develop collaboration in the field of life sciences.
STIC-AmSud, CLIMAT-AmSud and MATH-AmSud	Partnership between France and South American countries (Argentina, Brazil, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela) to support research exchange in science and technology, math's, and climate fields.
CYTED (Ibero-American Programme on Science and Technology for Development)	Network of Iberian (Spain, Portugal) and Latin American countries created in 1984 to encourage science and technology transfer and research in the academic and private sector.
EU-CELAC	Partnership between the EU and the Community of Latin American and Caribbean States since 1999 to encourage research collaboration in science and technology, including grant funding for joint projects.

In addition, CONICYT has previously launched grants for a number of specific bilateral research projects with partners including China, Germany, and Italy.[25]

[25] CONICYT (n.d.). 'MOVILIDAD'. Available at: https://www.conicyt.cl/pci/category/lineas-del-programa/movilidad-lineas-del-programa/

3 Emerging Results of the Newton-Picarte Fund in Chile

This section sets out the emerging results of the Newton-Picarte Fund in Chile. The findings are based on the three calls included as part of the case study as well as the broader consultations undertaken with the programme team (see Section 1.4 for details of the methodology).

3.1. Key findings

The Newton-Picarte Fund was highly relevant to the economic development priorities identified by the Chilean government. A key reason for this is the highly collaborative way the

Fund was administered with CONICYT, the Chilean funding partner – ensuring it focused on these priorities. This level of collaboration was underpinned by the joint financing model.

The process for evaluating project proposals was also highly collaborative. CONICYT deliberately chose a broad range of themes for possible projects, with a joint process for project applications and evaluating bids. Interviewees from CONICYT felt they had a high degree of influence in the selection process and that this helped ensure strong benefits for Chile.

The Fund was able to pivot successfully to satisfy the need to broaden its impacts. Only three projects were funded after the change to focus on regional and global issues in 2017. One of these - focussing on soil erosion - is reviewed for this case study.

There is evidence the Newton-Picarte Fund was managed effectively both at Fund level and within the individual projects. At the overall Fund level, some aspects of implementation proceeded more easily than others, and it took time to bed down ways of working between both the UK and Chilean partners. For instance, aligning match funding given different rules (and financial years) proved challenging though solutions were ultimately found. Several interviewees from different institutions noted that the Fund's administration became more efficient in later years once these ways of working had been established. Respondents noted that greater clarity on rules at the outset of the Fund would have improved the efficiency of fund administration.

There is also evidence that the Fund was effective in delivering results at a project level. All three of the projects reviewed for this case study delivered their outputs and were on course to achieve their objectives. Key factors supporting effective delivery at project level include sound project designs and strong partnerships characterised by shared objectives and good personal working relationships. Flexibility in the use of funds (for instance, shifting funds from other activities to pay for online events) also helped mitigate the effects of restrictions to face-to-face contact during the pandemic.

Chile gained substantial benefits from the collaborations supported by the Newton-Picarte Fund, including the spending of UK research funds in their country, access to UK researchers and facilities, improved networks, and opportunities for ongoing collaboration. Individual projects have also brought their own benefits. For instance:

- the TVET project was seen as an outstanding success with substantial impacts beyond those anticipated at the outset. Specifically, it had a strong direct influence in shaping TVET policy in Chile in ways that will support economic development and achievement of better outcomes for poor young people.
- although the full impact of Project Hephaestus in Chile could not be identified,[26] several of the technologies trialled in the project have been integrated into mining operations, contributing to a strategic national goal of promoting greater use of new technology in the sector. This will help upgrade Chile’s most important export sector, which provides more than a third of government income.
- the soil erosion project has created a collective understanding of soil erosion and how to address this among different actors in the River Rapel basin. This holds the potential to

[26] Despite significant effort it was unfortunately not possible to interview the Chilean beneficiary organisations – reflecting the fact that four years have passed since the end of the project and key individuals have moved on to other jobs.

deliver significant benefits at a regional level over the long-term, although whether this occurs in practice will depend on a broader set of conditions beyond the project's scope.

The Newton Fund had a strong positive impact in promoting the UK's relationship with Chile. This helped achieve significant benefits in the field of science and technology collaboration and also more broadly.

Prior to 2014, the UK's science and technology collaboration initiatives with Chile were ad hoc and limited. The establishment of the UK Science and Innovation Network (SIN) and the Newton-Picarte Fund in that year were therefore important departures. Financing from the Fund provided a significant resource for the UK embassy. Its science team worked in partnership with trade and investment representatives, the British and Chilean Chamber of commerce, and the British Council.

"*Science collaboration is not just about science, it's also about the doors it opens with government and business, the credibility it brings to an embassy, the linkages it creates*"

Fiona Clouder, HM Ambassador to Chile, 2014 - 2018

The Fund coincided with a move by the Chilean government to develop its knowledge economy to reduce its heavy dependence on mining and agriculture. According to the UK's ambassador to Chile at the time, the Chilean Minister of Economy said at the launch of the Fund that the UK was doing more than any other country to build bilateral science and technology cooperation, and that relationships with other countries in this area were not as advanced. The Fund created substantial opportunities for interaction and influence with a range of ministries and organisations. Examples of benefits to the UK from this include the following:

Deeper science and technology collaboration

- Greater levels of collaboration between the British Antarctic Survey and its Chilean equivalent, as well as in astronomical observation, where there were a number of high-level visits (this was of particular value as Chile has 80% of the world's ground-based astronomy facilities).
- Greater levels of UK participation in two major international conferences held in Chile – *Impact 4* in 2017 and *Our Ocean* in 2015.
- Development of a close relationship for Chile's annual Futures Congress, bringing top 100 scientists and thinkers across the world to Chile – as a result more British scientists were invited than from any other country in 2016 and 2017.
- The visit of the Natural Environment Research Council's (NERC) research ship to Chile for public events and private discussions with the Chilean navy. After reviewing the Newton-Picarte Fund environmental projects in Chile, NERC established its own independent partnership in the country.

Wider cooperation

- Collaborative projects with Chile to support the design of its national BIM (Building Information Modelling) strategy helped create opportunities for British companies tendering for projects.

- Work with the Satellite Applications Catapult (in addition to Project Hephaestus), including a pilot project with the Chilean Navy on monitoring marine fisheries. This has strengthened defence sector cooperation – an important strategic interest for the UK.
- Developing the UK's presence in Chile's mining sector. In 2016, for instance, the UK had a large presence at Chile's ExpoMin trade fair for the first time in ten years.

3.2. Benefits at project level

The experience of the three projects illustrates substantial benefits for UK researchers, including developing networks with researchers from Chile and elsewhere by providing access to ideas and exchange of information. It was suggested that this was particularly valuable for early-career researchers by providing them with a chance to work internationally or with new partners.

Collaboration with Chilean partners also provided researchers access to different environments (such as different geological or social contexts). For instance, Project Hephaestus helped both the Satellite Applications Catapult (SAC) and the British Geological Survey (BGS) develop a significant presence in extractive industries, creating new commercial opportunities.

Project Hephaestus – falling under the Newton Fund's Translation Pillar – generated significant economic impacts in its own right. **This £1 million project has subsequently increased income for SAC and BGS by several million pounds,** principally from the sale of commercial services and successful further grant applications (see Section 5).[27]

The TVET and soil erosion research projects (see Sections 4 and 6, respectively) did not generate income in this way. However, they do appear to have **contributed to Chilean students choosing to study at post-graduate level in the UK** – a growing trend, as noted in Section 2. Chilean respondents indicated they thought that similar benefits are likely to have been achieved through the Fund's other research projects. While the Newton-Picarte Fund is not the main reason for this trend, it is likely to have contributed to it by facilitating strong working relationships between academics and institutions in each country.[28]

Collaboration through the Newton-Picarte Fund positively influenced policy in Chile. This occurred both indirectly through broader science and innovation collaboration and directly through individual projects' outcomes.

For example, the Fund's launch created openings for the UK to influence Chile's emerging science and innovation policy. This was helped by the fact that the UK's ambassador herself had worked on science and technology for more than 20 years and therefore had strong credibility in the field. For instance, the ambassador and embassy staff participated in many meetings with the Ministry of Economy, leading universities and CONICYT in the lead up to Chile's decision to establish a separate Ministry of Science, Knowledge, and Innovation.

The TVET project also had a strong positive influence on the design of Chile's National Strategy for Technical and Professional training – a key policy for vocational education. There are good indications that the project helped strengthen the Strategy, particularly provisions for

[27] The UK partners provided evidence of this benefit but requested that full details not be included in the report for commercial reasons.
[28] The Chilean government's Beca programme, paying for Chilean masters and doctoral students to study abroad was substantially the most important factor.

governance at a sub-national level, the need to align different national policies and ensure these reflected the diversity of students' education and labour market trajectories.

The soil erosion project has had a strong positive influence at a regional level in the River Rapel river basin area. In particular, it provided decision-makers and stakeholder organisations with scientific data on the extent and causes of soil erosion and implemented processes for collective reflection on what could be done to address the problem.

Overall, interviewees from both the UK and Chile think it is unlikely the level of cooperation on science and technology established during the Fund will be sustained over time. The level of benefits derived from this cooperation by both Chile and the UK is therefore likely to be significantly reduced compared to the Fund period. However, some benefits are likely to endure, particularly at the project level.

Chile's graduation from the DAC list in 2018 meant the country no longer qualified for ODA (including the Newton Fund). Internal discussions were held within the embassy team and with FCO more widely to consider what might be done to avoid a 'cliff edge'. However, in practice, it was not possible to find alternative measures to replace the Newton-Picarte Fund even on a reduced scale, other than agreeing to host a permanent SIN position within the Embassy. As a result, the Newton-Picarte Fund's end has led to a significant and abrupt reduction in science and innovation collaboration with Chile.

Although the possibility of this occurring had been discussed with the Chilean partners, interviews for this case study indicated disappointment on their side. It was noted, for instance, that it takes time for funding mechanisms to deliver a stream of strong collaborations. While many of the benefits of these appear in later years once partnerships have been established for some time, the Fund's abrupt end is likely to have restricted this.

There are some areas in which the Newton Fund is likely to have a legacy:

- Some of the policy influence of the Fund at the national level is likely to continue, in light of the UK's support during the Fund period for Chile's emerging science and innovation framework. The impacts of some individual projects (notably TVET) on national policy are also likely to be sustained. Interviewees indicated that the Newton-Picarte Fund created substantial goodwill with Chilean officials. This should support ongoing cooperation at a government level, particularly where this is supported by the SIN officer position at the Embassy.
- There are good indications that academic networks established at a project-level between UK and Chilean researchers are likely to be sustained for several years. The partnerships for projects implemented under the research theme (on soil erosion and TVET policy) are continuing to work together and apply for further research funds for other sources. This indicates a high degree of sustainability for partnerships developed from Newton-Picarte Fund projects.
- Interviewees from both the UK and Chile side expected the collaboration at project level promoted by the Newton-Picarte Fund to continue, creating the potential for further research cooperation. CONICYT also noted that several projects with British academic partners had been submitted for national calls since the closure of the Fund. However, this cooperation is likely to be at a lower level than during the project.

- The contacts established between UK and Chilean institutions will help sustain the number of Chilean students applying for university courses in the UK. Interviewees also suggested this could create a self-sustaining dynamic, where Chilean PhD students returning home to work as researchers then seek further opportunities to collaborate with their UK alma mater or other universities in future.

4 Project: Governing the educational and labour market trajectories of secondary TVET graduates in Chile

Summary

Project title	Governing the educational and labour market trajectories of secondary TVET graduates in Chile
Call title	RCUK/ CONICYT Research Partnerships Call 2016
Short description	The project reviewed Chile's technical and vocational education and training (TVET) system. It undertook qualitative research on the system at the national and local levels and considered how young people engage with TVET in practice. It delivered academic and policy outputs and substantially influenced the new national TVET strategy in Chile.
Objective(s)	Influence policy debates on how TVET in Chile can better promote disadvantaged young people's employment prospects and support their wellbeing.
Pillar	Research
Acton value (total budget allocated in country, in GBP)	£206,698[29]
Start/end date (Status: on-going or complete)	February 2016 to May 2019
DP UK and overseas	Economic and Social Research Council (ESRC) and the Comisión Nacional de Investigación Científica y Tecnológica (CONICYT)
Award holders/grantees	The University of Glasgow and Universidad Alberto Hurtado

[29] It has not been possible to identify the match funding contribution for this or the other two projects reviewed in this case study

Brief description of the project

This was a highly successful project that helped improve the approach to TVET in Chile so that the needs of vulnerable young populations are more effectively addressed. The findings were intended to contribute to wider debates on how TVET can create opportunities for disadvantaged youth in middle-income and low-income countries. The project had a significant influence on the development of TVET policy in Chile, which was much greater than the project team had anticipated at the outset (see below).

The project analysed:

- the orientations and objectives of TVET policies in Chile.
- their compatibility and contradictions with the aspirations of TVET graduates.
- their intended and unintended effects on educational and labour market trajectories.

Events were organised with different actors working on developing TVET policies within Chile, including the Ministry of Education, Superintendencia de Educación, National Board of Education, National Training and Employment Service, representatives of international organisations, students, and trade unions. Two international seminars were also held.

Pathway to impact

The project had a relatively straightforward pathway – to carry out research to identify how the TVET system could be redesigned to improve outcomes for disadvantaged young people, and then work with decision-makers and stakeholders to incorporate appropriate changes into policy. Specific results at different levels of the theory of change included the following:

Activities

Undertake qualitative research, including:

- mapping and reviewing national TVET policies and programmes.
- interviewing policymakers and stakeholders.
- undertaking case studies with local authorities and TVET schools.
- interviewing secondary TVET graduates.

Outputs

Produce a range of publications along with a project website[30] to store and disseminate them. These included:

- four working papers (published on the website).
- several policy briefs and blog entries.

[30] TVET Chile. Available at: http://www.tvetchile.org/en/

- four journal articles.
- a book in Spanish – with the translated title *Technical and Professional Education – Where Are We Heading.?*[31]

Several workshops were also held at the national and local level, along with two international seminars, in addition to ongoing informal discussions with policymakers, educational authorities and institutions.

Expected outcomes focused on informing the debate on the future shape of TVET policy in Chile and making sure that policy and its implementation were more appropriate to the needs of TVET graduates and their future employers.

Expected impacts included stronger and more inclusive economic growth in Chile, resulting from more appropriately trained and skilled young people.

The project corresponded closely with the overall Newton Fund theory of change – see Annex 4. Specifically, through:

- developing a multidisciplinary research partnership and using this to identify socially-inclusive solutions from research – both of which are **output-level results in the ToC.**
- producing high-quality research publications – an **interim outcome level** result.
- providing evidence that influences change in policy and practice in partner countries – as occurred as a result of the project (see impacts section below) – **a long-term target outcome in the ToC.**

4.1. Emerging project results

Relevance of Newton-Picarte Fund activities

ODA Relevance

The project was clearly focused on Chile's economic development needs. It also had a strong poverty alleviation focus, given that young people from poor backgrounds are overly represented in the TVET system.

TVET is a very important component of secondary education in Chile. It is also central to ensuring an adequate level of workforce skills to support ongoing economic development. When the project started in 2016, there were more than 180,000 young people in the TVET system, representing 43% of total enrolment for the final years of secondary education.[32] Most of the TVET student population comes from low-income sectors of society. Of the poorest quintile of the population in higher secondary education in Chile, around two thirds were enrolled in TVET courses.

Relevance of the collaboration to Chile's socio-economic priorities

[31] Sepulveda L. and Valdebenito, M. J. (2019) Educación Técnico Profesional ¿Hacia dónde vamos? Políticas, reformas y nuevos contextos de desarrollo https://ediciones.uahurtado.cl/libro/educacion-tecnico-profesional-hacia-donde-vamos-politicas-reformas-y-nuevos-contextos-de-desarrollo/

[32] Sepulveda, L. et al (2016) Governing the educational and labour market trajectories of secondary TVET graduates in Chile. Available at http://www.tvetchile.org/en/

The project had a clear fit with Chile's economic development needs and a poverty reduction focus. As a result, there was also a good fit with the OECD's definition of ODA eligibility (which focuses on economic development and improved welfare) and the UK's ODA requirements that focus on poverty reduction.

The results of the project are also aligned with several of SDGs, including SDG 1 (no poverty), SDG 4 (quality education), SDG 8 (decent work and economic growth) and SDG 10 (reduced inequalities). The project was also relevant to wider international debates on the role of TVET in low- and middle-income countries. However, given the strong focus of the project on the Chilean context, its relevance to other countries is indirect.

Origins and quality of the collaboration

Partners on both the UK and Chile sides of the collaboration largely viewed the relationship as equitable. Chile has experienced a considerable educational expansion in recent decades due to the growing demand for education and competition for qualified jobs in the formal economy. Previously, TVET policies were designed to help disadvantaged young people move swiftly into the labour market. However, in recent years, these policies' orientations and objectives have become less clear, amid changing needs for secondary TVET graduates. In this context, TVET continues to be very important in improving the skills of the most disadvantaged young people in the country. However, transitions to work are now more complicated and have been hindered by poor coordination of public policies targeting young adults.

4.2. Effectiveness of Newton-Picarte Fund activities

Additionality

There is good evidence that the project's achievements were strongly additional to what might otherwise have been expected, namely**, that the project would not otherwise have occurred without the Newton-Picarte Fund.** While the Chilean team would have continued to carry out research in this field (as they have for many years), its impact would have been substantially less. The following factors in particular promoted the strong additionality of the project:

- although the AHs at the participating universities in Chile and the UK knew each other's work, they had not collaborated previously or discussed doing so. Without the Newton Fund specifically requiring specific collaboration with UK academics, this particular partnership would not have been formed.
- both partners also brought distinctive knowledge and experience – without the combination of these, the project's scope and results would have been significantly narrower. For instance, the Glasgow team had previously worked on a project with 8 European partners examining governance issues in young adults' education trajectories. The Chilean team then adopted the framework developed in this project.
- the international nature of the research brought prestige, stimulated interest, and allowed a greater degree of engagement with senior policymakers in Chile than might otherwise have been possible.

Opportunities created for the UK's research base

The project has made a valuable contribution to the UK researchers based in the Department of Education at the University of Glasgow. In particular it:

- broadened their perspective in the field of comparative education, providing them with detailed insights into the design and application of TVET policies in a new country.
- provided access to broader networks of researchers working in the same field in Chile and other South American countries.
- helped support a successful subsequent application for ESRC funding (outside the Newton Fund), to undertake further comparative research on TVET in Mexico and India.
- created the basis for a further funding application currently being developed with the same Chilean researchers at the Universidad Alberto Hurtado.

Beyond these, the project has not led to any commercial benefits such as new for trade or innovation.

4.3. Emerging signs of impact

The project had a significant influence on the design of a new national strategy governing the TVET sector in Chile, the National Strategy for Technical and Professional Training,[33] published by the education ministry in 2018. The project coincided fortuitously with the start of a high-level political debate in Chile on the future shape of TVET provision. This debate helped ensure strong interest among different stakeholders in the project's process and results. It also opened doors for discussions with policymakers. As a result, the project team was able to work closely for the duration of the project with a key government committee on TVET reform.[34]

Key areas where the project made a difference to national strategy included:

- Identifying the need for policy to be tailored to regional and local circumstances and that it provided detail on how TVET would be governed at a sub-national level. This detail was not included in the policy's early drafts but was included after discussions with the project team.
- Ensuring coherence between different policies (e.g., from the education and labour ministries and between central and regional government). After intervention from the project team, the need to achieve this was listed as a key national policy issue.
- Ensuring that the national policy recognised the complexity and diversity of post-graduate trajectories.

The project's areas of influence correspond closely with its focus on governance and its focus on the labour market conditions for TVET students. It is also notable that the strategy explicitly acknowledges the work of the team from both universities and lists the Chilean AH (Leandro Sepúlveda) as a member of its technical team.

While the project team's precise impact will depend on how the strategy is implemented in the coming years, the project team expects TVET in Chile to be significantly more effective in the

[33] Ministry of Education (2018) Estrategia Nacional de Formación Técnica Profesional. Available at: https://bibliotecadigital.mineduc.cl/handle/20.500.12365/2217

[34] The formal name of the committee in Spanish is Consejo Asesor de Formación Técnico-Profesional.

future. To the extent that this occurs in practice**, the project has excellent potential to contribute to inclusive economic growth in Chile**, albeit in a context of high levels of inequality and social unrest.

Signs of sustainability

The project set out to influence policy in Chile from the outset, and in this sense, sustainability considerations were actively integrated into its design. The fact that many of the project's key findings were integrated into the national strategy is also a good sign that impacts (in terms of the content of the project) will be sustained over time. In addition, there are some indications that the partnership between the two universities will also be sustained.

- The teams from the University of Glasgow and Universidad Alberto Hurtado are currently working on an application for a new project also including universities in Mexico and Argentina, covering secondary school education as well as TVET.
- The Glasgow team is working on a follow-up project with the Autonomous University of Barcelona and the University of Valladolid in Spain. It will also be contributing to another book in Chile based on this collaboration.
- The Chilean partner is also aiming to expand international collaborations with partners in Europe. The Funds to support this cooperation in Chile are likely to be cut in the coming months due to government fiscal tightening.

Complementarity and coordination

The project was effective in delivering its intended results. There was effective collaboration between the two teams, which helped it deliver a range of policy and academic outputs as described above.

The project encountered some operational challenges – such as differing perspectives on priorities (for instance, UK researchers were under stronger pressure to produce publications in line with the UK's Research Assessment Exercise requirements). However, the partnership was successful in finding ways to negotiate these. Although the Chilean and UK sides had not previously worked together, the fact they both had experience working in international initiatives was cited as strongly contributing to the project's success. Participants also noted that potential difficulties with language did not arise because several participants from the Glasgow side (including the AH) were native Spanish speakers.

4.4. Conclusions

- **Overall, this was a very successful project that fitted well with the Newton Fund's objectives and whose results exceeded team members' expectations**. The project was highly relevant to Chile's economic development needs and focused on a cohort of the population (TVET students) which is disproportionately made up of young people from poor backgrounds.
- **The project was very timely in coinciding with a high-level political debate on TVET in Chile.** This helped to ensure its findings were integrated into national policy and provide a strong indication that its impact will be sustained over time. While its achievements will be felt most strongly in Chile, the project provided some benefits for the UK in terms of

broadened experience and international networks for the UK academic team at the University of Glasgow. These have contributed to that team's ongoing work.

Lessons learned and points to consider going forward

- **It is helpful to anticipate that partners in international research collaborations will be guided by their own institutions' imperatives, which are likely to be different**. For instance, the Glasgow team were under strong pressure to publish journal articles in English from the project to meet the requirements of the Research Assessment Exercise. In contrast, the Chilean AH team saw the priority for publication as being determined principally by the domestic debate on TVET. The participants on both sides noted that their prior experience in international collaboration helped in negotiating this issue.
- **The project was seen as successful and had a strong impact, particularly because it coincided with a high-level national debate on TVET policy**. In practice, it is unlikely to be easy to align projects with such opportunities to influence policy. International funding collaborations are not particularly nimble as it takes time for discussions on subjects and teams, as well as for application forms to be drafted and bids reviewed. The likelihood that policy research will come at a particularly appropriate moment is something that funders should consider in evaluating different bids.

5 Project: Hephaestus

Summary

Project title	Project Hephaestus: Sustainable Economic Development of Medium-Sized Mineral Extraction Companies in Chile
Call title	Chile-UK Experimental Development Call
Short description	Demonstrate how satellite technology can be used to improve the social, economic and environmental impacts of mining operations in Chile by creating a pilot software application that allows virtual investigation of different aspects of mining operations and its supply chain activities.
Objective(s)	Demonstrate how satellite technology can be used to improve the social, economic, and environmental impacts of mining operations in Chile, focusing on small and medium-sized enterprises.
Pillar	Translation
Acton value (total budget allocated in country, in GBP)	£1 million[35]
Start/end date (Status: on-going or complete)	June – December 2016
DP UK and overseas	Innovate UK and the Chilean Economic Development Agency (CORFO)
Award holders/grantees	Satellite Applications Catapult (SAC), and the Empresa Nacional de Mineria de Chile (ENAMI)

[35] It has not been possible to identify the Chilean match funding contribution for this project.

	Key Chilean partners: Servicio Nacional de Geología y Minería (SERNAGEOMIN) and the Comisión Chilena del Cobre (COCHILCO)[36]

Description of the project

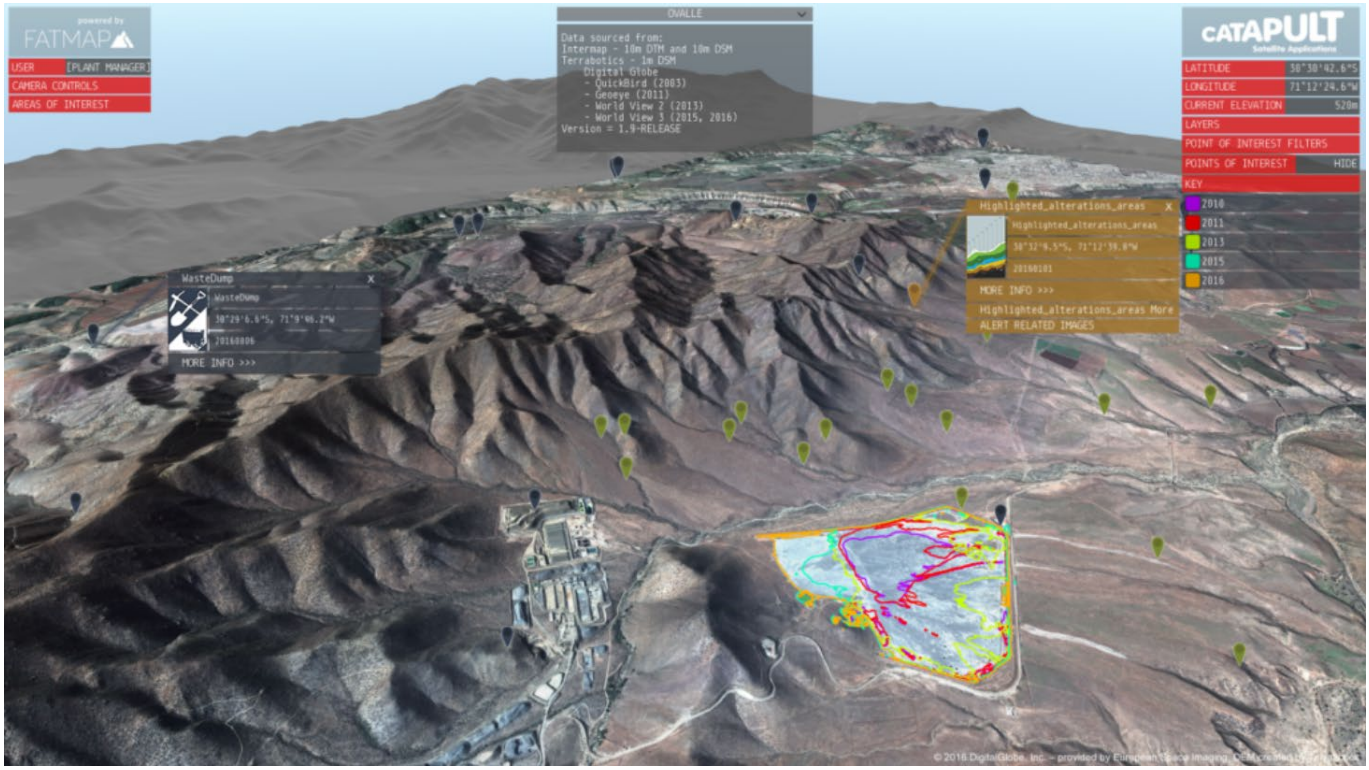
The project aimed to demonstrate how satellite technology can be used to improve the social, economic, and environmental impacts of mining operations in Chile. It created a pilot software application showing how satellite data could be visualised in 3D by end-users without requiring any specialist knowledge, skills, or expensive hardware. In this way, the application allows access to complex sets of data traditionally only available to specialists.

The application builds on a 3D gaming engine to provide an immersive and interactive environment in which users can 'fly' through the region of Chile where the products were created and navigate directly to specific points of interest. The application was used to showcase the potential of using satellite-based data to drive business process changes, reduce the need to visit the locations and reach a broad number of stakeholders. Illustrative examples of how the application can add value include:

- using spectral signatures to identify when tailings reservoirs (holding mining waste) have been breached. This can be combined with other data – for instance, on agricultural activities in an area – to assess the potential for environmental damage caused by spillages.
- analysing alteration zones to identify significant changes in geology, and therefore the chance of finding particular metals.
- identifying the best sites for solar farms by analysing data on wind profile, gradients, and other contextual information.

[36] It was not possible to contact relevant representatives of ENAMI, SERNAGEOMIN or COCHILCO or to interview them. Key individuals have since moved to other organisations during the four years since the project ended. Discussion of longer-term impacts (up to the current moment) is largely restricted to the UK side. It has however been possible to assess early impacts within Chile from project reports and interviews of UK stakeholders and to comment on their potential for longer-term impacts.

Figure 4 Sample screen from the Hephaestus application



Source: Satellite Applications Catapult

The ultimate aim of the application and associated satellite-derived data products was to **deliver significant economic improvements to Chile's mining sector** over the subsequent decade and improvements in the environmental management of extractive industries that would have broader applicability worldwide.

The project focused on improving the performance of SMEs within the sector. The operations of this segment at that moment (and now) are generally characterised by low use of modern technologies. Consequences of this include prospecting for minerals by guesswork or through other cost-ineffective measures, as well as the inadequate assessment of potential environmental impacts – risking long-lasting damage. Correspondingly, appropriate use of technology across a range of business practices provides the potential to increase production and productivity, with significant impacts on the Chilean mining sector and economy.

The project worked directly with the state organisations that regulate and support the sector (rather than SMEs themselves), including:

- Empresa Nacional de Mineria (ENAMI - National Mining Company). ENAMI refines and smelts copper from Chile's small- and medium-scale miners, makes loans and provides technical assistance to the sector.
- Servicio Nacional de Geología y Minería (SERNAGEOMIN - National Geology and Mining Service) provides geological information, advice, and technical assistance to support the mining sector in Chile.
- Comisión Chilena del Cobre (COCHILCO - Chilean Copper Commission) is the lead regulatory agency for copper and other mineral mining in Chile, overseeing the sector's development.

Pathway to impact

The project's pathway to achieving its intended impact can be summarised as follows (see Annex 4 for a diagrammatic representation of the pathway, mapped against the overall Newton Fund Theory of Change).

Activities

- visits by UK team members to Chile to understand their counterparts' interests and priorities.
- UK team members working alongside technical staff from the Chilean organisations to identify how different mining processes can be improved using the application.

Outputs

- the principal outputs were developing a demonstration software application using satellite data and then using it for various pilot/proof of concept activities.

Anticipated interim outcomes included:

- broad adoption of the software application and similar tools (e.g., the British Geological Survey's virtual field reconnaissance mapping tools – see below) by the Chilean partners and other organisations and companies in the sector.
- strengthening networks and relationships between UK and Chilean institutions to create the potential for further cooperation and mutual benefit in future**.**
- the identification of opportunities for using the technology more widely in the sector after the end of the project, creating benefits for both Chile and the UK.

Intended long-term outcomes included benefits to small and medium-sized mining enterprises using the technology, including:

- increasing productivity – by reducing the time and resources required for geological investigation.
- improving interoperability – an explicit government objective in mining – by promoting common use of digital technologies.
- building capacity – by practically demonstrating the value of applying new technology, particularly in smaller mining enterprises.

This pathway is strongly aligned with the overall Newton Fund ToC. Specifically, the project helped promote:

- 'New socially inclusive solutions derived from research' – an output level result in the ToC.
- 'Products and services from collaborative research', and the 'testing of socially-inclusive solutions'– both interim outcome level results.
- 'Strategic partnerships that unlock opportunities (adoption of new solutions, foreign direct investment, trade) between the UK and partner countries' – an intended long-term outcome for the Newton Fund.

5.1. Emerging project results

Relevance of Newton-Picarte Fund activities

Relevance to Chile's economic development objectives

The project is closely aligned with Chile's economic development objectives. Mining of copper and other minerals is central to Chile's economy (see Section 2), with copper alone accounting for nearly half its exports. At the time of the project application in 2016, the sector included 1,935 SMEs. However, discussions with staff from the Chilean sectoral coordination organisations (ENAMI, SERNEAGOMIN and COCHILCO) during the scoping stages of the project identified their common strategic objectives to support this segment further as it was not delivering its full potential. They further confirmed that technological upgrading had been identified as likely to produce significant increases in sector output.

ODA relevance

There is a clear link (albeit indirect) between project outcomes and poverty reduction. The main link is by increasing government tax revenues, which provides resources for greater public spending and has been the main factor in reducing poverty in Chile (through social spending, tax and transfers, rather than through labour market measures, i.e., creating new jobs).[37]

Several of the initiatives resulting from the project are likely to contribute to broader development benefits by improving mining safety and reducing the potential for environmental damage. This aligns the project well with the OECD requirements for ODA spend (focusing on welfare rather than just reduced poverty). The project also aligned more broadly with several of SDGs, including SDG 1 (no poverty), SDG 8 (decent work and economic growth) and SDGs 12 and 15 (responsible production and life on land, respectively).

Origins of the collaboration

The project application arose from contacts made during a previous project implemented by SAC in the mining sector in Chile and occurred in the context in which SAC was seeking to expand its presence in the country. These led to discussions with ENAMI, which identified the broad potential for satellite data and applications to improve Chilean mining SMEs' competitiveness (a key task for ENAMI).

Additionality

The SAC team were unable to identify alternative funding mechanisms that would have enabled this at the time of developing the Hephaestus project concept. They further said that the generous size of available Newton-Picarte Fund resources meant that the resulting project was larger in scale than otherwise would have been possible. Other available evidence suggests that project achievements have been at least partially additional, i.e. it is likely to contribute to stronger economic growth, reduced poverty, and less damage to the environment than would otherwise have occurred.

[37] Poverty, inequality and employment in Chile (2014) Gammage, S., Alburquerque, T, Durán, G.; International Labour Organisation, Geneva. Available at: https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/documents/publication/wcms_248029.pdf

5.2. Effectiveness of Newton-Picarte Fund activities

Development of the Hephaestus application successfully demonstrated the potential value of combining satellite data with modern visualisation technologies to Chilean partners. It also led to further collaboration projects (e.g., with the BGS – see below).

The UK partners noted a number of challenges during the implementation of the project, including:

- **cultural differences** in the ways that different organisations approach issues. While the project was exciting for both sides, differences in perspective created some tensions and challenges, though it was possible to work these out. While there were some language issues, the use of translators proved to be effective. Having native Spanish speakers in the UK team also helped.
- **having a common professional background (e.g., in geology, or mapping) helped create a common perspective that contributed to resolving issues that did arise**.
- that the **geographical distance** between the two countries would have been more of an issue, but the UK team addressed this by **spending significant time in Chile** (a total of eight weeks over the seven months of the project).

The project was effective in achieving its immediate demonstration objectives. It demonstrated how satellite data and analytics could enable and facilitate evidence-based decisions, to help the agencies involved identify where they should focus their efforts to support and accelerate regional mining ecosystems.

Creating opportunities for commercialisation of UK scientific capabilities

- The project led to the **development of strong relationships** between SAC, BGS and the Chilean partners and an appreciation for the UK partners of operating in the country. These were then a significant factor in SAC deciding to appoint a full-time representative in Chile from September 2017 to pursue further market opportunities for its services.
- The project also **substantially increased SAC's understanding of the mining sector** and helped it build a strong relationship with the BGS. These things helped SAC build its presence in using satellite data in the mining sector (see below).
- In addition, a minor additional benefit for the UK partners was **strengthening networks with other UK academic institutions.** For example, the SAC team worked with academics at Leeds University to incorporate data obtained through synthetic aperture radar analysis into its tools. This radar analysis can penetrate clouds and identify ground movements at millimetric levels, helping, for instance, to identify any movement in tailings dam structures.

5.3. Emerging signs of impact

Potential impact on poverty reduction and economic development in Chile

ENAMI made approximate estimates of the potential contribution of the project's economic impact.[38] While these were based on rule of thumb assumptions, rather than detailed ex-ante

[38] There are estimated to be 1,935 small to medium mineral extraction companies in Chile. Of these, 35 medium sized companies are exploiting large deposits averaging approximately US$7M p.a. turnover

impact estimates, they were plausible enough to expect substantial benefits from the project both in terms of economic growth (safeguarding and increasing jobs) and reducing the scape of negative environmental impacts.

The project's focus on SMEs – a predominantly Chilean-owned segment – would also help ensure value-added is retained in Chile rather than sent offshore. Overall, these impacts are anticipated to reduce poverty in Chile, thereby fulfilling the criteria for ODA spending. It was also anticipated that the application developed by the project could be used elsewhere in the world, with similar positive impacts.

Creation of new opportunities for collaboration and trade by UK partners

Involvement in the project has been a key factor in SAC and BGS carrying out additional commercial projects with a collective value in the order of a few million pounds.[39] Both organisations stated that the project was key in developing their presence in extractive industries and developing commercial networks in Chile and elsewhere in South America. Specific follow-on projects include:

Satellite Applications Catapult

- A project for a global consultancy firm (not named for reasons of commercial confidentiality), providing insights for a mining client based on satellite data for various business operations. SAC did not provide a value for this contract but indicated the project had been successful and has led to further opportunities being scoped involving UK businesses.
- Work with the government of Minas Gerais state in Brazil, demonstrating how space has a role in monitoring tailings dam stability. This has led to a multimillion-pound monitoring centre concept that aims to provide opportunities for UK organisations.
- SAC has provided analysis using satellite data, AI, and machine learning for the Church of England's pension fund on the stability and seepage of tailings storage facilities. The first phase was worth £0.5 million. It also contributed to creating the first global database of tailings dams in the context of the Church of England's Mining and Tailings Safety Initiative. The Initiative was set up in the aftermath of the 2017 Brumadinho dam disaster in Brazil, which killed 270 people. Its work will help mining companies, governments, and other stakeholders worldwide manage the risks associated with tailings, contributing to better safety.
- Ongoing work with BGS to identify sources of high-grade lithium deposits in Bolivia and Cornwall (value of £0.75M for all partners, including SAC, BGS and others).

Benefits for the British Geological Survey

- Involvement in the Cornish lithium project. BGS said this subsequently led to a further project in Lithium project Bolivia where BGS is leading. It was also a key factor in a £0.5million project ('Satellite for Batteries') with the UK Space Agency.

each. The 1900 smaller concerns average $263k p.a. each. For this project, ENAMI has the central economic expectation that 1% of the smaller companies will be 'promoted', through supply chain enhancements, to become similar medium sized concerns. This has potential to increase the segment output by $1.3bn.

[39] SAC did not wish to disclose full details of its income for commercial reasons; BGS also only provided approximate figures.

- BGS expects its business in South America to develop further – two additional projects are currently being discussed.

Signs of sustainability

The project was conceived as an opportunity to demonstrate the value of satellite data for mining with the intention that this would be a starting point for further future collaboration. In this sense, sustainability considerations were factored into the project from the initial design stage. Although the information on whether collaborations have continued is only partial, it indicates that sustained impacts from the project have been achieved in Chile and elsewhere.

Longer-term impacts in Chile

At the end of the Hephaestus project, the **Chilean partners identified the following areas to be developed further**:

1. Undertake collaborative research and research on mutually significant aspects of applied and economic geoscience (BGS and SERNAGEOMIN).
2. Homogenise and standardise relevant data for small and medium-sized mining companies, including satellite data (ENAMI, SERNAGEOMIN AND COCHILCO).
3. Increase knowledge of satellite technologies and their capabilities by creating a centre of excellence for small and medium-sized mining (ENAMI, SERNAGEOMIN AND COCHILCO).

Due to difficulties in following up with Chilean partners for this evaluation, it has only been possible to assess the first of these subsequent projects, a cooperative venture between BGS and SERNAGEOMIN to exploit digital mapping tools to undertake virtual field reconnaissance (VFR) in several areas (see Figure 5).

Figure 5 Geologists from SERNAGEOMIN, ENAMI and BGS discuss terrain data to decide which field sites to target

Source: British Geological Survey

This pilot project proved that VFR substantially reduces the cost of field surveys by allowing geologists to go into the field already having a good understanding of the terrain they are interpreting. The project provided SERNAGEOMIN with an increased understanding of the geology of the trial area in Chile's Ovalle region. Although it was not possible to interview the Chilean partner about what happened subsequently, BGS confirmed for this case study that SERNAGEOMIN has continued to use the BGS GeoVisionary software trialled in this pilot.

BGS also confirmed that it introduced SERNAGEOMIN's geologists to a new technology – radar interferometry – to assess the stability of tailings dams. A recent publication by SERNAGEOMIN's remote sensing expert indicates that the Chilean partner has subsequently adopted and benefitted from this technology.

Longer-term impacts for UK partners

The project has been significant in developing SAC's presence in the mining sector and delivering additional income from the sale of services, as indicated above.

The successful delivery of the project and the development of a network of contacts within Chile was also a contributory factor in SAC deciding to appoint a Chilean country representative, covering extractive industries, transport, and agriculture. SAC representatives also said that the Hephaestus Project was the principal factor in establishing a mining workstream within the organisation – which has continuing potential to deliver future impacts as indicated by the projects listed above.

Complementarity and coordination

The examples provided make it clear that the project successfully introduced new technology to the mining sector in Chile. Unfortunately, it has not been possible to assess the extent to which this occurred due to difficulties in obtaining interviews with representatives of the Chilean partner organisations. Nonetheless, the fact that SAC appointed a long-term representative in Chile after the project suggests that the subsequent transfer of technology to Chilean organisations may have occurred.

5.4. Conclusions

- The available evidence indicates **this was a successful project that promoted overall Newton Fund objectives in line with the Fund's theory of change.** The project was highly relevant to Chile's economic development priorities, and its need to promote technological upgrading by mining SMEs. While the Chilean partner organisations might have found alternative sources of technical expertise, there is no indication that they were about to do so when the project launched. It is likely then that the project has promoted the adoption of advanced technologies faster than would otherwise have been the case.
- **The project significantly helped UK organisations develop their expertise in this sector**, enabling them to exploit this experience in ways that have generated commercial income and contribute to a safer and less environmentally damaging mining sector in other developing countries.

Lessons learned and points to consider going forward

- A key factor in the success of the project was that the UK project team spent sufficient time in Chile to understand the local context. This was further helped by working alongside their Chilean counterparts in the field to demonstrate the practical advantages of the technologies discussed.
- The project highlighted the value of having a local presence in the country to facilitate collaboration, understand the local context fully and compensate for the large geographical distance between the UK and Chile. These issues were important factors in SAC deciding to establish a permanent presence in the country.
- An important lesson of relevance to future evaluation of science and technology (and other) ODA programmes is the trade-off between allowing time for longer-term project impacts to emerge and having the means to investigate these. In the four years since the project was completed, the main contacts from all the Chilean organisations had moved on to work in other organisations.

6 Project: Making soil erosion understandable and governable at the river basin scale for food, water, and hydropower sustainability in Latin America

Summary

Project title	Making soil erosion understandable and governable at the river basin scale for food, water and hydropower sustainability in Latin America
Call title	UK-Chile Broadening Impact Call
Short description	Pilot a new approach to managing soil erosion at the Rapel River catchment basin in Chile. This approach incorporated evidence from natural science on the scale and reasons for erosion, as well as being informed by social scientific approaches using participatory methods to identify solutions among a range of social actors. Once developed, the approach will be disseminated more widely in Latin America through the involvement of partners from Argentina, Brazil and Mexico, and globally through organisations such as the International Atomic Energy Agency (IAEA) and the UN Food and Agriculture Organisation (FAO). The impacts are expected to be reduced contamination of land, water and reduced hydropower siltation, all of which will promote higher levels of economic output, productivity, employment and ultimately reduced poverty.
Objective(s)	Develop, validate and make globally available a transformative approach for controlling soil erosion at the river basin scale in developing countries. The approach lays the ground for collective action by government, businesses, communities and other stakeholders to reverse the social and technical processes that lead to soil erosion which impacts negatively on food, water and hydropower.
Pillar	Research
Total budget	£405,509[40]

[40] UK contribution from the Newton Fund.

Start/end date (Status: on-going or complete)	May 2018 to April 2020 – extended to March 2021.
DP UK and overseas	Natural Environment Resources Council (NERC); Comisión Nacional de Investigación Científica y Tecnológica (CONICYT)
Award holders/grantees	The University of Plymouth, Universidad Austral de Chile

Description of the project

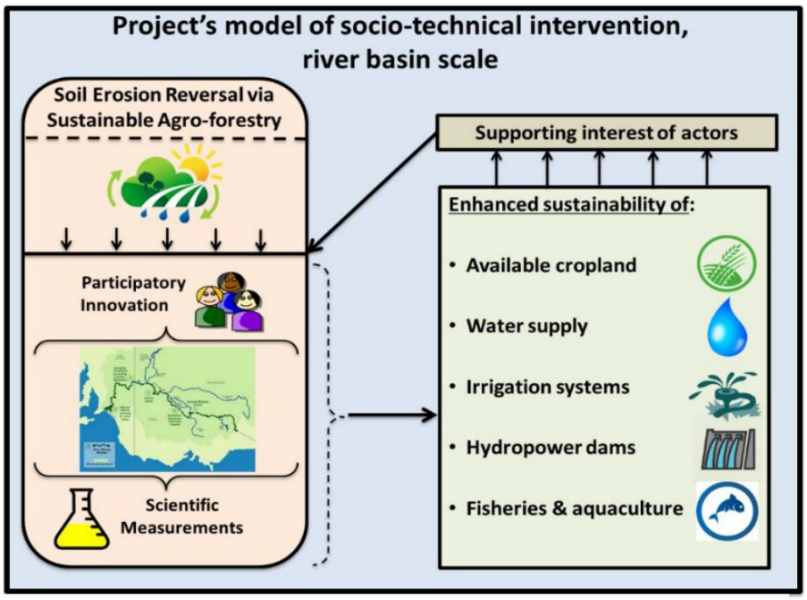
The project developed and piloted a new approach to managing soil erosion in Chile, with the aim of disseminating the approach more widely within Latin America and globally. The project is distinctive in fusing natural and social science elements, based on the premise that creating impact requires scientific approaches that quantify and identify the reasons for soil erosion and insights about human behaviour, institutions, and infrastructure. Therefore, **it has taken a multi-disciplinary approach**, combining scientific measurement methods with stakeholder engagement at a regional level. It is also distinctive and innovative in addressing these issues at the scale of a whole river basin, rather than just at local levels.

The approach has been developed and tested within the Rapel River basin in Chile. This area provides a base for diverse economic activities, including agriculture and viniculture, light industry, services, and hydroelectric power generation. Multi-disciplinary teams from Argentina, Brazil, and Mexico have closely observed and reviewed the project through an integrated learning process.

The project has brought together natural and social science expertise from the two award-holders, the University of Plymouth, and the Universidad Austral de Chile. The combined team has benefitted from complementary skills and experience. Both sides have scientific testing facilities, including some specialist equipment in Plymouth that would not otherwise have been available to the Chilean partner. The partnership also included regional partners from elsewhere in Latin America: The Federal Fluminense University (Brazil), Universidad de San Luis (Argentina) and the Instituto Tecnológico de Sonora (Mexico), bringing further testing facilities and broad expertise in the use of radioisotopes and tracers to assess soil erosion.

Key elements of the research collaboration are outlined in Figure 6.

Figure 6 Key elements of the soil erosion project



Source: grant application form prepared by the project team

The project's pathway to impact is summarised as follows:

Activities and outputs:

- Implement action-research projects in the target river basin area, combining scientific analysis on soil erosion with broader stakeholder discussions on the implications and potential solutions.
- Form and train groups of promoters from the target area along with participants from Argentina, Brazil, and Mexico to lead on implementing the approach in their areas.
- Disseminate the results of the project to regional and global soil erosion community groups.
- Formal outputs include six academic journal articles, grey literature, and policy briefs.

Interim outcomes

- Demonstrate the viability of an innovative approach to addressing soil erosion at a regional level.
- Build capacities among local stakeholders (individually and collectively) to identify measures to reverse soil erosion.
- Promote capacities in other development contexts across the world to make soil erosion governable.

Longer-term outcomes

- Alliances of stakeholders take sustained action to address soil erosion in the pilot project area and elsewhere.
- Levels of soil erosion are reduced, promoting greater productivity in various economic activities, including agriculture, fisheries, and hydropower generation.

The project is closely aligned with the overall Newton Fund ToC. There is a clear pathway towards the achievement of the Fund's overall target impacts (see Annex 4 for a diagrammatic representation). In particular, elements of the project correspond closely with the ToC as:

- it includes establishing multi-disciplinary research partnerships and promoting knowledge exchange through international networks, **which are output-level goals in the Newton Fund ToC.**
- it uses research to develop and test socially inclusive solutions and disseminate these through high-quality research outputs, which are **interim outcome goals in the ToC.**
- it is expected to deliver evidence that changes policy and practice in partner countries and globally, ultimately reducing soil erosion and contributing to more sustainable economic development and reducing poverty, which are **long-term outcome and impact goals in the ToC.**

6.1. Emerging project results

Relevance of Newton-Picarte Fund activities

Activity targeting and ODA relevance

The project is highly relevant to Chile's priorities, including a focus on stronger economic development and the promotion of international science and technology cooperation (see Section 2). It fits centrally with the overall strategy for the Newton-Picarte Fund, which defined energy, water, and minerals as well as the environment as focus themes. The strong alignment with Chile's development priorities is underlined by the fact that the evaluation panel for the Broadening Impact call had a very large number of applications to choose from (there were over 100 initial expressions of interest), ensuring the three projects (this one and two others) selected for funding were closely aligned with the country's wider needs.

The project also has specific relevance at the local level in an area that has been severely affected by erosion, with consequences that can be seen in Rapel Lake and hydropower generation activity at the Rapel Dam. One of these is that water has been severely polluted by livestock activities and by sediments resulting from intensive agro-forestry, resulting in high levels of eutrophy[41], poor water quality, and bad odours.

The project also has a very strong focus on addressing global challenges by providing an effective approach to soil conservation that can be transferred elsewhere. This was important given Chile's accession from the DAC list and the Broadening Impact call's assessment criteria, which required strong potential to promote economic and social development and impact in other developing countries. It also aligns clearly with several SDGs, particularly SDG 8 (economic growth) and SDG 15 (life on land).

[41] E.g., bodies of water becoming overly rich in nutrients and correspondingly poor in oxygen, reducing or killing off other forms of life.

Additionality

The project is likely to have gone ahead without Newton funds, but with a substantially narrower scope and with fewer overall benefits. For instance, the large-scale testing required for a regional approach would not have been possible without the substantial funding provided by the Fund. Impacts are, therefore, likely to be partially additional to what otherwise would have been expected to occur.

Partial additionality is demonstrated in a number of ways. The project:

- enabled a broad multi-disciplinary focus, including both social science and natural science elements.
- allowed Chilean researchers to access specialist testing equipment and expertise at Plymouth University – reducing costs and allowing the overall project scope to be broader.
- provided significant resources than might not have been achievable through other sources. This allowed a significantly more ambitious project. For instance, over 2,000 samples were taken from across the river basin – an exceptionally large number for a soil erosion project.

6.2. Effectiveness of Newton-Picarte Fund activities

Implementation of the projected was negatively impacted first by political unrest in Chile and then by the COVID-19 pandemic. Despite this, **the project was on track to achieve its objectives**, with approximately 80% of activities completed with four months remaining. The following adaptations were made:

- NERC granting the project a no-cost extension.
- Having some flexibility in spending the budget, for instance allowing funds to be switched to pay for online workshops, which were not part of the original proposal.
- UK Research and Innovation (UKRI) also gave all institutions undertaking research funds that underwrote project extensions of up to three months. This took the pressure off the researchers and allowed them to put successful mitigating actions in place rather than making significant cuts to the project.

The final list of outputs is likely to include:

- at least six academic articles with joint authors from both the Chile and UK sides. Of these, there are already two manuscript concepts on the natural sciences side, one on the social sciences side and another on overall methods.
- grey literature reports, for instance, on how the project's participatory approach was developed and managed.
- a policy brief setting out how an integrated river basin management approach can be implemented in practice.

These outputs will be supported through ongoing discussions with networked partners and within wider fora. The IAEA in Vienna is expected to be pivotal in this. The IAEA already undertakes significant work using nuclear and isotopic techniques to improve soil erosion management – this was also the organisation through which the AHs met and began discussing

the project. Specific measures through which this impact may be disseminated more broadly include the IAEA's soil erosion in upland environments research group and its reservoir siltation research programmes (the project team has already initiated discussions on this).

Involvement by researchers from Brazil, Mexico and Argentina also provides scope to disseminate the approach to these and other countries in Latin America. The fact that the funding call made the involvement of other DAC-list countries a condition of support was cited by the AHs as an important factor in promoting wider dissemination and poverty-reducing potential.

Boosting the capacities of UK researchers and creating opportunities for science and innovation in the UK

The project has made a modest but useful contribution to the capacity and skills of the UK researchers. Examples of benefits include:

- expanding the international networks of the UK researchers involved in the project, creating the potential for further knowledge exchange, collaborations, and grant applications.
- broadening their experience and horizons. This has occurred through the cross-disciplinary perspective at the heart of the project and applying methods in a completely new and distinctive context – covering a geographic area stretching from the Andes to Chile's coastal plain.
- studentships for Chileans at the University of Plymouth, estimated to bring an additional income of roughly £100,000 in total and a corresponding increase in research capacity.
- the experience of successfully applying for funding, which has improved capacities for further applications – including a successful Newton Fund application in Peru a year after the soil erosion project started.
- access to data for further analysis – the Rapel Catchment Area dataset is very substantial, creating the basis for further analysis and academic outputs.
- the professional development of researchers involved, with one describing it as "*a milestone in my career… giving me the credentials to manage other large grants*".

The project is also likely to lead to additional funding applications and, therefore, scope for further research income for the University of Plymouth (see below).

6.3. Emerging signs of impact

Potential for economic development and poverty reduction impacts

This approach includes bringing a wide range of actors together from across the catchment area, providing them with scientific evidence on the sources of erosion and facilitating discussions to identify a range of different solutions. More than 30 organisations in the pilot Rapel Basin area have been brought together for the first time to discuss soil erosion, including agricultural communities and businesses, a hydropower dam, and the water authority.

There has not yet been a concrete change in policy in the local area in terms of downstream impacts. Putting these solutions into practice will not be straightforward as they will require dedicated effort and investment over time. Therefore, impacts are only likely to emerge in the

Rapel Basin area over the medium-long term – namely, around five to ten years. However, it is reasonable to conclude that work to date constitutes an important step in developing a collective understanding of what needs to be done.

Over the medium to long-term, the project has good potential to contribute substantially to Chile's economic development and potentially in other countries in Latin America and beyond. If successfully implemented, it should deliver economic development benefits by i) reducing farmland lost through soil erosion, ii) reducing contaminants that pollute the water supply, fisheries and aquaculture, and iii) boosting sustainable energy generation by slowing or stopping the siltation of hydropower reservoirs. This has the potential to benefit a range of different groups, including some currently experiencing poverty, according to Chilean definitions.[42]

Potential to generate wider benefits, including new opportunities for collaboration and trade

The project has brought the important benefits described above, including a strong likelihood of further collaboration by the UK researchers and other partners. As a component of the wider Newton Fund, it has also contributed to good diplomatic relationships with Chile. However, as part of a relatively small funding call which is not directly linked to private sector partners or new commercial ventures, it is not expected to directly produce further secondary benefits (for instance, increased trade or investment between the UK and Chile).

The extent to which sustainability was integrated into project design

There is strong evidence that the sustainability of impacts was closely integrated into the project from the design phase. For instance, the grant application makes clear that the project is a pilot intended for wider dissemination, with partners from Argentina, Brazil and Mexico expressly included for this purpose. Some of the main mechanisms for dissemination were also detailed at the outset (such as participation in international meetings with the IAEA, FAO, and other organisations).

Potential for longer-term impact

The project has **built an international partnership and network** that is likely to endure over time and result in further research collaboration in the foreseeable future.

The UK and Chilean AHs say they will **continue to analyse the data together** for a further two years beyond the scheduled end date of March 2021. Two Chilean PhD students are now studying at the University of Plymouth on closely related themes, cementing this ongoing collaboration.

The AHs have already collaborated to develop an (unsuccessful) application for the EU's Horizon 2020 Fund for an extension project in this field. **They are now working on a joint application for an EU Green Deal funding call (the Chilean partner may lead this, as Britain is now outside the EU).** They are also looking at further funding opportunities from CONICYT, though they anticipate this will be difficult as the budget for public research funding has recently been reduced in Chile.

[42] In 2013 (latest data) 16% of the population of the surrounding O'Higgins region lived in poverty. Available at: http://observatorio.ministeriodesarrollosocial.gob.cl/

Work is also ongoing to widen the partnership and undertake further research, using the networks of the research teams from Argentina, Brazil, and Mexico. This opportunity to develop new working relationships in this field is cited as a significant benefit by UK researchers. The project provides the opportunity for "*our institution to prove itself*". Governments in all three countries provide scholarships for graduate students to study abroad, and this is expected to bring additional international students and income to the UK in due course.

Complementarity and coordination

There are indications the project **will result in changes in organisations' behaviour at a local level** in the project pilot area over time. However, given the project has not yet completed it is too soon to detect these at a broader level in Chile or elsewhere.

6.4. Conclusions

- **The project is a successful multi-disciplinary international research collaboration, with strong potential to achieve its overall objectives and contribute to those of the wider Newton Fund.** The collaboration is closely aligned with the Research pillar of the overall Newton Fund ToC and Chile's own priorities for science, innovation, and economic development.
- **The project is likely to produce impact in helping to address soil erosion in the immediate Rapel Basin area.** In doing so, this is likely to have positive economic effects in terms of greater output, productivity, and employment – with some accompanying contribution to poverty reduction. It has also helped to develop the experience, capabilities, and networks of both Chilean and UK researchers.
- **The project also has the potential to produce benefits in other developing countries in Latin America and globally.** Importantly, there are good transmission mechanisms in the form of existing international networks to help this happen in practice.
- **These benefits are partially additional to what otherwise could have been expected to occur**; namely, some research cooperation might have occurred without the Newton-Picarte Fund but with a substantially narrower scope. It is also likely that benefits will be sustained over time, both in terms of the research partnership (which is seeking funds to develop its work further) and applying the soil erosion management model in other contexts.

Lessons learned and points to consider going forward

- **A strong partnership and good personal relationships have been central to the success of the project.** This was helped by the fact the AHs had already met and knew the other party (though not particularly well). Mutual trust developed quickly, which helped to smooth implementation and allow the different partners to focus on academic work. It also helped that the principal investigator on the Chilean side had studied in the UK and understood British culture (both in the general sense and the ways that universities work). This made him a good mediator with other partners in Latin America and helped in particular around funding discussions.
- **International collaboration gave the project additional prestige, which helped when working with different social** actors at a local level in the Rapel Basin by generating interest in the project and improving their confidence that results could help address local problems.

- **A flexible approach by UK research institutions has made an important contribution to achieving project success despite the major challenges posed by the COVID-19 outbreak**. These include granting extensions and allowing some flexibility in the use of the budget.

Annex 1 – Methodology

Research methods and data collection approach

Preparation for the research included a document review of country-specific documents on Chile's research and development context. Documents reviewed include the evaluation Chile End line Report and the updated Country Situation Note. We also conducted a literature review of additional documentation on Chile's science and innovation landscape and existing UK-Chile collaboration activities. Project-specific documentation, such as application forms, progress, and final reports, were reviewed for each action included in the study, where provided by the Delivery Partner, local partners, or researchers.

The document review was accompanied by **remote research with respondents in Chile and in the UK** in November and December 2020. Three main categories of stakeholders were interviewed: i) in-country UK representatives and Newton Fund in-country team; ii) UK and local funders; and iii) participating researchers.

Our data collection was complemented with an analysis of the pathway to impact for each action, which can be found in Annex 4. Here, we analysed each project's trajectory to impact by placing it within the Newton Fund Theory of Change. This allowed us to visually represent the pathway to outputs, outcomes and impact of each activity and highlight its (potential) contribution to broader Newton Fund goals.

Limitations of the research approach

Case studies were limited to three projects per case study, which were conducted remotely owing to the Covid pandemic. In some projects, the added logistical challenge of remote research limited the number and range of stakeholders consulted. The volume of documentation provided varied by project, thus limiting the possibility of triangulating findings. The case study findings reflect the data provided by each project and what is available online. The case study is not representative of all Newton Fund activities. Whereas it provides valuable depth and illustration of Newton Fund activities, the case study alone does not provide generalisable evidence.

Research findings have been triangulated across different stakeholder groups and various sources of documentation (project documents and online resources such as the RCUK Gateway to Research portal). However, the research team could not independently verify statements by all the different contributing stakeholders or verify what was reported in the documentation.

Additionally, the COVID-19 pandemic has resulted in the need to revisit our data collection approach, particularly in terms of our 11 country case studies. The case study research was originally scheduled to take place in three waves of partner country visits between March and August 2020. The inability to travel internationally and the closure of offices, embassies, universities, and research centres required switching to a **remote-based approach**, as agreed with BEIS in March 2020.

In revising our case study approach, we recognised that switching to a remote-based approach would have likely implications on the quality of data collected, as outlined in our April 2020 Concept Note. The quality of interviews could have been affected for several reasons, including:

- problems with connectivity, technical issues and limited telephone or internet coverage, which posed the risk of lowering the quality of calls and cause loss of rapport, creating abrupt feelings in interviews, and affecting the depth and quality of our findings.
- the absence of visual or nonverbal cues, inability to observe behaviour and body language, with the risk of telephone interviews becoming mechanical and cold.
- having little opportunity to establish rapport with respondents and having potentially shorter times for interviews as respondents may more easily become fatigued by telephone compared to face-to-face interaction.
- limited engagement, low response rates and little interest in participating in our research, which might limit the breadth and depth of our findings.
- the inability to visit laboratories or facilities, and limited scope for unplanned interviews with additional staff members, researchers, or others in the same institution.
- fewer opportunities for check-ins and informal conversations with in-country teams (ICTs), who are a rich source of data.

We mitigated these issues in several ways, where:

- we included additional time for document review prior to interviews so that conversations moved on to speaking about results, emerging impact, and challenges (to consider for shorter interview times and potentially lower quality interviews). However, it is important to consider that availability and quality of project data and information varied considerably across sampled interventions.
- we favoured video interviews wherever possible to limit the lack of nonverbal cues and to help establish rapport with respondents.
- we had several email exchanges prior to interviews to create an initial connection and rapport with participants, and to set out the objectives and areas covered in the interviews by sharing topic guides prior to our calls.
- we organised follow-up interviews wherever possible to fill any remaining information gaps brought about by having shorter interview times. We also gathered interviewee insights on additional respondents and carried out additional interviews which emerged from email exchanges and interviews.
- we organised regular check-ins with ICTs via email or telephone and delivered online presentations and validation sessions with each ICT to share emerging findings after having carried out all interviews. This allowed us to ensure we had accurately reflected the Newton Fund's experience in each country.

Annex 2 – Case Studies Sampling Overview

This Annex summarises the sampling approach used for the country case studies which inform the Final Evaluation of the Newton Fund. Detail on the approach and criteria used to develop the sample for the case studies is annexed to Tetra Tech's Newton Fund Final Evaluation Report.

Final evaluation country sample

A total sample of 11 countries with three calls per country (totalling 33 calls) was agreed with the Department of Business, Energy, Innovation and Science (BEIS).

The countries selected for the country sample were China, Malaysia, Chile, Turkey, South Africa, Brazil, India, Philippines, Jordan, Peru, and Kenya. The sample includes three additional countries (Jordan, Kenya, and Peru)[43] due to the Newton Fund's expanded scope. Six of these countries were included in the Mid-Term Evaluation (MTE)[44] of the Newton Fund case study research.[45]

The criteria used for the country selection were:

- coverage of all regions covered by the Newton Fund.
- coverage of different levels of existing innovation and capacity of partner countries (as defined by the 2015 Global Innovation Index rankings and BEIS' initial assessment of capacity).
- learning opportunities from new ways of working regionally in countries that either graduated from the DAC list or have ODA sensitivities; or operating in/ recovering from crises.
- the inclusion of Peru, Jordan, Kenya (countries that have not been explicitly included in the evaluation scope until now).

Non-selection of countries (or calls) does not reflect significance, quality, or importance.

[43]Jordan, Kenya, and Peru were not included in the MTE data collection, as they had just joined the Newton Fund. BEIS agreed to carry out in-depth case studies in the three new countries to ensure coverage of activities there.
[44] Mid-Term Evaluation of Newton Fund (December 2018). Available at: https://www.newton-gcrf.org/resources/
[45] These were: China, Malaysia, South Africa, Brazil, India, and the Philippines. Mexico and Egypt, which were part of our MTE sample, have been replaced with Turkey and Chile respectively to increase opportunity for learning.

Proposed sample of calls and projects

Data from BEIS' Newton Fund Activity Tracker (January 2020)[46] enabled the evaluation to determine 'call' activity and identify three 'calls' per country, giving a total of 33 calls in the sample. The following criteria were used to develop the call sample:

- ensuring coverage of all DPs.
- ensuring coverage of the three different pillars.
- reflecting emphasis on spending/thematic priorities in each country.
- allowing for longitudinal analysis by including six projects analysed as part of the MTE.

The outcome of the call sampling approach allowed for the identification of specific projects under each selected call. This was achieved in consultation with DPs, BEIS ODA Research and Innovation and ICTs.

The project sample allows for coverage of all DPs and pillars within the Newton Fund portfolio. Six projects were analysed as part of the MTE and again at Final Evaluation to allow for longitudinal analysis. The sample list of 33 calls and projects is annexed to Tetra Tech's Newton Fund Final Evaluation Report.

[46] The BEIS 'Activity Tracker' is an Excel-based internal monitoring tool by BEIS and updated quarterly by the UK Delivery Partners.

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Research Participants

Project 1 – Governing the educational and labour market trajectories of secondary TVET graduates in Chile

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- Judith Jacovkis, Academic at Glasgow University

Project 2 – Project Hephaestus: sustainable economic development of medium-sized mineral extraction companies in Chile

- Alastair Lees, Global Services Development Director, Satellite Applications Catapult
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- Luke Bateson, Remote Sensing Geologist, British Geological Survey

Project 3 – Making soil erosion understandable and governable at the river basin scale for food, water, and hydropower sustainability in Latin America

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- Janet Geddes, Deputy Director – Global, Innovate UK
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UK Embassy in Chile

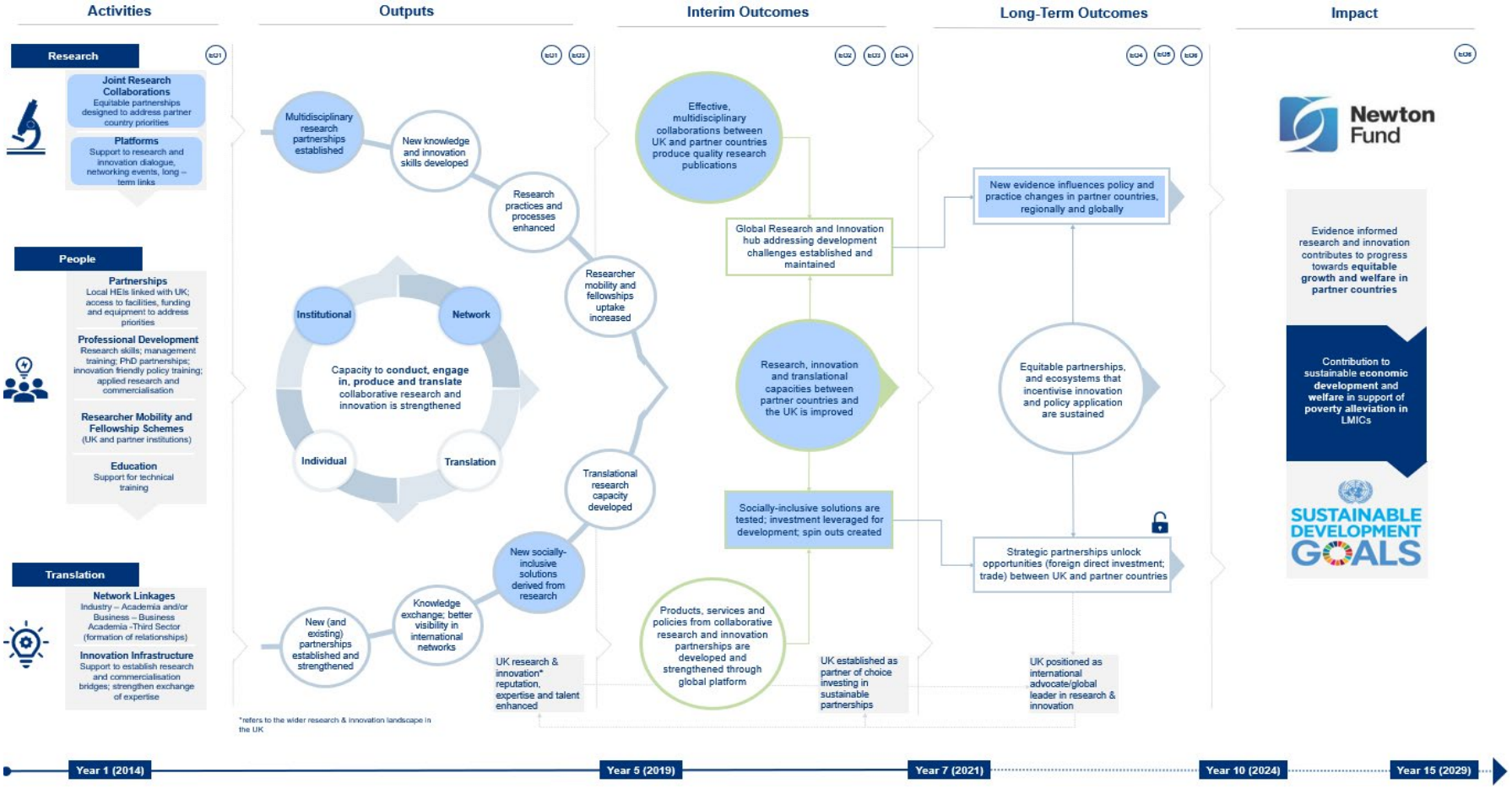
- Fiona Clouder, formerly HM Ambassador to Chile
- Álvaro Cabrera Urrea, Newton Fund Manager, UK Embassy, Chile
- Francisco Álvarez Roca, Science and Innovation Network Officer, UK Embassy, Chile

Other

- Charlotte Kelsey, Senior Policy Adviser- Science and Innovation, Latin America, Department for Business, Enterprise, and Industrial Strategy.

Annex 4 – Theories of Change per Action[47]

Figure 7 Governing the educational and labour market trajectories of secondary Technical and Vocational Education and Training graduates in Chile



[47] The figures present the pathways to impact for the three projects reviewed in this case study, set within the overall Newton Fund theory of change. Specific pathways to impact for each project are indicated by the blue shaded shapes in each figure.

Figure 8 Project Hephaestus – sustainable economic development of medium-sized mineral extraction companies in Chile

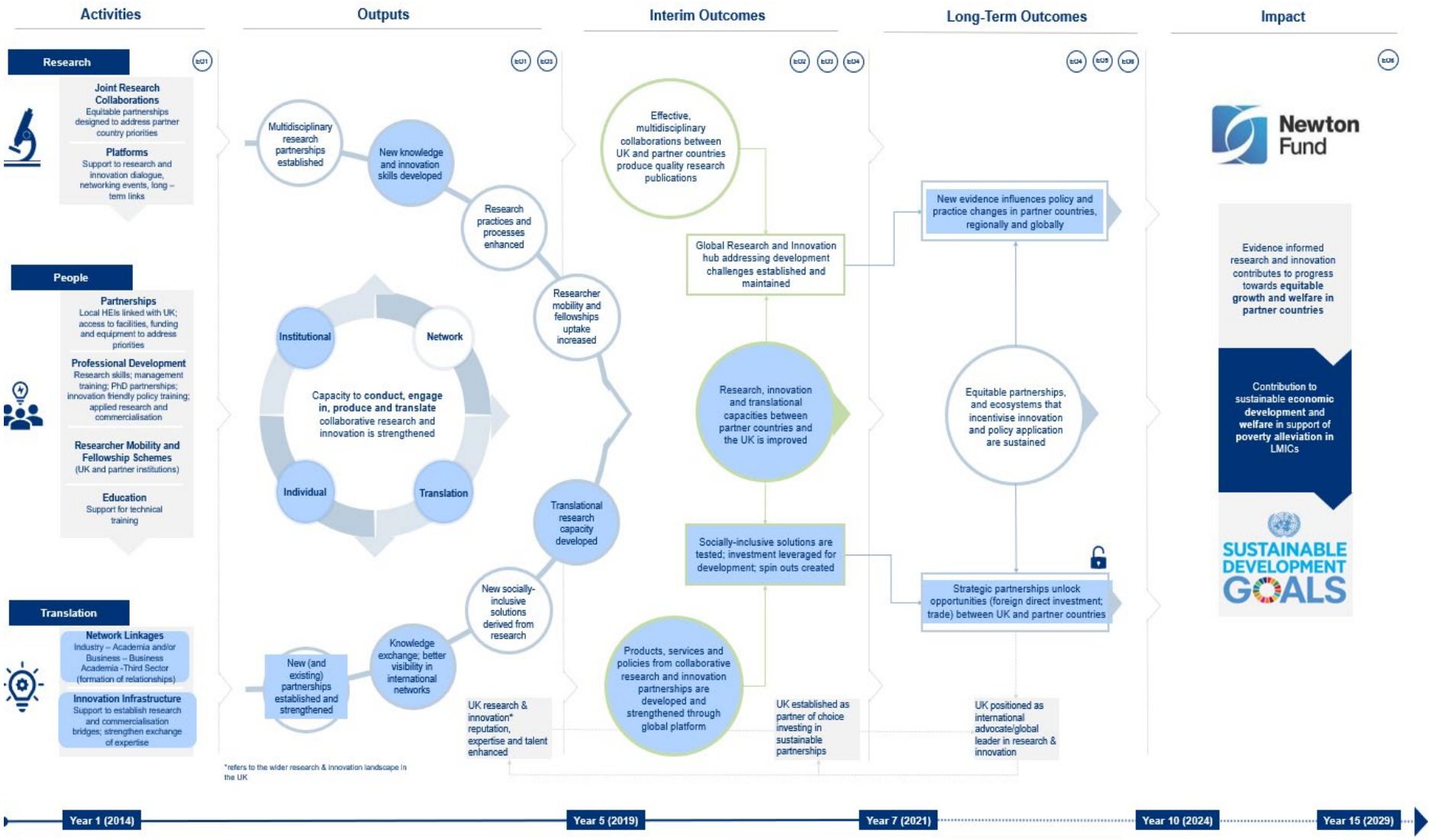
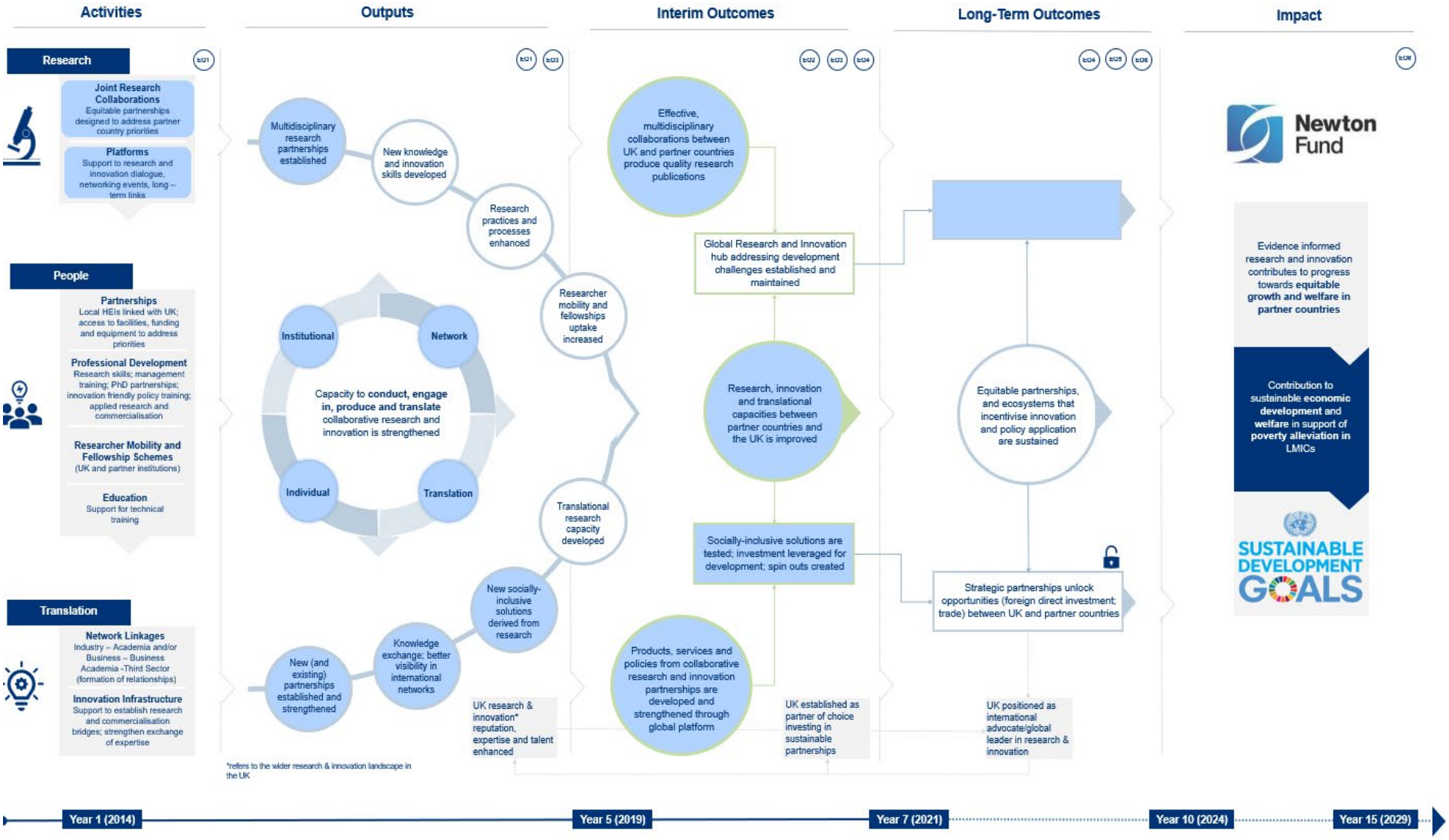


Figure 9 Making soil erosion understandable and governable at the river basin scale for food, water, and hydropower sustainability in Latin America



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