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Final evaluation of Sêr Cymru II

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Final evaluation of Sêr Cymru II

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HATCH

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Views expressed in this report are those of the researcher and not necessarily those of the Welsh Government

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Glossary

BEIS

Department for Business, Energy & Industrial Strategy.

CBAA

Capacity Building Accelerator Award.

CCTs

Cross Cutting Themes.

CISM

Centre for Integrative Semiconductor Materials.

CSA

Chief Scientific Advisor.

CTER

Commission for Tertiary Education and Research.

DEFRA

Department for the Environment, Food and Rural Affairs.

DfT

Department for Transport.

DHSC

Department for Health and Social Care.

EIC

European Innovation Council.

EPSRC

Engineering and Physical Sciences Research Council.

ERC

European Research Council.

ERDF

European Regional Development Fund.

ERRM

Economic Resilience and Reconstruction Mission.

ESNR

Economy, Skills and Natural Resources Group.

EU

European Union.

EW

East Wales.

FWCI

Field Weighted Citation Index.

HCRW

Health and Care Research Wales.

HE-BCIS

Higher Education Business and Community Interaction Survey.

HEFCW

Higher Education Funding Council for Wales.

HEI

Higher Education Institution.

HESA

Higher Education Statistics Agency.

IAA

Infrastructure Accelerator Award.

ISCF

Industrial Strategy Challenge Fund.

LCEE

Low Carbon Energy and Environment.

MDI

Medicines Discovery Institute.

MSCA

Marie Skłodowska-Curie Actions.

NRN

National Research Network.

OCVO

Office of the Chief Veterinary Officer.

PCETR

Post-Compulsory Education, Training and Research.

PMF

Precision Medicine Fellow.

RD&I

Research, Development and Innovation.

REF

Research Excellence Framework.

RIW

Research and Innovation Wales.

SME

Small and medium enterprises.

SPAA

Strategic Partnership Accelerator Award.

STEMM

Science, Technology, Engineering, Mathematics and Medicine.

STFC

Science and Technology Facilities Council.

TERCfW

Tertiary Education and Research Commission for Wales.

TERWA

Tertiary Education and Research (Wales) Act.

UKRI

UK Research and Innovation.

WEFO

Welsh European Funding Office.

WWV

West Wales and the Valleys.

1. Introduction

Hatch and OB3 were appointed by the Welsh Government to undertake an evaluation of the European Regional Development Fund (ERDF) components of the Sêr Cymru II operation.

1.1. About Sêr Cymru II

The Sêr Cymru initiative was initially launched in 2012 by the Welsh Government to address the STEMM capacity deficit in Wales and build a stronger science base in Wales. It aimed to develop research excellence in the grand challenge areas of life sciences and health, advanced engineering and materials and low carbon, energy and environment which form the cornerstone of Wales' Smart Specialisation strategy^[footnote1]. Although published after the inception of Sêr Cymru, a stimulus paper by the Leadership Foundation for Higher Education found that there was a deficit of 600 researchers in Wales involved in STEMM-related disciplines with the largest subject deficits being in clinical medicine, biosciences, physics, electrical and computer engineering, mechanical engineering and maths ^[footnote2].

Sêr Cymru II builds upon a predecessor operation, Sêr Cymru (subsequently referred to as Sêr Cymru I), which operates via three National Research Networks (NRNs) covering Life Sciences and Health NRN, the Advanced Engineering and Materials NRN and the Low Carbon, Energy and Environment NRN.

The original Sêr Cymru II operation (Sêr Cymru II+ is described later) aimed to further strengthen Wales' research performance by targeting investment, attracting world-class research talent and, in the case of non-ERDF-funded elements, supporting infrastructure. While building on the work of Sêr Cymru I which focused on recruitment of research Chairs, Sêr Cymru II also aimed to attract research-excellent scientists in the early or middle stages of their career, and those currently on a career break into research posts in Wales.

Footnotes

[1] Smart Specialisation Strategies are a key part of the European Commission's approach to Cohesion Policy for 2014-2020. They are national or regional innovation strategies that are integrated, place-based economic transformation agendas. Source: European Commission. Smart Specialisation factsheet. March 2014.

[2] The Case for Growing STEMM Research Capacity in Wales. Stimulus Paper. Page 2. Halligan, W and Bright L. Leadership Foundation for Higher Education. London. May 2015

1.2. Overview of Sêr Cymru II Fellowship Categories

1.2.1. Rising Star

These are prestigious and competitive positions, designed to attract the very best 'rising stars' of academic research. Ten five-year Rising Star fellowship packages were awarded (five in WWV and five in East Wales).

1.2.2. Research Fellow

Research fellowships are aimed at stellar candidates; 3-5 years post PhD, from anywhere in the world to come to work in Wales. The fellowships are three years in duration. 30 fellowships were awarded (15 in WWV and 15 in East Wales).

1.2.3. Precision Medicine Fellows (PMF)

These fellowships were similar to Research Fellowships but focused specifically on research relevant to precision medicine. These received match funding from Health and Care Research Wales and were designed to address a strategic need. Four PMFs were awarded, all of which were in East Wales.

1.2.4. Recapturing Talent

This strand of Sêr Cymru II aims to provide support for stellar researchers returning to work following a career break. The operation initially intended to support 12 fellows (six in WWV and six in East Wales) but only three were awarded (all in WWV).

1.3. Chair

These awards were initially suggested as part of the operation in order to provide opportunities to attract the best senior academic researchers into Wales. Following initial consultation work with universities as part of the design phase of Sêr Cymru II, this category was excluded from the operation, but was subsequently re-introduced as a result of unexpected demand for a small number of Chair positions through the applications process. Five Research Chair packages were initially supported (three in WWV and two in East Wales).

Following the full allocation of the research funding for Research Chairs, an opportunity arose to consider an application for funding in collaboration with WEFO and the Office of the Chief Veterinary Officer (OCVO). The proposed Sêr Cymru Chair was to enable an internationally recognised expert on bovine tuberculosis to establish a Centre of Excellence at Aberystwyth University. This took the total number of Research Chairs to six.

In addition to the ERDF funded element, the Sêr Cymru II programme also contained a Marie Skłodowska-Curie COFUND funded operation, part of the Horizon 2020 programme. This £17m fellowship scheme awarded by the European Commission to the Welsh Government provided support for up to 90 fellows in a pan Wales operation that ran alongside the ERDF operations. COFUND applicants were expected to be 3-5 years post-PhD. They could be of any nationality but must not have been resident in the UK for more than 12 months in the three years preceding the award. The COFUND element was delivered in parallel with the ERDF operations and was evaluated separately by the European Commission; therefore it is not evaluated as part of this study.

1.3.1. Sêr Cymru II+

Following a further call for research and innovation proposals issued by WEFO in December 2017, Welsh Government was successful in securing additional funding to expand Sêr Cymru II. These new funding opportunities were focused on further developing Wales' academic and industrial partnerships and building capacity in strategic areas. These later awards are collectively referred to as Sêr Cymru II+ in the business plan and hereafter in this report (SCII+).

1.4. Details of SCII+ awards

1.4.1. Industrial Fellowships

These were aimed at strengthening the relationship between Welsh academic researchers and UK and global industrial partners. These partnerships aim to lead to more formal collaborations between Higher Education Institutions (HEIs) and commercial enterprises which may in turn lead to joint funding bids. It was originally intended that six fellowships would be funded, although only five were in practice.

The business plan also states that it was initially the intention to offer a pilot subset of Industrial Fellowships in collaboration with Science Foundation Ireland. This was a pilot scheme that would test the potential to link with this organisation in broader activities once the UK has left the EU. However this did not proceed for administrative reasons outside the control of Welsh Government.

1.4.2. Strategic Partnership Accelerator Awards (SPAAs)

These were aimed at strengthening established strategic research partnerships with universities around the world. Four awards were made compared to an original target of five.

1.4.3. Infrastructure Accelerator Awards (IAAs)

These awards offered a level of funding to support multi-user equipment grants to improve the quantity and quality of research in Welsh HEIs. It was anticipated that ten awards would be made, although this was subject to uncertainty and the value of applications. Eight awards were made.

1.4.4. Capacity Building Accelerator Awards (CBAAAs)

These were aimed at building and strengthening capacity in smart specialisation area. Seven awards were made compared to an original assumption of five.

1.5. National Research Networks

Sêr Cymru I previously supported NRN networks in Low Carbon, Energy and the Environment; Life Sciences and Health; and Advanced Engineering and Materials before funding came to an end. SCII+ provided additional funding to sustain the networks and collaborative culture that were built through the NRNs, and identify new opportunities for funding, interdisciplinary working and/or commercialisation opportunities.

1.6. Funding

The funding packages approved by WEFO for Sêr Cymru II are set out in

Table 1.1. This includes the funding for the original elements of Sêr Cymru II and SCII+ and covered the period from December 2016 to July 2023.

Table 1.1: ERDF funding for each region (December 2016 to July 2023)

Funding by region	WWV	EW
ERDF Approved	£20.6m	£9.5m
Total Project Cost	£29.8m	£21.3m

Source: Welsh Government

The Higher Education Funding Council for Wales (HEFCW) committed £3.8m in Sêr Cymru II while Health and Care Research Wales (HCRW) committed £130,000. The Welsh Government Economy, Skills and Natural Resources Group (ESNR) committed £7.3m to the programme.

For each ERDF funded fellowship award, the participating university was expected to make a financial contribution to the overall cost.

Table 1.2 outlines the financial contribution rates for universities in WWV and East Wales.

Table 1.2: Financial contribution rates for each region

Financial contribution rates by funded region	Sêr Cymru II contribution^[footnote3]	University contributions
Sêr Cymru II Fellows, Recapturing Talent and Rising Stars	83% (WWV)	17% (WWV)
	66% (EW)	34% (EW)
SCII+ awards	95% (WWV and EW)	5% (WWV and EW)

Source: Welsh Government

Footnotes

[3] Consisting of Welsh Government, ERDF, HEFCW and HCRW funding

1.7. Evaluation aim and objectives

Sêr Cymru II has been evaluated in three stages, all of which were undertaken by Hatch (formerly Regeneris Consulting) and OB3:

- An [inception](#) stage, undertaken in 2017.
- A [mid-term](#) stage, undertaken in 2018.
- A final impact stage. This is the focus of this evaluation.

The objectives of the final evaluation are to:

- i. Provide an assessment of whether Sêr Cymru II has achieved the ERDF indicators, aims and objectives set out in its business plan.
- ii. Provide an updated review on the strategic policy and funding context for Sêr Cymru II, examining its contribution to key Welsh Government, WEFO and regional policy priorities.
- iii. Assess the strategic fit of the programme against key Welsh Government strategies in relation to employment, Well-being of Future Generations Act, and Welsh language and others applicable.
- iv. Provide an assessment on the success of Sêr Cymru II in meeting the objectives set for the WEFO Cross Cutting Themes, considering:
 - What worked well/what didn't work, problems identified and how these were addressed?
 - How and to what extent, has the operation provided opportunities to promote the Welsh language through its activity?
 - How have the operations contributed to the goals of the Well Being of Future Generations Act?
- v. Provide an assessment of the effectiveness of management, delivery and monitoring processes and identify how these may be improved for future, similar programmes.
- vi. Update the theory of change for Sêr Cymru II.
- vii. Assess the impact of Sêr Cymru II in building scientific research quality and capacity in Wales. This will include a counterfactual analysis and identification of any deadweight or displacement effects.

- viii. Provide recommendations regarding: the rationale, design, delivery and management of any future programmes that will build on and enhance the outcomes delivered by Sêr Cymru II; and address the Welsh Government's strategic aims in relation to the growth of scientific research capacity and capability in Wales. Where feasible, recommendations should consider potential and opportunities and constraints in relation to:
- The future economic and social context
 - The planning, design and delivery of interventions
 - Evaluation approaches.

1.8. Structure of the Report

The report is structured as follows:

- Chapter 2 provides an outline of the evaluation methodology adopted for the final evaluation and the profile of those who contributed to the fieldwork.
- Chapter 3 updates the theory of change for Sêr Cymru II, focusing specifically on the new elements of the operation (SCII+).
- Chapter 4 reviews recent policy and strategic developments which have taken place in Wales and at the UK level since the mid-term evaluation was prepared and considers the implications for Sêr Cymru II.
- Chapter 5 provides an updated baseline position on STEMM academic research in Wales.
- Chapter 6 assesses the performance of the operation compared to the targets in the business plan.
- Chapter 7 assesses the effectiveness of management and delivery of Sêr Cymru II.
- Chapter 8 assesses the outcomes and impacts of the original fellowships funded by Sêr Cymru II.
- Chapter 9 assesses the outcomes and impacts of the later awards funded through SCII+.
- Chapter 10 assesses Sêr Cymru II's contributions to Cross Cutting Themes (CCTs) and the goals of the Wellbeing of Future Generations Act.

- Chapter 11 provides the evaluation's conclusions and recommendations.

2. Methodology

The research for the final evaluation has included the following tasks:

- A desk-based analysis of:
 - recent policies published by the Welsh and UK governments.
 - recent trends in research income, research capacity and interactions with business in Wales' HEIs, drawing upon data published by the Higher Education Statistics Agency (HESA).
 - programme monitoring data, including the progress against financial and output targets^[footnote4]. This included a large number of output indicators which are detailed in Chapter 6.
 - quarterly progress reports prepared by all of the recipients of Sêr Cymru II funding. These summarise the main achievements of fellowships and awards and the progress towards output and result targets.
 - responses to the destination survey which was sent to all grant recipients and a number of the researchers recruited by Research Chairs and Rising Stars after the funding period had ended. 60 responses were received and analysed. It is not possible to determine the response rate as it is not clear how many beneficiaries it was sent to.
- Design, dissemination and analysis of an online survey (March to May 2023). This was sent to all Rising Stars, Recapturing Talent Fellows, Research Fellows and PMF fellows where email addresses were available (40 in total, out of a total of 46 fellows). 19 responses were received, meaning this achieved a response rate of 47.5%.
- Semi-structured consultations with 30 stakeholders including Welsh Government officers involved in the design, delivery and management of Sêr Cymru II (four consultees), WEFO officers (four consultees), evaluation panel members (six consultees) and HEI stakeholders (16 consultees^f

Footnotes

[4] This was based on the final claim data and captures all of the outputs and results achieved by the programme between November 2017 and the end of the funding period in June 2023.

[footnote5]). These used a topic guide agreed with Welsh Government and WEFO. These were undertaken in February and March 2023.

- Semi-structured consultations with 32 of the 79 grant recipients (40%) undertaken between May and July 2023. This includes a cross section of different fellowship types and SCII+ awards as shown in Table 2.1. All grant recipients were invited to be interviewed, however a number either declined, did not reply or could not be contacted. The participation rate was lower for some of the original Sêr Cymru II awards (e.g. Research Fellowships) than the SCII+ awards. This is likely to be explained by a number of factors including the fact that many of the Research Fellowships ended some time ago, while the SCII+ awards were all ongoing or had only recently finished at the time of the evaluation. Research Fellows, Recapturing Talent and Rising Stars fellows had also all been invited to take part in the online survey so may have felt that they had already conveyed their views on the programme.
- A counterfactual analysis of the impact of Sêr Cymru II on research income, research publications and citations. More detail on the approach used is provided in Chapter 8.

Table 2.1: Breakdown of consultations by award type

	Number of awards	Number interviewed
Research Chairs	6	5
Rising Stars	10	4
Recapturing Talent	3	1
Research Fellowships	30	6
PMF	4	1
Industrial Fellowships	5	3
SPAAs	4	3
IAAs	8	4
CBAs	7	3
NRNs	3	2
Total	80	32

The evaluators conclude that the evaluation is based on robust data and evidence. All of the surveys achieved a response rate of at least 40% and included a broadly

Footnotes

[5] A number of the interviews with HEIs involved multiple participants from the university

representative sample of beneficiaries, meaning these should provide robust results. The monitoring data was also detailed, comprehensive and timely. There are, however, a number of weaknesses or uncertainties, including:

- There is uncertainty about the amount of research income secured and the total number of partners cooperating in research projects, as Welsh Government found that a large number of the claims were either ineligible or unsupported by evidence. This particularly relates to SCII+ awards. It is clear that a large number of the claims were ineligible and should not have been claimed, however it appears that other claims were genuine and legitimate but were not supported by the evidence needed by WEFO. This is described in Chapter 6 (paragraphs 0 to 0).
- The monitoring data on the number of research fellows taking up permanent roles in their host institution is inaccurate. The evaluation has taken additional steps to identify a more robust figure which is described in Chapter 6 (paragraphs 0 to **Error! Reference source not found.**).
- It has not been possible to undertake a robust counterfactual analysis of the impact of Sêr Cymru II on research income. This is due to a lack of available datasets which offer the required level of granularity. The evaluation has undertaken a benchmarking analysis which compares the income performance of Wales's HEIs with similar universities in those subject areas that have received support. However this should be treated with caution. This is explained in more detail in Chapter 8 (paragraphs 0 to 0).

3. Updating the Theory of Change

A theory of change is a comprehensive and logical description of how and why a desired change is expected to occur as a result of a policy or programme. It outlines the activities that are believed to lead to outcomes and impacts and describes the assumptions that this is based on.

This chapter updates the theory of change for Sêr Cymru II, with a particular focus on the newer elements of the programme (referred to as SCII+). This included:

- Industrial Fellowships
- Accelerator Awards, which can be further divided in to
 - Strategic Partnership Awards
 - Infrastructure Accelerator Awards
 - Capacity Building Accelerator Awards
- National Research Networks

These theories of change have been set out in diagrams on the following pages (see Figures 3.1 to 3.5). Each diagram shows:

- the context and need for the intervention, setting out the challenges and opportunities they were designed to address,
- the aim of the intervention,
- the inputs (the value of the public investment) and the specific activities which this funded,
- the outputs and targets identified in the business plan. These include a mix of ERDF output and result indicators and Welsh Government indicators. The business plan only identified targets for ERDF outputs and results,
- the key assumptions underpinning the theory of change i.e. the conditions that would need to be met for project activities to lead to outcomes and impacts, and
- The outcomes and impacts that were expected to occur as a result of the intervention. This distinguishes between short and intermediate term outcomes and long-term impacts. Given that most of the SCII+ awards

have only recently completed, it is likely that only short-term outcomes have occurred to date.

These theories of change are used to assess the emerging outcomes and impacts of the SCII+ awards in Chapter 9, with a particular focus on short term outcomes.

The theories of change for the original elements of the programme including Research Chairs, Rising Stars, Recapturing Talent and Research Fellows was described in the [inception evaluation](#) and are still up-to-date and relevant.

Figure 3.1: Theory of change for Industrial Fellowships

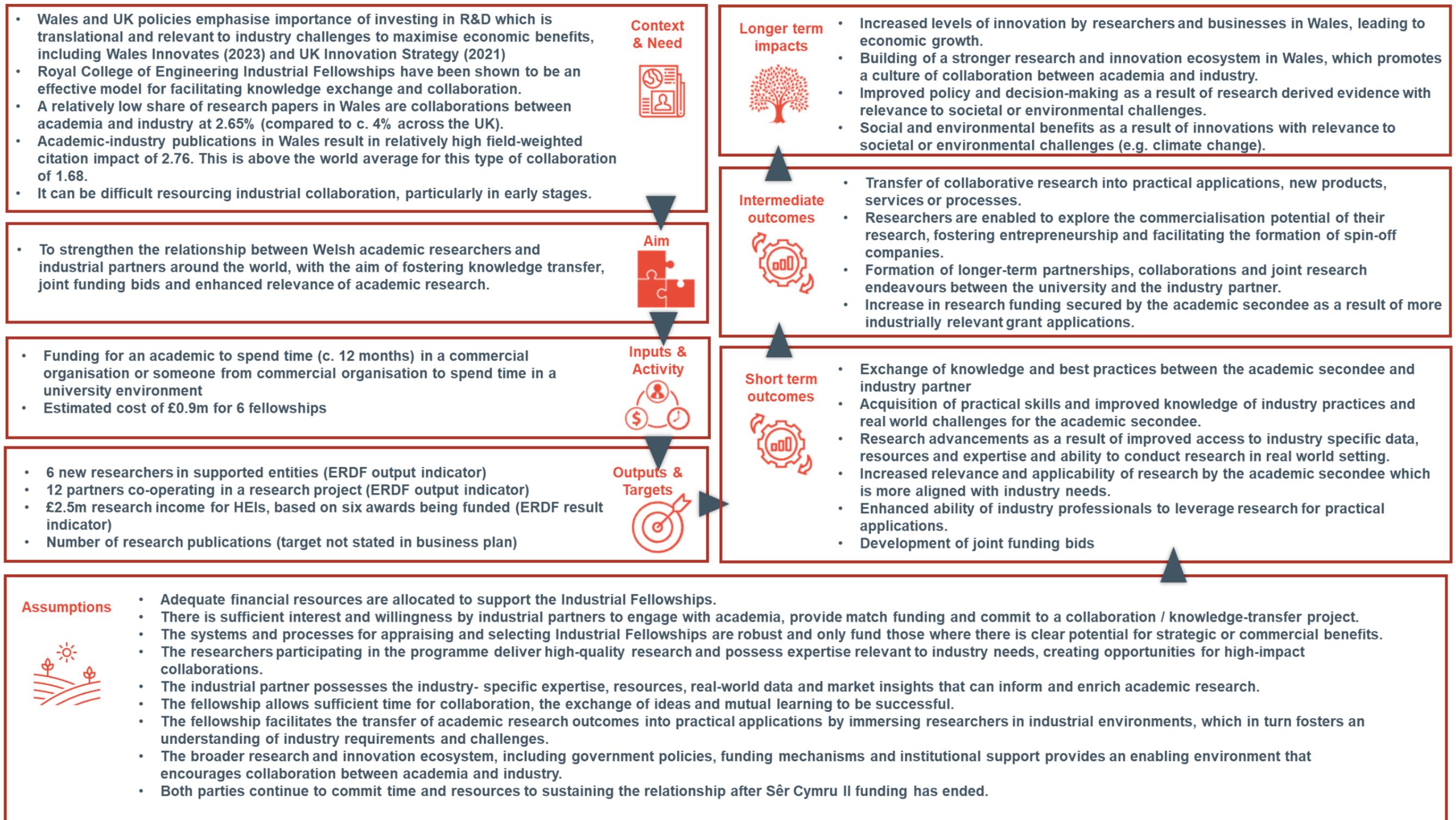


Figure 3.2: Theory of change for Strategic Partnership Accelerator Awards

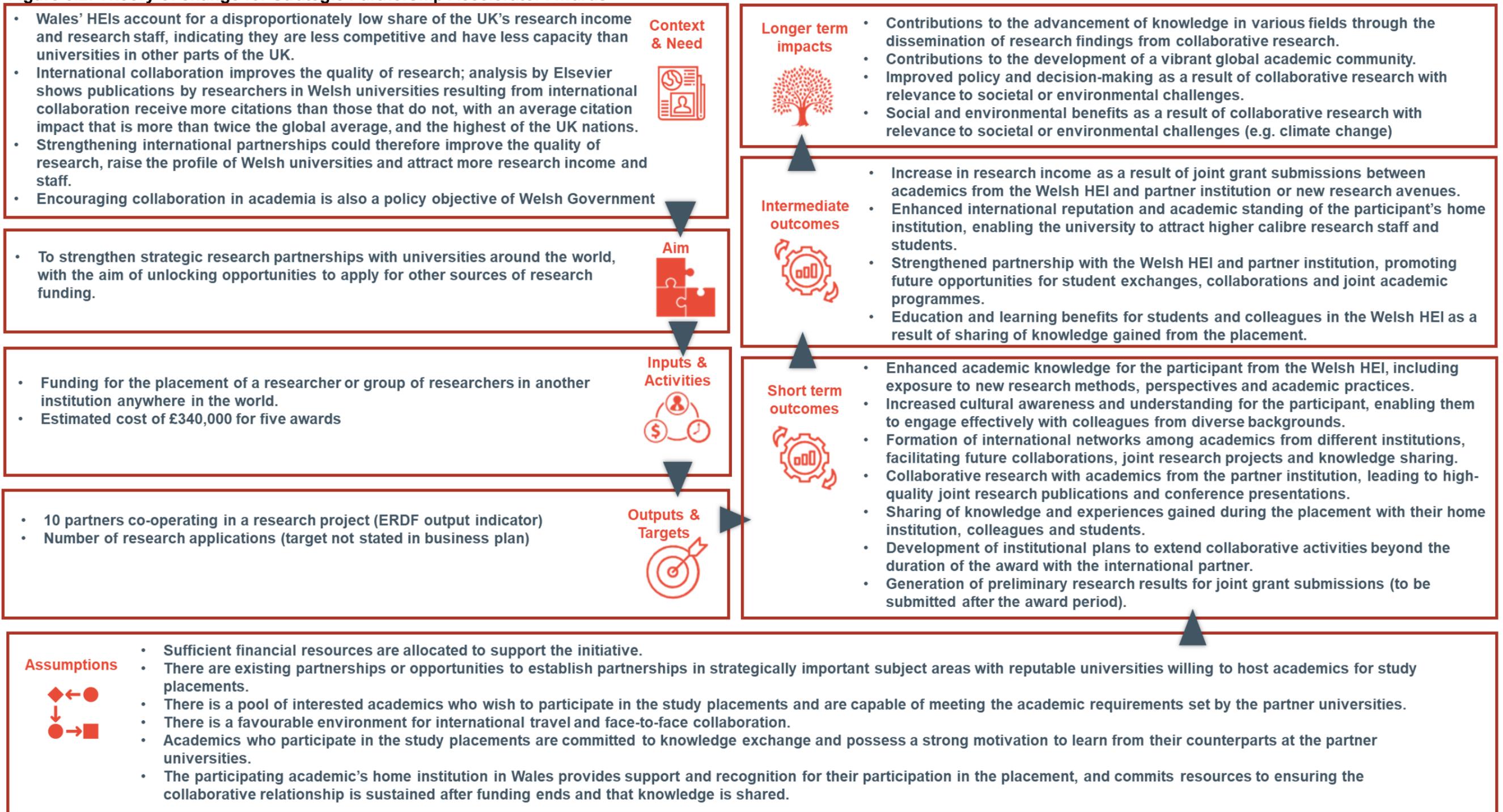


Figure 3.3: Theory of change for Infrastructure Accelerator Awards

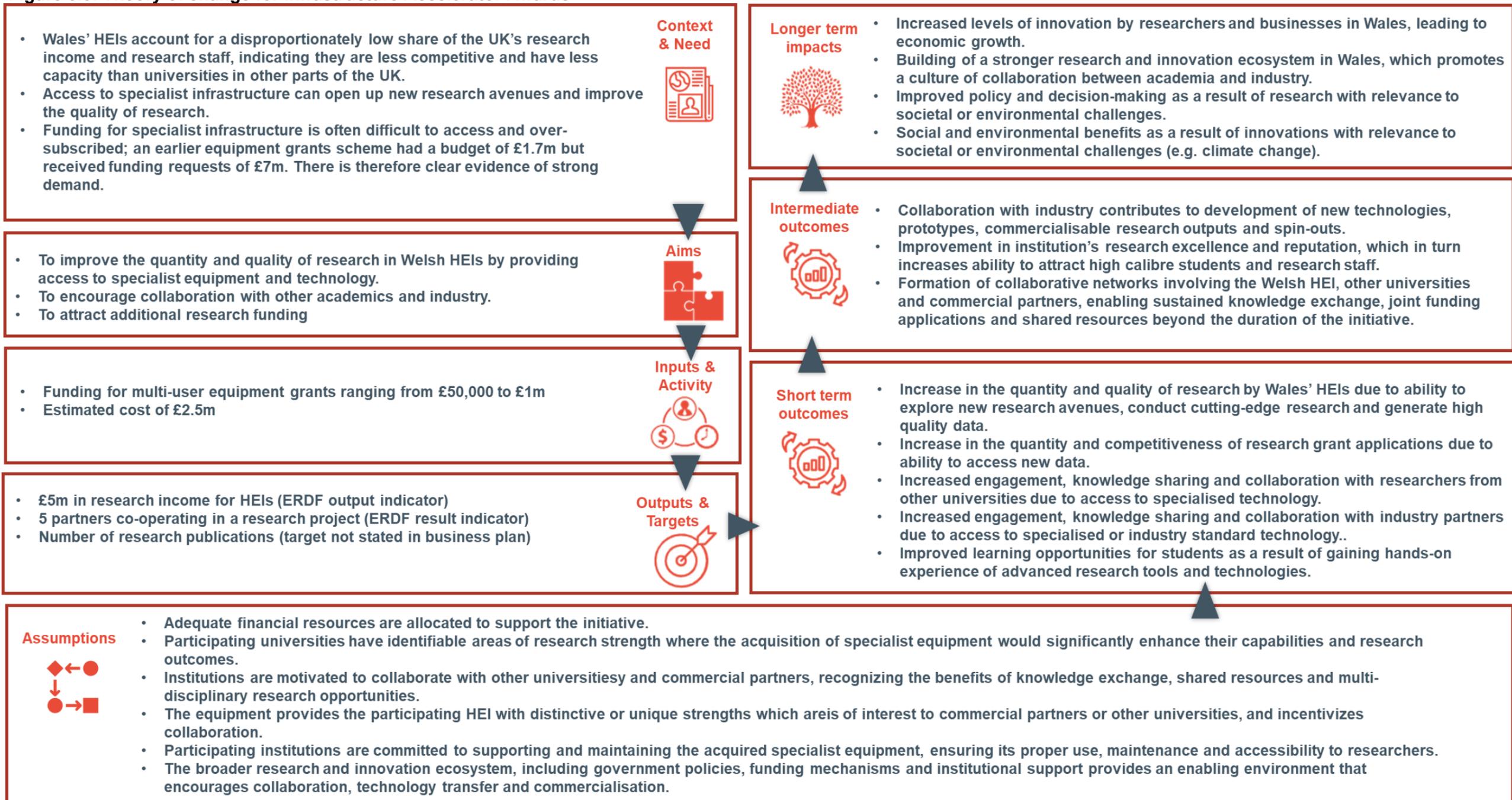


Figure 3.4: Theory of change for Capacity Building Accelerator Awards

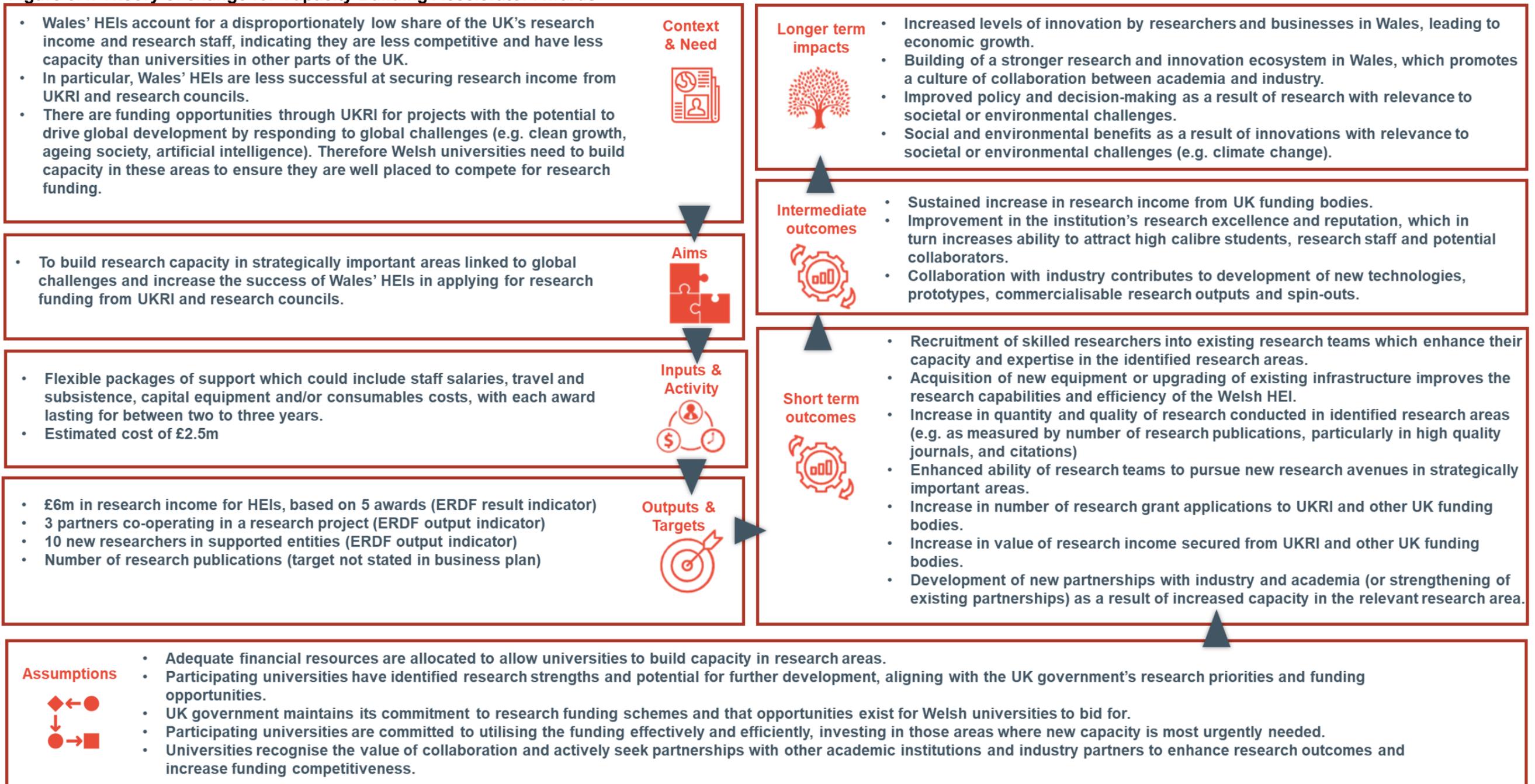
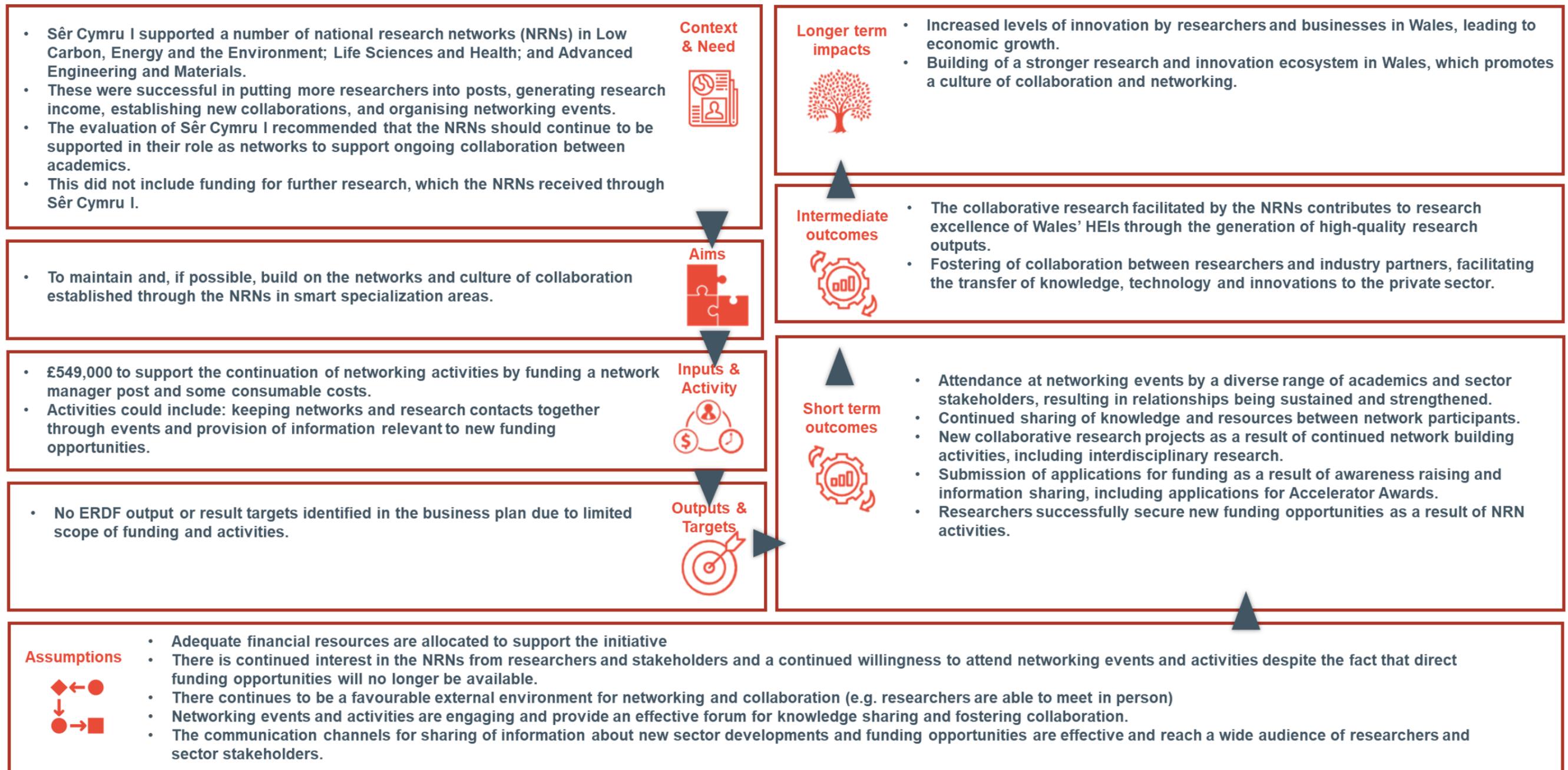


Figure 3.5: Theory of change for continuation of National Research Networks.



4. Policy Context

This chapter considers recent Welsh and UK policy developments since the interim evaluation was undertaken in 2018, and implications for the continued relevance of Sêr Cymru II.

Table 4.1 lists the policy documents reviewed in the inception evaluation. The review found that there was a very clear, detailed and supportive policy framework in place for the development of both Sêr Cymru I and Sêr Cymru II. The review also found that the objectives of Sêr Cymru II were well-aligned with Welsh Government policy although there was scope for the programme to demonstrate how it could better reflect the objectives of the Well-being of Future Generations (Wales) Act.

The review of UK Government policies found these were of less direct relevance to Wales given that they focus on policy choices that only apply in England. However, the report suggested that some of the UK Government's recent policy responses (such as the National Productivity Investment Fund) could impact upon the operation's performance and its achievement of key outcomes.

Table 4.1: Policy documents included in the inception evaluation

Welsh policy documents	UK policy documents
<ul style="list-style-type: none">• Programmes for Government, 2011-16^[footnote6] and 2016-21^[footnote7]• Science for Wales• Innovation Wales^[footnote 8]• Diamond Review of higher education in Wales and the Welsh Government's response to its recommendations^[footnote8]• Hazelkorn Review^[footnote9] and the Welsh Government's response to its recommendations via the 'Public Good and a Prosperous Wales' White Paper consultation document• Well-being of Future Generations (Wales) Act	<ul style="list-style-type: none">• Roberts Review^[footnote10]• The Concordat developed by the Research Councils UK^[footnote11]• UK Government's White Paper on Higher education and HE Bill• The UK Industrial Strategy^[footnote12]• Details of the National Productivity Investment Fund.

Footnotes

[6] Welsh Government (2011), Programme for Government, Cardiff (available on request)

[7] Welsh Government (2016): Taking Wales Forward, Welsh Government, Cardiff (available on request)

[8] Welsh Government (2016) Welsh Government response to the recommendations from the Review of Student Support and Higher Education Funding in Wales 'The Diamond Review', Cardiff (available on request)

[9] Hazelkorn, E. (2016) Towards 2030. A framework for building a world-class post-compulsory education system for Wales, Cardiff (available on request)

[10] Roberts, G. (1998): Research Careers Initiative Report. London (available on request)

[11] Research Councils UK (2008): Concordat to Support the Career Development of Researchers (available on request)

[12] HM Government (2017): Green Paper. Building our Industrial Strategy, London (available on request)

Table 4.2 lists the documents reviewed in the mid-term evaluation. This found that the Welsh policy context remained highly supportive of the Sêr Cymru II approach and its underlying objectives. Policy developments had offered a greater level of direction to the funding of research and innovation in Wales and suggest moving towards a more strategic way of operating at both a UK and Wales level.

It also found the proposed changes offered by the Reid review and the formation of the Tertiary Education and Research Commission for Wales (TERCfW) could have major implications for how future academic research will be funded and monitored in Wales.

Table 4.2: Policy documents included in mid-term evaluation

Welsh policy documents	UK policy documents
<ul style="list-style-type: none"> • Prosperity for All: Economic Action Plan • Reid review of research and innovation in Wales • Public Good and a Prosperous Wales – the next steps^[footnote13] • The Weingarten Review^[footnote14] • Securing Wales' Future 	<ul style="list-style-type: none"> • Details of the formation of UK Research and Innovation (UKRI) • Details of the Industrial Strategy Challenge Fund • The future relationship between the UK and EU

4.1. Welsh policies published since the mid-term evaluation

4.1.1. Welsh Government Programme for Government: update

The Welsh Government's [Programme for Government](#) was updated in 2021 to reflect the Co-operation Agreement reached with Plaid Cymru. This programme sets out the priorities for the period 2021 to 2026 and the actions that Welsh Government will take to realise these priorities. The priorities are as follows:

- Provide effective, high quality and sustainable healthcare.
- Protect, re-build and develop our services for vulnerable people.
- Build an economy based on the principles of fair work, sustainability and the industries and services of the future.
- Build a stronger, greener economy as we make maximum progress towards decarbonisation.
- Embed our response to the climate and nature emergency in everything we do.
- Continue our long-term programme of education reform, and ensure educational inequalities narrow and standards rise.

Footnotes

[13] Welsh Government (2018): 'Public Good and a Prosperous Wales – the next steps Consultation Document *available on request)

[14] Professor Weingarten (April 2018) Maximising the contribution of the post-compulsory education and training system to the achievement of Welsh national goals – a review of systems for monitoring and improving the effectiveness of post-compulsory education in Wales (available on request)

- Push towards a million Welsh speakers, and enable our tourism, sports and arts industries to thrive.
- Make our cities, towns and villages even better places to live and work.
- Lead Wales in a national civic conversation about our constitutional future, and give our country the strongest possible presence on the world stage.

These priorities are relevant to Sêr Cymru II in a number of ways:

- The priority relating to the programme of education reform includes specific commitments to take the Tertiary Education and Research (Wales) Bill through the Senedd, and to develop a new national innovation strategy. These both have implications for the way in which research will be funded in future, which are described in more detail below.
- Much of the research funded through the Sêr Cymru II operation is contributing to a number of these priorities by delivering research in the fields of medicine and healthcare, energy and sustainability. This is explored in more detail in later sections of the report.
- A number of the priorities reinforce the importance that Sêr Cymru II contributes to the cross cutting themes of sustainability, equal opportunities and promotion of the Welsh language through the funded projects.

4.1.2. Research and Innovation in Wales, 2019

In June 2018 the National Assembly for Wales' Economy, Infrastructure and Skills Committee agreed to undertake an inquiry into research and innovation in Wales in advance of a proposed [Post-Compulsory Education, Training and Research \(PCETR\) Bill \(eventually named the Tertiary Education and Research \(Wales\) Act \(TERWA\)\)](#). This would create a new arms-length body responsible for higher and further education, adult education and community learning, and apprenticeships and training. The new body would have responsibility for all Welsh Government research and innovation funding which would fall under the remit of a new committee called Research and Innovation Wales (RIW).

The Inquiry made a number of recommendations about the roles and responsibilities of RIW, most of which were accepted by Welsh Government. These included:

- The legislation should “empower RIW to influence sector activity and adapt to wider changes in the sector over time without further detailed legislation being required”.

- Given that the RIW will be made up of sector experts, it should be empowered to decide how to allocate public funding between basic research and applied research.
- To increase its influence over investment decisions made in London, Welsh research and innovation needs to be better woven into the fabric of UK level discussions and be more visible. This stated: “the Welsh Government should review whether the mid-level post it has created in response to Professor Reid’s report has sufficient gravitas to drive this effort”.

4.1.3. Tertiary Education and Research (Wales) Act

The [TERWA Bill](#) was introduced in to the Senedd on the 1 November 2021 and became law on 8 September 2022. The Bill establishes the Commission for Tertiary Education and Research (CTER), the new Welsh Government sponsored body described above, and dissolves HEFCW. The Welsh Government’s intention is to establish the Commission for Tertiary Education and Research in September 2023 and for it to become operational in April 2024.

The Act sets out eleven strategic duties for the CTER, one of which is promoting research and innovation. The committee with responsibility for advising the CTER on research and innovation will be known as the Research and Innovation Committee (RIC), rather than the RIW.

The Welsh Government will be required to publish a statement of priorities for tertiary education, training and research in Wales. The CTER will then produce a strategic plan, following consultation with stakeholders, which will set out how it will deliver on these priorities.

The CTER will then have responsibility for most aspects of Welsh Government research and innovation funding (although some funding streams will be outside its remit, such as health research and innovation). This is intended to strengthen the strategic approach to meeting Wales’ major economic, industrial, social, wellbeing and environmental challenges. This does not affect the rationale or delivery of Sêr Cymru II but would have significant implications for the way research funding is awarded in future.

4.1.4. Wales Innovates: Creating a Stronger, Fairer, Greener Wales, 2023

[Wales Innovates](#) is the new Innovation Strategy for Wales. It sets out how Wales can adjust to a more challenging funding environment post-Brexit by adopting a mission-based approach, prioritising research which is translational and encouraging greater collaboration between academia around shared priorities. It states: “by acting like this, our innovation ecosystem can develop larger and more compelling RD&I propositions to leverage greater support from the responsible UK-wide agencies”.

The strategy identifies four ‘missions’ relating to Education, the Economy, Health and Wellbeing and Climate and Nature. The Education mission is described as follows:

“An education system that supports the development of innovation skills and knowledge throughout people’s lives in Wales.... Schools, colleges, universities and research organisations create knowledge through research. This research can lead to commercialisation, create societal value, and support a stronger economy”.

The strategy notes the loss of EU Structural Funds to support research activities will mean Welsh universities and research institutions will need to transition to alternative funding sources including UK Government, UKRI, charities and businesses. This “will require a strategic approach which focuses on areas of strength which are internationally competitive and aligned to our priorities set out in this strategy, and our Programme for Government”. It specifically mentions the next phase of the Sêr Cymru programme, stating that £10m will be allocated over the period to 2025 on a competitive basis^[footnote15], with the goal of fostering skills and expertise amongst researchers in Wales and encouraging the retention and arrival of high-calibre scientists.

This suggests the policy environment continues to be highly supportive of Sêr Cymru, but that future allocation of funding will need to be more selective, more closely aligned with Welsh Government policy priorities and building on Wales’ key research strengths (see recommendations in Chapter 11).

It should also be noted that a large proportion of the research funded through Sêr Cymru II is relevant to two of the missions, particularly Health and Wellbeing and Climate and Nature, as described in later chapters.

Footnotes

[15] This marks a significant reduction from Sêr Cymru II which had a total project cost of £51m.

4.1.5. Our Economic Resilience and Reconstruction Mission, 2021

The Programme for Government also includes a specific commitment to progress the Welsh Government's [Economic Resilience and Reconstruction Mission](#) (ERRM) for Wales. This builds upon previous strategies and legislation including Prosperity for All: The Economic Action Plan and the Wellbeing of Future Generations Act to set out how the Welsh economy can recover and rebuild following the Covid pandemic.

This sets out a vision of a “well-being economy which drives prosperity, is environmentally sound, and helps everyone realise their potential”. This is underpinned by three desired outcomes: a prosperous economy, a green economy and an equal economy.

Sêr Cymru II helps to deliver on these desired outcomes by funding research which could lead to economic and environmental benefits in the longer term.

4.2. UK policies published since the mid-term evaluation

4.2.1. EU-UK Trade and Co-operation Agreement

The EU-UK Trade and Cooperation Agreement (TCA), which entered into force on 1 May 2021 enabled UK entities to participate in all pillars of Horizon Europe on equivalent terms as those from member states with the exception of the EIC equity fund.

Protocol I, of the TCA detailed the specific terms of the UK association to Horizon Europe and following an agreement in September 2023 and approved in December by the Specialised Committee on Participation in Union Programmes, the UK Government and European Commission formally confirmed the UK's association to Horizon Europe as of 1 January 2024.

However, at the time of the consultations (February – July 2023), these agreements had not been made and consultees described how created significant uncertainty for Welsh universities and deterred many UK researchers from applying for funding through Horizon Europe. It was also reported that some European partners were reluctant to involve UK HEIs in funding bids owing to this uncertainty.

4.2.2. UK Innovation Strategy: leading the future by creating it, 2021

This [strategy](#) sets out the UK government's ambitions for an innovation-led economy, including a commitment to increase annual public investment in RD&I to a record £22 billion.

Pillar 3 of the strategy relates to institutions and places and aims to “ensure our research, development & innovation institutions serve the needs of businesses and places across the

UK”. This includes specific objectives to ensure that research and innovation investment and activity is more evenly spread across the country. It also focused on maximising benefit for local areas through innovation clusters, which will help to meet the government’s objective to level up the UK economy. The strategy states that the UK Government will take “a place-based approach by tailoring support to the research, development and innovation strengths of different places and developing policies in partnership with local government, businesses and research, development and innovation institutions”. It sets out a number of measures it will take to achieve this, including:

- reviewing how major RD&I funding bodies’ core organisational objectives need to change to help deliver on levelling up ambitions.
- reviewing how best to increase local engagement, and the regional presence, of major RD&I funding bodies, and the influence that local, regional and national stakeholders have on UK-wide decision-making.
- making levelling up a factor in investment decisions for new research and innovation infrastructure and facilities.

The other pillars of the strategy stress the importance that RD&I activity funded by the UK government is:

- commercially focused, by maximising knowledge transfer between universities and business, attracting investment to UK universities and being more effective at bringing ideas to market.
- mission-oriented. Investment should aim to stimulate innovation which tackles the major challenges facing the UK and the world, including climate change, an ageing population and cyber-security.

4.2.3. Levelling Up White Paper

The [Levelling Up White Paper](#) sets out how the UK government will spread opportunity more equally across the UK. This includes a target that “by 2030, domestic public investment in RD&I outside the Greater South East will increase by at least 40%, and over the Spending Review period by at least one third. This additional government funding will seek to leverage at least twice as much private sector investment over the long term to stimulate innovation and productivity growth”. The strategy states that RD&I investments will build on centres of expertise that exist around the country and will support their growth

by fostering greater collaboration between national funders, local leadership, the private sector and high quality research institutions”.

It states that a number of Government departments will be given specific spatial RD&I targets, which will ensure more funding occurs outside the South East of England. This includes the Department for Business, Energy & Industrial Strategy^{[footnote [footnote16]]} (BEIS), the Department for Health and Social Care (DHSC), Department for Transport (DfT) and the Department for the Environment, Food and Rural Affairs (DEFRA).

4.2.4. Independent Review of the UK’s Research, Development and Innovation Organisational Landscape

This [review](#) assesses the UK’s RD&I landscape, identifies strengths and weaknesses and makes recommendations for how it can be improved, with a particular focus on publicly funded RD&I.

The review identifies “longstanding and serious” problems with RD&I, which in turn will require “increased investment, reduced policy volatility, a clear focus on optimising and implementing change, good data collection, and a long-lasting, consistent, systematic approach to policy development and safeguarding of the RDI landscape”.

In relation to universities, the review raises concerns about the financial sustainability of public research funding, arguing that current funding arrangements do not provide adequate ‘end-to-end’ research support. Proper ‘end-to-end’ support should include direct research costs, administrative services, technical facilities and laboratory facilities. Current funding arrangements do not support all these components. It makes two recommendations:

- Government should take account of the true cost of ‘end-to-end’ research activity. It should also review and if necessary reform competitive grant funding, quality-related research funding (and devolved administration equivalents) and full economic costing. The “overall objectives should be to optimise research delivery, remove perverse incentives and outcomes, and ensure the longer term sustainability of the research system”.
- Universities should develop plans to optimize their operations in support of research, to empower researchers and reduce their administrative loads

Footnotes

[16] Since the publication of the White Paper, BEIS has been split to form the Department for Business and Trade (DBT), the Department for Energy Security and Net Zero (DESNZ) and the Department for Science, Innovation and Technology (DSIT).

and to improve the quality of support services, core technical facilities and laboratory buildings.

4.3. Implications for the Sêr Cymru programme

There continues to be a highly supportive policy environment for Sêr Cymru II. Recent policies and strategies continue to emphasise the importance of growing the research base in Wales, particularly where this can lead to commercialisation and economic growth.

The main points to note from recent policy developments relate to the future availability of research funding in Wales and how this is allocated in future, and what this means for future rounds of Sêr Cymru. The UK's exit from the EU has created a more challenging funding environment for Wales' HEIs. As we show in the following chapter, EU funding has been one of the major sources of research income for Wales' HEIs and one of only two where Wales has secured more than 5% of the UK's funding. Any reductions in the amount of EU funding also means that future phases of Sêr Cymru may need to be met from Welsh Government budgets, which will limit the scale of funding available.

The Welsh Government's response is to be more strategic and selective in its investments in research funding than it has been in the past. The policy review suggests that, from now on, funding decisions will be far more guided by whether research:

- Helps to meet Wales' key priorities, such as climate change and healthcare.
- Builds on existing research strengths and capabilities.
- Is collaborative, involving both the private sector or other disciplines.
- Has the potential for commercial benefits.

Some of the criteria above were taken into account in the application and selection process for Sêr Cymru II. For instance, the application forms asked applicants to describe how their research project was aligned with Welsh Government's strategic priorities and how their research complements other activity taking place in Wales. However, a large number of consultees (including members of the Evaluation Panel) reported that the main criteria used to select fellowships was scientific excellence, which resulted in a wide range of research being funded. It was noted, however, that the SCII+ awards were more strategic, focusing on areas where Wales' HEIs could compete for funding from UKRI and research councils and forge stronger links with industry.

The loss of EU funding will also mean that Wales' HEIs will need to secure a greater share of other UK funding streams in order to maintain or increase current levels of research income, an area where they have historically underperformed (see the next chapter).

It is positive, however, that current UK Government policy is committed to ensuring that RD&I funding is more equally spread across the UK than it has been in the past, with specific targets for increasing the amount of research funding outside the South East of England by 40%. It is therefore vitally important that the Welsh Government advocates on behalf of Welsh science and raises its profile in order to ensure that Wales benefits from this commitment. This is consistent with the findings of the inquiry into research and innovation in Wales which identified a need for a more forceful voice in Westminster to ensure Welsh research and innovation is more visible and better woven into the fabric of UK level discussions. As the Welsh Government's flagship investment in research and innovation, a key part of this should be celebrating the achievements of Sêr Cymru II and raising the profile of its 'stars'.

5. Research capacity and income in Wales

This chapter presents an updated position on the levels of research capacity in Wales' HEIs up to the 2021/22 academic year, the latest year for which data is available. It builds upon the baseline position set out within the previous mid-term evaluation report which offered a detailed overview of Wales' performance up to 2015/16. It considers HESA data supplied on request from HEFCW as well as published data.

Research capacity includes the human resources (i.e. research staff) and financial resources (i.e. research income) required to undertake research activities. The outputs of these research activities are then measured in terms of numbers of publications and citations, as well as collaborations with third parties.

The analysis benchmarks Wales' position and performance against the UK (especially with reference to the 5 per cent share target) as well as internationally, where the data allows.

The 5% share target is based on Wales as a proportion of UK population as features in publications that examine the research capacity in Wales, as well as the business plans for Sêr Cymru II.

5.1. Research income

The following sections analyse recent trends in research income in Wales and the main sources of this income. This uses HESA data which defines research income as “all income in respect of externally sponsored research carried out by the HE provider or its subsidiary undertaking for which directly related expenditure has been incurred”.

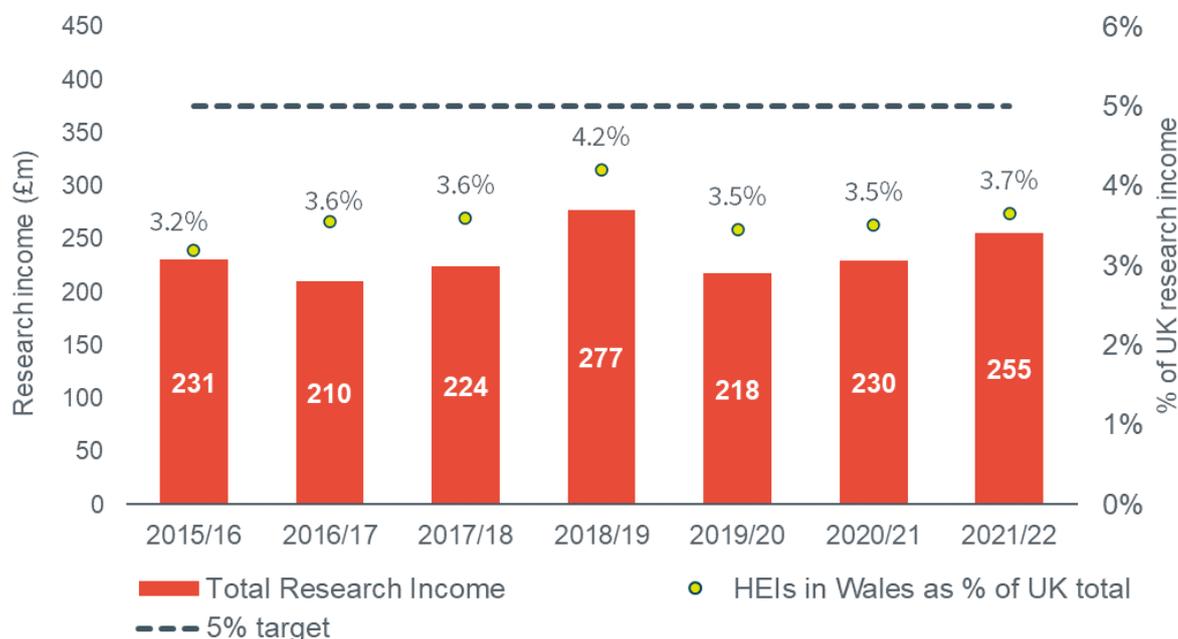
5.1.1. Research income trends

HESA data for 2021/22 shows that HEIs in Wales secured £255 million in research income - in all disciplines - out of the total £6,981 million secured by all HEIs across the UK. This represents a 3.7% share of UK research income, which falls below the target of 5% based on Wales' population share. Nevertheless, Figure 5.1 shows there has been some narrowing of the gap since the start of Sêr Cymru II in 2015/16, increasing from 3.2% to 3.7%, although this has fluctuated over time.

This implies that, in order to meet its target of 5% of the UK total, Wales' institutions would need to secure an additional £94 million of research funding per annum (if the total value of UK remained the same). If Wales was to secure research income which is entirely additional to the UK, it would require £99 million to achieve a 5% UK share.

Whilst Sêr Cymru was expected to contribute towards filling this gap, it is important to note that the programme was never expected to fully address it.

Figure 5.1: Nominal value of research income of HEIs in Wales (£m), 2015/16 to 2021/22



Source: [Table 5 - Research grants and contracts - breakdown by source of income and HESA cost centre 2015/16 to 2022/23 | HESA](#)

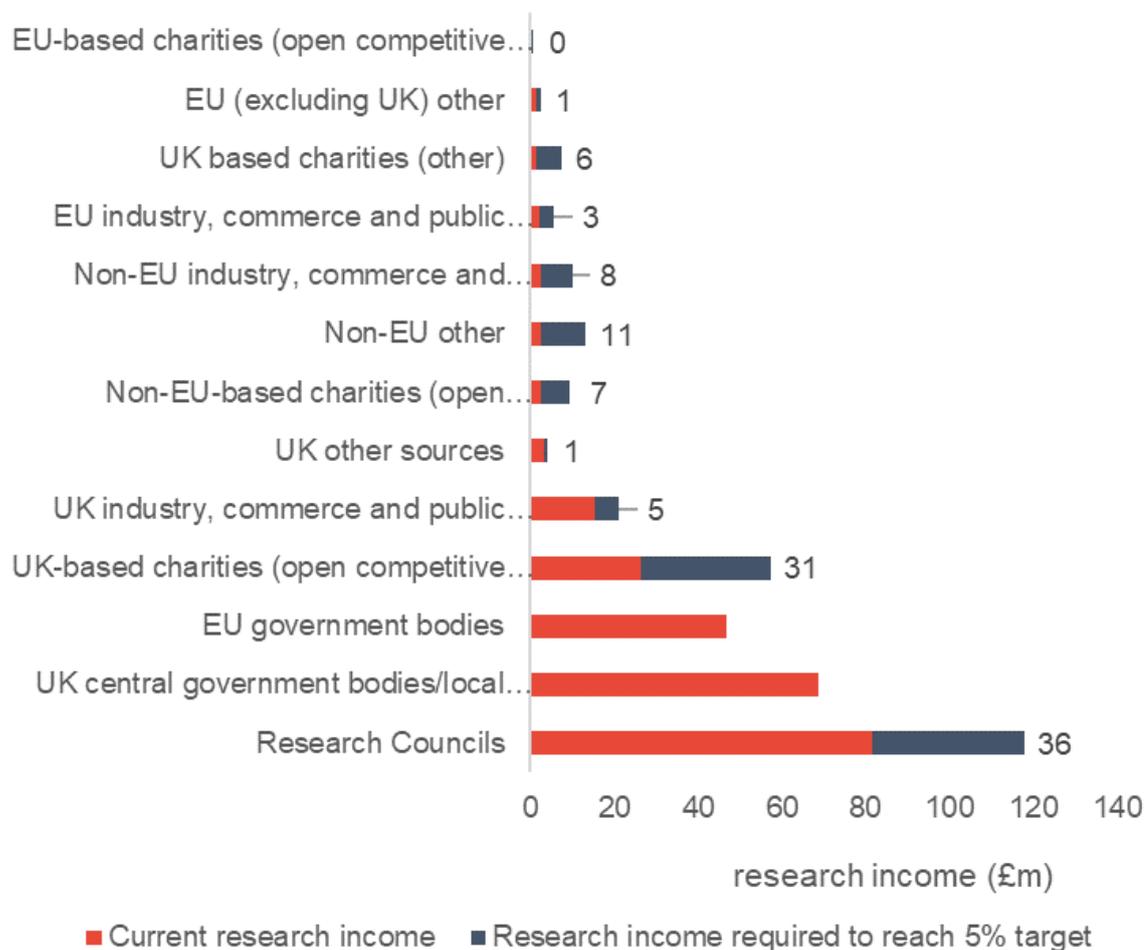
5.1.2. Research income by source

The largest source of research income for Welsh HEIs are Research Councils and UKRI. These provided £81.7m of research income in 2021/22, equivalent to 32% of all research income. The second largest sources were EU and UK central government.

Figure 5.2 presents analysis of how much additional research income would be required to achieve a 5% share from each of the current income sources. It demonstrates that Wales falls short on all but two income sources in securing its 5% share of national research income:

- The areas in which Wales outperforms its target 5% share are EU government bodies (7%) and UK central government income sources (5%), both of which are likely to come under increased pressure in future years.
- In absolute terms, the largest gap in research funding is from research councils and UK-based charities, with an additional £36 million and £31 million required from each source respectively to bring Wales up to the 5% national share.

Figure 5.2: Additional research income required by source to achieve 5% UK share



Source: [Table 5 - Research grants and contracts - breakdown by source of income and HESA cost centre 2015/16 to 2022/23 | HESA](#)

The total amount of research income secured by Welsh HEIs as a percentage of the UK is shown in tabular form in Table 5.1 Figure 5.2

Table 5.1 Research income by source, 2021/22

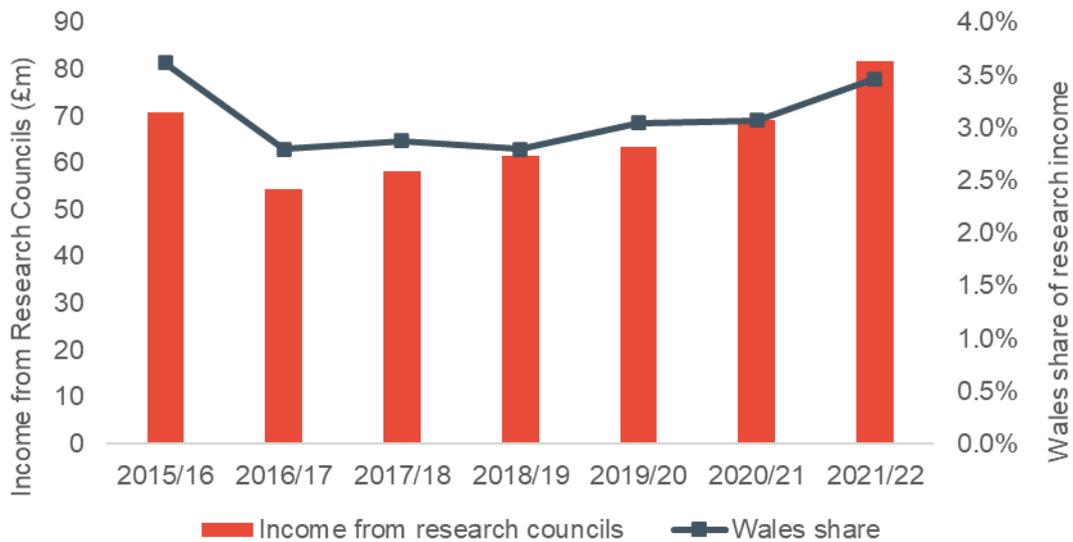
Research Income Source	Research Income of HEIs in Wales (£m)	Research Income of HEIs in the UK (£m)	Wales as a share of UK Research Income (%)
Research Councils and UKRI	81,655	2,357,085	3.5%
UK central government bodies/local authorities, health and hospital authorities	68,771	1,312,816	5.2%
EU government bodies	46,937	676,526	6.9%
UK-based charities (open competitive process)	26,499	1,146,585	2.3%
UK industry, commerce and public corporations	15,563	417,932	3.7%
UK other sources	3,302	78,631	4.2%
Non-EU-based charities (open competitive process)	2,622	185,144	1.4%
Non-EU other	2,553	262,299	1.0%
Non-EU industry, commerce and public corporations	2,420	204,444	1.2%
EU industry, commerce and public corporations	2,303	114,397	2.0%
UK based charities (other)	1,445	149,702	1.0%
EU (excluding UK) other	1,400	49,977	2.8%
EU-based charities (open competitive process)	70	10,863	0.6%
Total	255,540	6,968,035	3.7%

Source: HESA [Table 5 - Research grants and contracts - breakdown by source of income and HESA cost centre 2015/16 to 2022/23](#) | HESA

Figure 5.3 shows income from Research Councils and UKRI has been growing year-on-year since 2016/17 (in nominal and real terms). There was a particularly large increase in the most recent year (up by £12.6m, representing an increase of over 18% compared to 2020/21). Wales' share of research income from Research Councils is slightly lower than in 2015/16 (3.5% compared to 3.6% in the baseline year), although it should be noted that 2015/16 was a particularly strong year. Compared to 2016/17, the share has increased from 2.8% to 3.5%.

The largest growth has been from the Engineering and Physical Sciences Research Council (EPSRC). This increased by over £11m since 2016/17 (+73%) and by £6m between 2020/21 and 2021/22 (+55%).

Figure 5.3: Nominal value of research income from research councils and UKRI in Wales, 2015/16 to 2021/22



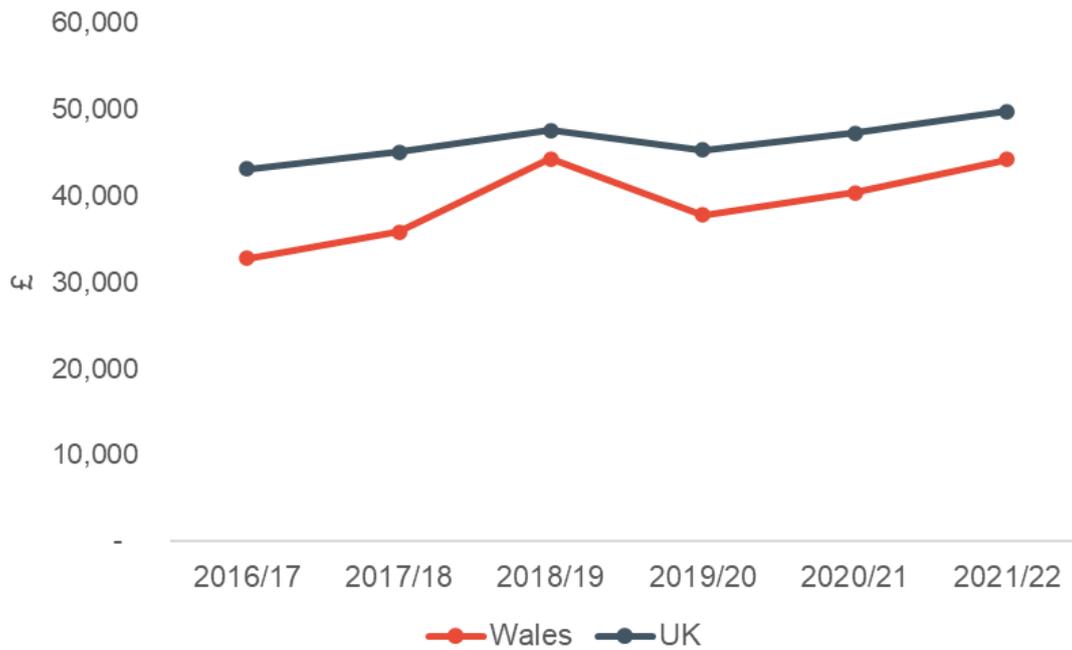
Source: [Table 5 - Research grants and contracts - breakdown by source of income and HESA cost centre 2015/16 to 2022/23 | HESA](#)

5.1.3. Income per researcher

The research income secured by Wales’ HEIs was equivalent to £44,200 per researcher in 2021/22. This is 11% lower than the average for the UK (£49,800). However the gap has narrowed since 2016/17 when it was 24% lower.

The gap in income per researcher means that, even if Wales’ HEIs accounted for 5% of the UK’s research staff there would still be a gap in terms of research income. It should be noted that the amount of research income per researcher will also be determined by the profile of researchers in Wales, in terms of their seniority and levels of experience, and how this compares to institutions in other parts of the UK.

Figure 5.4: Income per researcher, 2016/17 to 2021/22



Source: [Table 5 - Research grants and contracts - breakdown by source of income and HESA cost centre 2015/16 to 2022/23 | HESA](#) and [Chart 6 - Academic staff by academic cost centre and sex 2014/15 to 2021/22 | HESA](#)

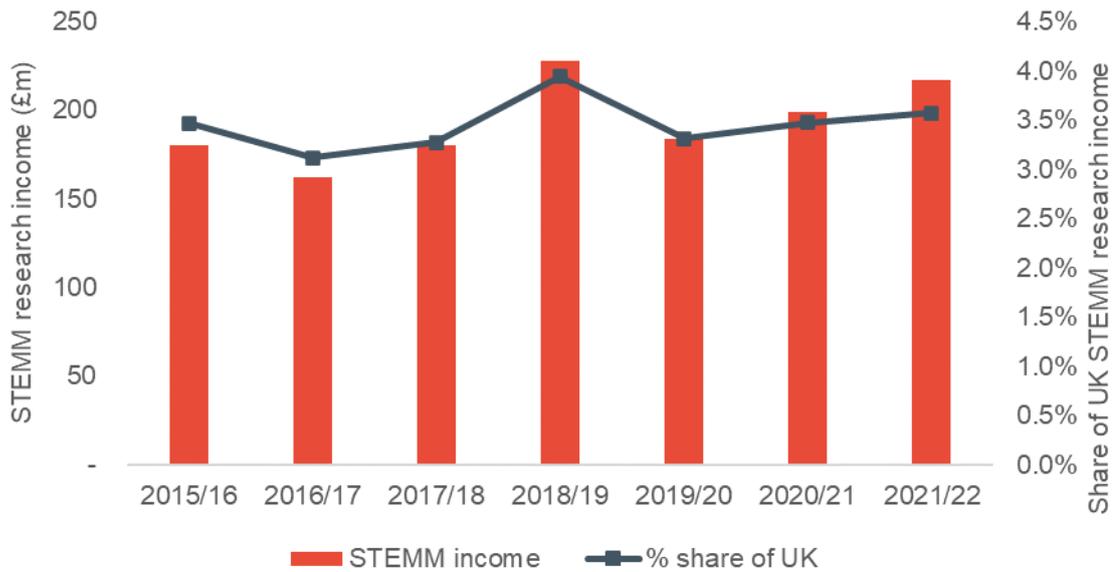
5.1.4. STEM research income and trends

STEMM-related research income is the main focus of Sêr Cymru II. HESA data show that in 2021/22, Welsh HEIs secured £217m in research income in STEMM related subjects. 85% of all research income in Wales is therefore STEMM related, which is just below the UK average (87%).

Welsh HEIs attracted 3.6% of the UK's STEMM related research income in 2021/22. This was the second highest level in the seven years since Sêr Cymru II launched (beaten only by 2018/19). Again, there is some evidence of an upward trend since 2016/17.

Based on the performance in 2021/22, Welsh HEIs would need to attract an additional £87m of STEMM specific research income per annum to meet its target 5% share, assuming the UK total remained unchanged.

Figure 5.5: STEMM related research income in Welsh HEIs, 2015/16 to 2021/22

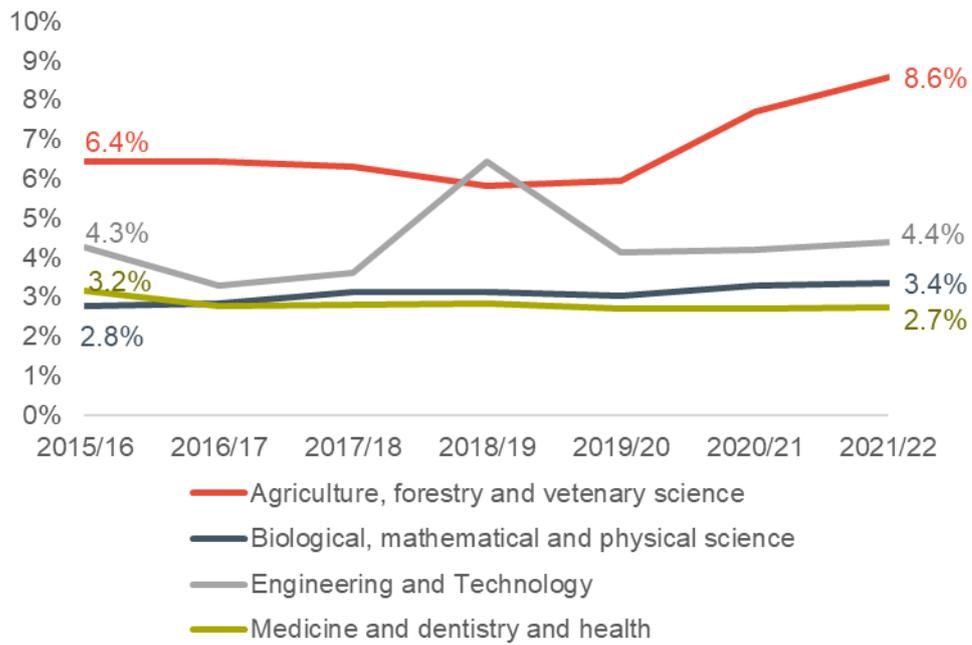


Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

Research income by STEMM subject area

In terms of broad subject areas, Medicine, Dentistry and Health accounts for the largest share of STEMM research income in Wales (36%), followed by Engineering and Technology (27%), Biological, Mathematical and Physical Science (25%) and Agriculture, Forestry and Veterinary Science (13%). However, the latter subject area is the only one in which Welsh HEIs account for more than 5% of research income in the UK. The share of UK income has also increased significantly in the last few years, from 6% in 2019/20 to 8.6% in 2021/22. The only other subject area where there is clear evidence of growth in the share of UK income since the start of Sêr Cymru II is Biological, Mathematical and Physical Science, up from 2.8% in 2015/16 to 3.4% in 2021/22. The share of income in the Engineering and Technology sector has fluctuated, but is still at a broadly similar level to 2015/16.

Figure 5.6 Research income in Wales as a share of UK in STEMM subject areas



Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

5.1.5. Composition and trends by institution

Figure 5.7 shows the distribution of research income by institution in Wales in 2021/22. Cardiff University and Swansea University account for the vast majority of research income in Wales, followed by Bangor University and Aberystwyth University.

Figure 5.7: Research income by institution, 2021/22



Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

Table 5.2 shows that Swansea University has increased its research income by £26m since 2015/16, which is significantly more than any other institution in Wales. The other strong performers were Bangor University, which increased its income by £13m (75%) and University of South Wales (£4m or 98%). Aberystwyth University was the only institution to experience a fall in its research income since 2015/16.

Table 5.2: Change in research income by institution, 2015/16 to 2021/22

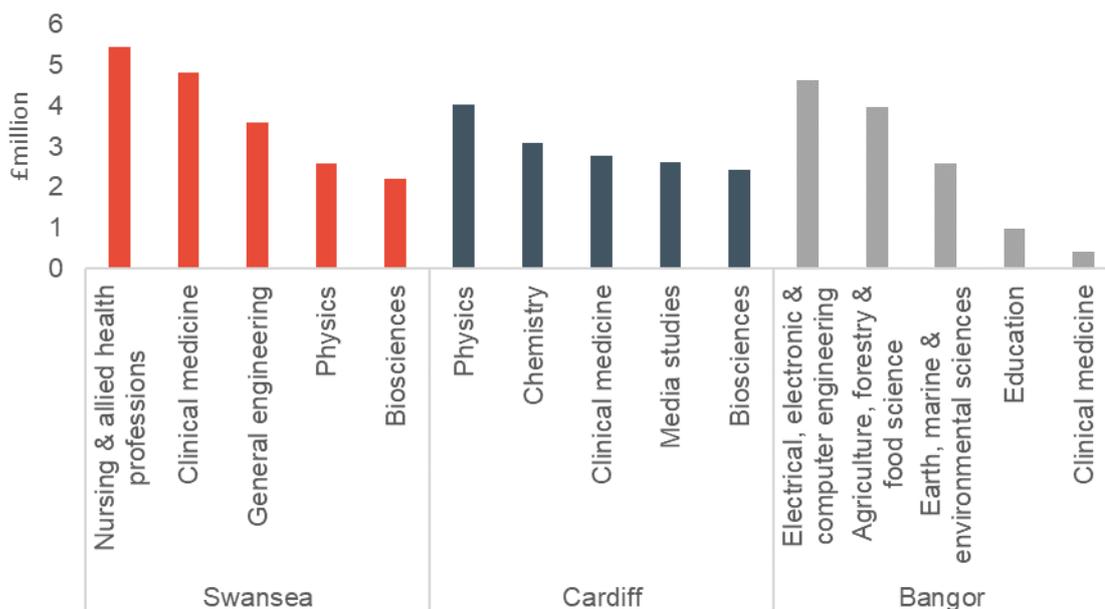
Region	Institution	2015/16	2021/22	Absolute change (£m)	% change
West Wales and the Valleys	Swansea University	43	69	26	60%
	Bangor University	17	30	13	75%
	University of South Wales	4	8	4	98%
	UWTSD	0	0	0	16%
	Aberystwyth University	22	17	-4	-20%
East Wales	Cardiff University	114	125	12	10%
	Cardiff Metropolitan University	3	4	1	35%
	Glyndŵr University	1	2	1	55%

Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

Figure 5.8 shows the specific subject areas (HESA cost centres) that have driven the growth in research income at the three universities with the largest absolute income growth

since 2015/16. It shows a number of the subject areas relevant to Sêr Cymru II Chairs have been among the fastest growing in terms of research income, which may indicate Sêr Cymru II has helped to accelerate growth. However, it should be noted that the absolute change in research income in the relevant areas still look relatively low when compared to the research income that Research Chairs have secured (explored in more detail in Chapter 6).

Figure 5.8: Subject areas with largest increase in research income at Swansea, Cardiff and Bangor Universities, 2015/16 to 2021/22



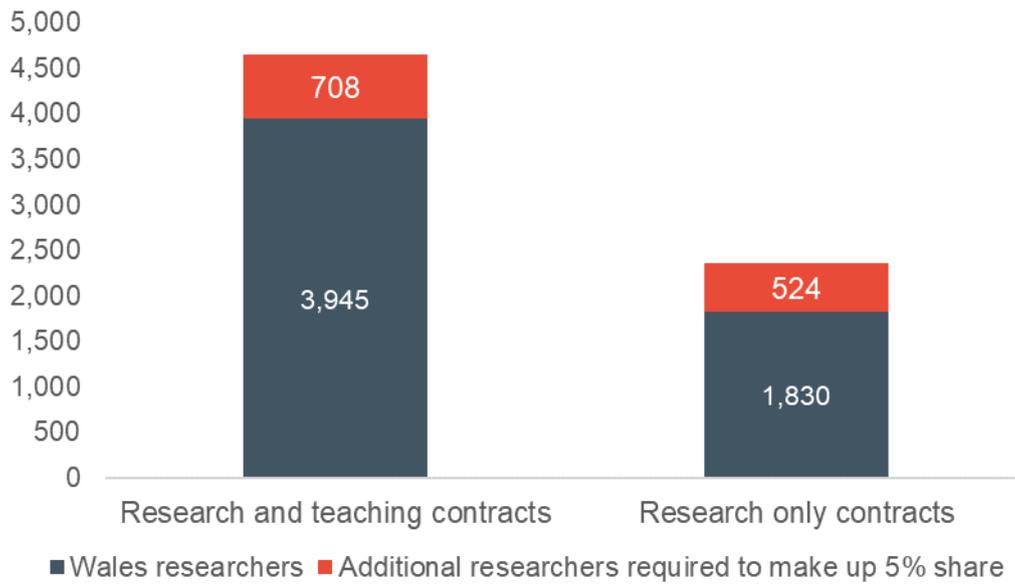
Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

5.2. Research Staff

In 2021/22 there were 1,830 full time equivalent (FTE) staff on research only contracts in Wales' HEIs and 3,945 staff on research and teaching contracts (see

Figure 5.9). Together this accounts for 4 per cent of the UK's research staff (138,880 FTEs). An additional 1,232 FTE researchers would be required (across all disciplines) for Wales to achieve a 5 per cent share of the UK research base.

Figure 5.9: Research staff in Wales (FTEs), 2021/22



Source: [Chart 6 - Academic staff by academic cost centre and sex 2014/15 to 2021/22 | HESA](#)

There are 3,335 STEMM research FTEs in Wales (including research only and research and teaching staff), also representing a 4 percent share of the UK.

Figure 5.10 shows that the number of research staff in Wales' HEIs increased by around 400 FTEs between 2015/16 and 2018/19. This represents a 13% increase compared to only 3% in the UK as a whole. As a result, the number of additional FTE researchers required to achieve a 5% share of the UK research base shrank from over 1,000 to just over 800. However, since then, the number of researchers has fallen by 3% in Wales but has risen by 0.4% in the UK. As a result, the number of additional staff required to close the gap has risen back to over 900.

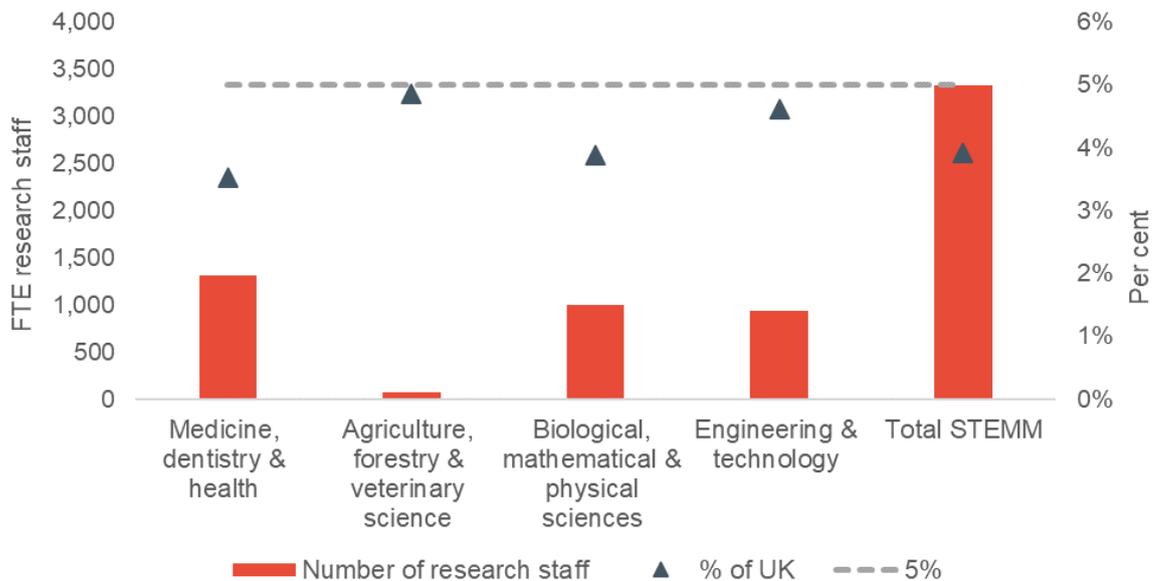
Figure 5.10: STEMM research staff in Wales (FTEs), 2015/16 to 2021/22



Source: [Chart 6 - Academic staff by academic cost centre and sex 2014/15 to 2021/22 | HESA](#)

The subject area with the largest number of FTE research staff was medicine, dentistry and health (1,315), followed by biological, mathematical and physical sciences (1,005) and engineering and technology (940). However the fastest growing subject area since 2015/16 was engineering and technology, which increased its headcount by 165 (21%), while the other subject areas experienced little change^[footnote17].

Figure 5.11: Research staff by subject area (FTEs), 2021/22



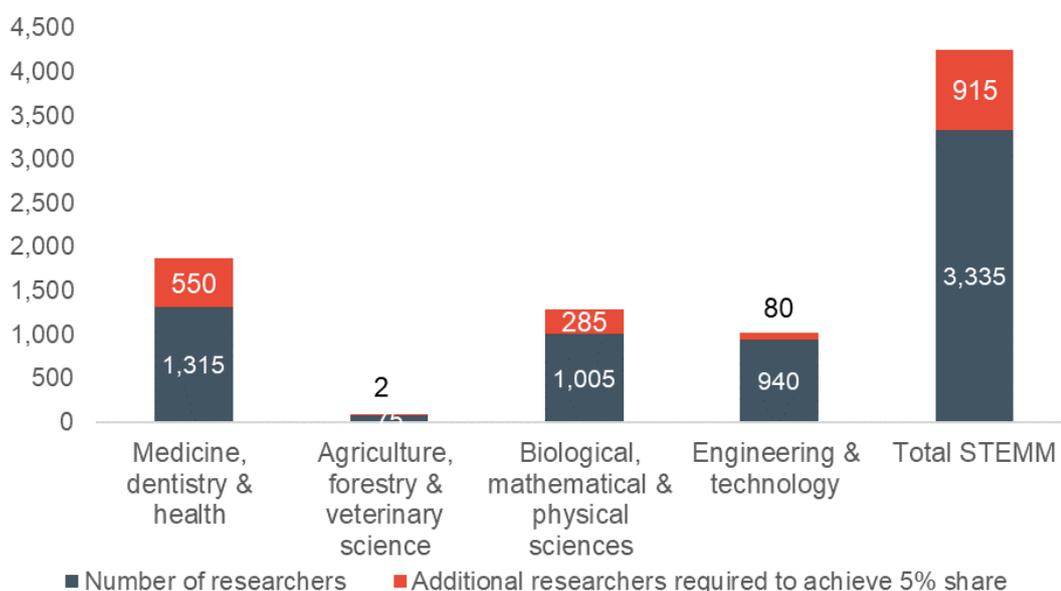
Footnotes

[17] The data accessed by the evaluators does not break this down by individual institution.

Source: [Chart 6 - Academic staff by academic cost centre and sex 2014/15 to 2021/22 | HESA](#)

Figure 5.12 shows Wales' HEIs would need to recruit an additional 550 FTE research staff in medicine, dentistry and health in order to achieve a 5% share of the UK. This is the largest gap in absolute and percentage terms. In contrast, only 80 additional FTEs would be required to close the gap in engineering and technology.

Figure 5.12: Additional research staff by subject area required to meet 5 per cent of the UK (FTEs), 2021/22



Source; [Chart 6 - Academic staff by academic cost centre and sex 2014/15 to 2021/22 | HESA](#)

5.3. Research outputs and quality

It is also useful to consider measures of research output, or the outcomes that result from the research inputs and activities. The sources of published information on research outputs are limited, in a large part due to the source data being held in commercial databases. However, there are a number of publications which can be drawn on, which consider how Wales performs.

5.3.1. Publications and citations

A report by Elsevier, prepared for the Chief Scientific Adviser (CSA) for Wales, provides useful information on publications and citations relevant to Sêr Cymru II. This analyses the performance of the Welsh research base over the period 2010 to 2018. The report

concludes “Wales’ research is highly productive, collaborative, and deeply embedded in the UK research system. Its researchers are the most efficient^[footnote18] and mobile^[footnote19] of all UK nations’ researchers”. The key findings were as follows:

- Between 2010 and 2018 Wales’ research output grew by 3.0% annually, comprising 59,391 publications in total. This represents 4% of all UK publications over that period. The annual growth rate was the second lowest of the UK nations, behind England and Scotland (with annual growth of 3.5% and 3.3% respectively) but ahead of Northern Ireland (2.9% p.a.). This was attributed to slower growth in the total number of researchers in Wales.
- Despite a smaller researcher base, Wales achieved the second highest publication output per researcher of all of the global comparators included in the analysis.
- Wales achieved a Field Weighted Citation Index^[footnote20] (FWCI) of 1.8 in 2018, an increase of 0.3 points since 2010. This was the highest FWCI growth of all the UK nations. Welsh research outputs received 80% more citations than the global average, which was the second highest of UK nations.
- Wales has a high share of the most highly cited publications across all subject areas and above the global average and UK average. Natural Science and Medical and Health Science are the most prolific subject areas, accounting for 54% and 39% of all research output. Publications from these subject areas were also most impactful: Medical and Health Science publications showed an average FWCI of 2.0, accumulating twice the average citations as the global average.

5.3.2. Research impact

The [Research Excellence Framework \(REF\) 2021](#) assesses the quality of submitted research outputs across UK universities. The result show that 81% of submissions by

Footnotes

[18] As measured by the number of publication outputs per researcher

[19] Almost 60% of the researcher base is transitory making the Welsh researcher base the most mobile among all UK nations

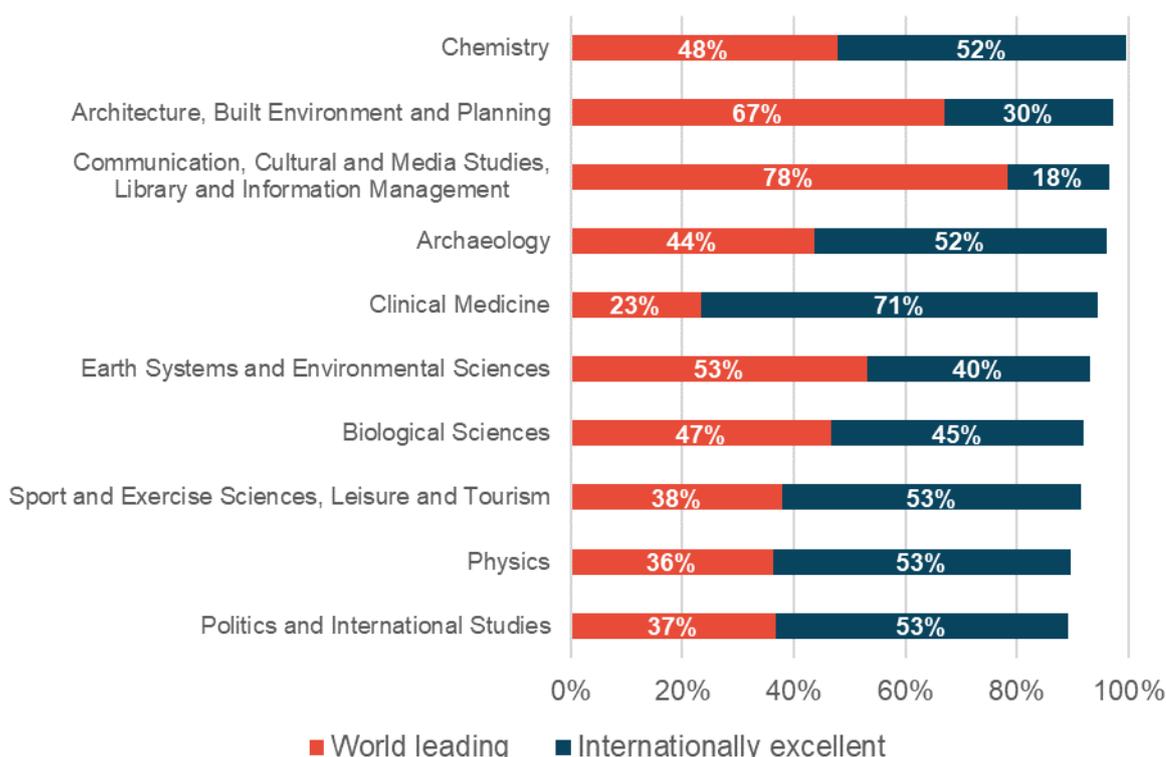
[20] This is an indicator of research impact. FWCI divides the number of citations received by a publication by the average number of citations received by publications in the same field, of the same type, and published in the same year.

Wales' HEIs have been assessed as world leading or internationally excellent which was slightly below the UK average (83%).

The results also show that 45% of Wales' submissions were classed as world leading in terms of impact on life beyond academia.

Wales' highest performing subject areas include Chemistry, Architecture, Built Environment and Planning and Communication, Cultural and Media Studies, Library and Information Management

Figure 5.13: Quality of submitted research outputs by subject area, 2021



Source: [Results and submissions : REF 2021](#)

5.4. Interactions between HE providers and businesses

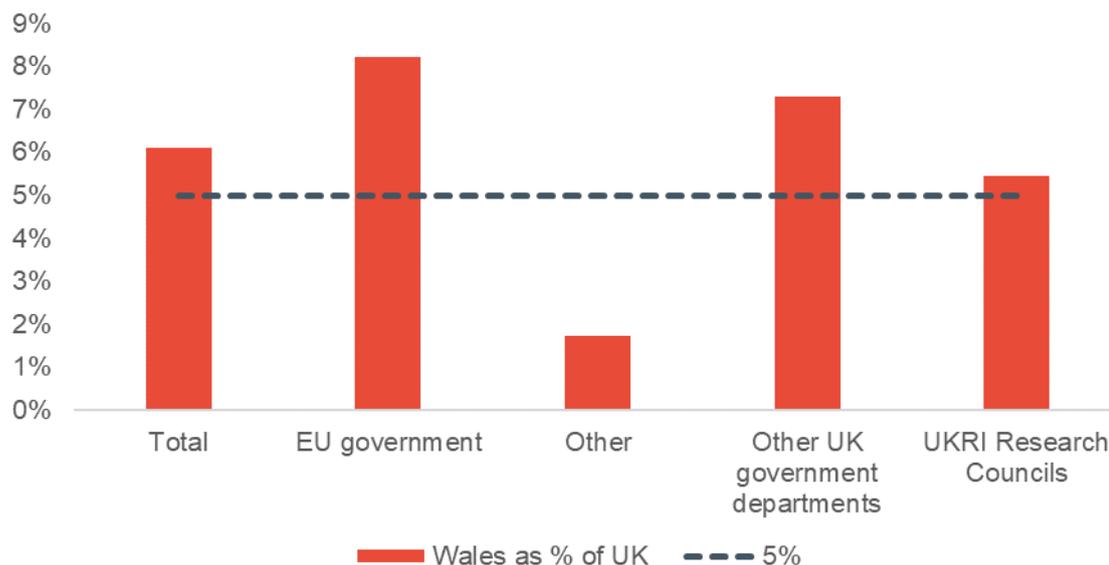
HESA also provides data on collaborative activities achieved by researchers through the HE Business and Community Interaction survey (HE-BCIS). This provides a good indication of the extent to which researchers in Wales' HEIs are engaged in collaborative research and commercialisation activities with the private and public sectors, linking to one of the intended outcomes of Sêr Cymru II.

5.4.1. Collaborative Research

The latest HE-BCIS data shows that Welsh universities secured £115m in collaborative research funding in 2020/21, with the largest sources being UKRI and research councils

(£55m) and other UK government departments (£42m). Figure 5.14 shows that Wales already secures more than 5% of the UK's collaborative research income across most sources. In total Welsh HEIs achieved a 6.1% share in 2021/22.

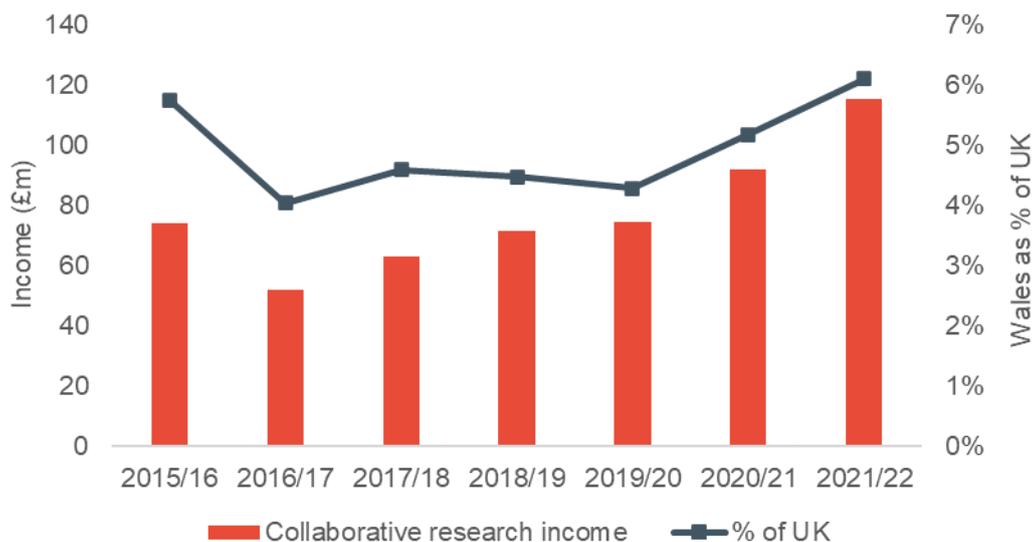
Figure 5.14: Wales' income from collaborative research as a percentage of UK, 2020/21



Source: [Chart 2 - Income from business and community interactions 2014/15 to 2021/22 | HESA](#)

Figure 5.15 shows that both the total value of collaborative research income and the share of the UK average has increased over time (although 2015/16 was a particularly strong year in comparison to later years).

Figure 5.15: Collaborative research income as share of the UK, 2015/16 to 2021/22



Source: [Chart 2 - Income from business and community interactions 2014/15 to 2021/22 | HESA](#)

Cardiff and Swansea universities together account for 75% of collaborative research income in Wales (£31m and £55m respectively). However Swansea University and the University of South Wales have seen by far the highest growth in collaborative research income since 2015/16. This increased by £25.6m at Swansea University (+85%) and by £13m at the University of South Wales (+1,231%). As a result, total collaborative research income in WWV institutions has almost doubled since 2015/16, but increased by only 6% in East Wales.

Table 5.3: Collaborative research income by area and HEI in Wales, 2021/22

Institution	Collaborative research income 2021/22 (£m)	Change since 2015/16	
		Absolute (£m)	Percent
Cardiff University	31.9	-0.3	-1%
Cardiff Metropolitan University	3.3	1.1	53%
Glyndŵr University	1.5	1.2	384%
Total East Wales	36.6	2.0	6%
Aberystwyth University	4.9	1.2	33%
Bangor University	4.3	-0.5	-10%
Swansea University	55.5	25.6	85%
University of South Wales	14.1	13.0	1231%
Total West Wales and the Valleys	78.8	39.3	99%

Source: [Chart 2 - Income from business and community interactions 2014/15 to 2021/22 | HESA](#)

In 2021/22, HEIs in Wales had 446 contracts for research^[footnote21] with commercial organisations, amounting to £17.8m in research income. This represents 3.1% of the number of contracts with commercial organisations in the UK and only 2.6% by value.

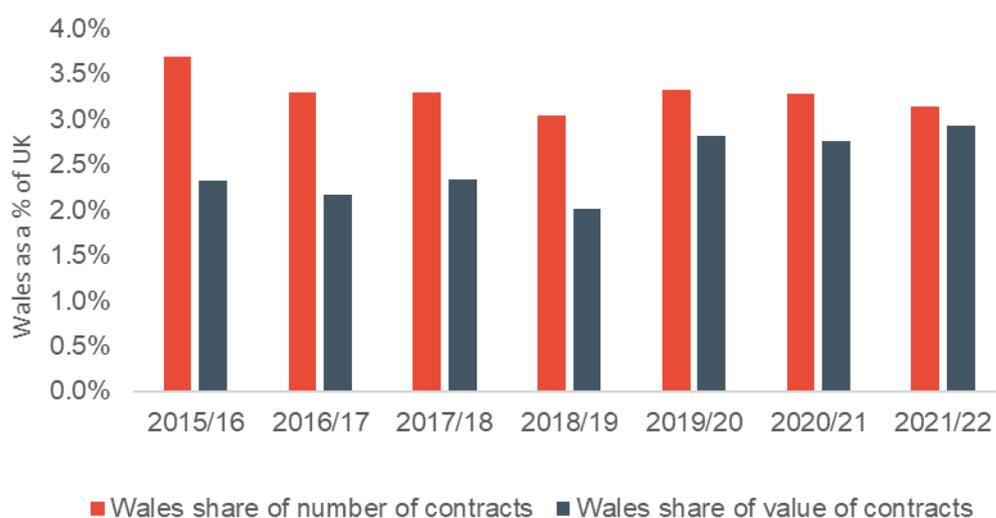
Footnotes

[21] Contract research refers to income identifiable by the HE provider as meeting the specific research needs of external partners, but excluding any research income already counted under the collaborative research activity (Source: HESA Definitions)

Figure 5.16 shows some evidence that the share by value has increased over time, but it remains some way off the target of 5% of the UK. Further analysis shows that the main reason for this is that Welsh HEIs secure relatively few of the contracts with large organisations (non SMEs) which tend to have larger values.

Analysis at institutional level shows Cardiff University secures the largest share of commercial contracts in Wales (44% by number and 47% by value) followed by Swansea University (33% by number and 25% by value).

Figure 5.16: Contract research with commercial organisations, 2015/16 to 2021/22



Source: [Chart 2 - Income from business and community interactions 2014/15 to 2021/22 | HESA](#)

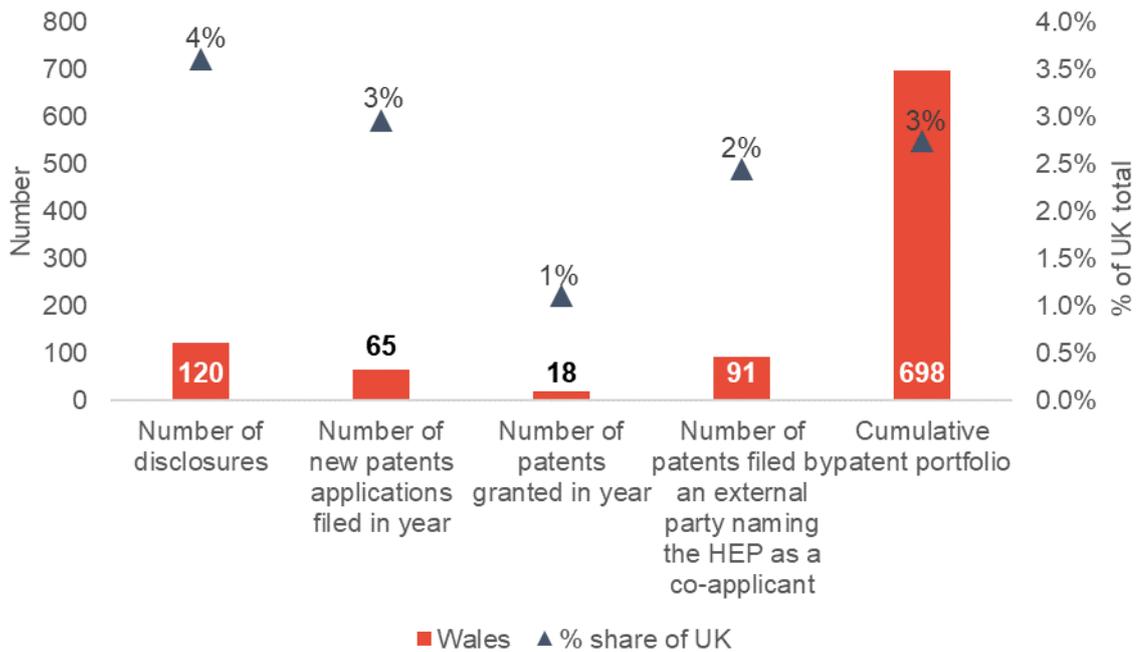
5.4.2. Intellectual Property

HE-BCIS collects a range of intellectual property (IP) indicators to measure ‘the value added by the HEI when interacting with a range of external partners. These indicators provide a helpful indication of how research activities at HEIs translate into products and ideas en-route to commercialisation.

Figure 5.17 shows an overview of Welsh HEI's performance in relation to disclosures and patents:

- In 2021/22 Wales' HEIs had a total of 120 disclosures (a public sharing of an invention) which is 4 per cent of the total in the UK. This is a decrease on previous years, as Wales was previously capturing more than 6 per cent of the total in 2015/16.
- The total number of live and active patents at HEIs in Wales (the cumulative patent portfolio) includes 698 individual patents. This has increased from 557 in 2015/16, but the share of the UK has remained broadly stable over time (3%).

Figure 5.17: Disclosures and patents filed by or on behalf of HEIs in Wales



Source: [Table 4a - Intellectual property: Disclosures and patents filed by or on behalf of the HE provider 2014/15 to 2021/22 | HESA](#)

It is a very mixed picture for Wales’ HEIs in relation to software and non-software licences^[footnote22]:

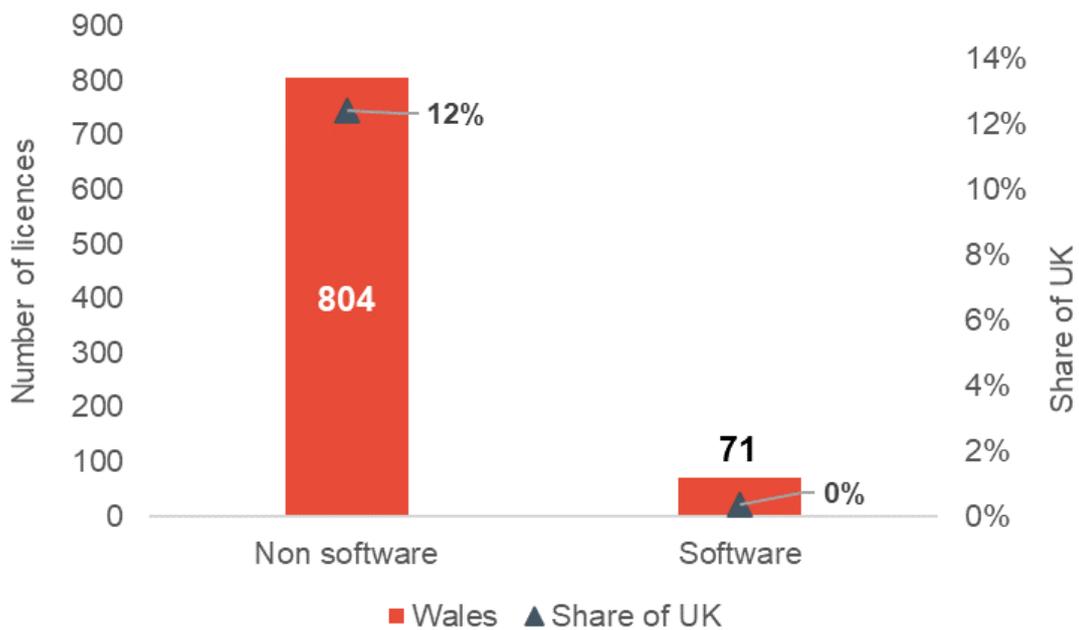
- 71 software licences were granted with commercial organisations representing just 0.4% of the total for the UK.
- 804 non software licences were granted, representing a 12% UK share. The vast majority of these (781) were granted to Cardiff University.

It should also be noted that there were a large number of licences granted with non-commercial organisations in 2021/22, including 3,289 software licences and 662 non software licences.

Footnotes

[22] Licences include the number of all active licences granted from licence agreements, assignments, exercised option agreements, licences to spin-outs and income generating Material Transfer Agreements (MTAs). Software licences govern the use or redistribution of software.

Figure 5.18: Software and non-software licences granted at Wales HEIs with commercial organisations, 2021/22



Source: [Table 4b - Intellectual property: Licence numbers \(including patents, copyright, design, registration and trade marks\) by HE provider 2014/15 to 2021/22 | HESA](#)

Figure 5.19 shows a broadly upward trend in terms of the value of IP income, but no evidence that Wales’ HEIs are increasing their share of total IP income for the UK as a whole. 90% of IP income in Wales was generated by Cardiff University in 2021/22 (£2.4m), which has been consistently the case over time.

Figure 5.19: IP income with commercial organisations



Source: [Chart 2 - Income from business and community interactions 2014/15 to 2021/22 | HESA](#)

5.4.3. Spin-off and start-up activity

Spin-offs are ‘companies set up to exploit IP that has originated from within the HEIs. The activities are the advanced stages of a research journey, as the initial research projects get closer to commercial business activities and hence closer to contributing to economic objectives.

The table below summarises the performance of Wales HEIs. Cells marked with a * highlight the indicators where Wales exceeds 5 per cent of the UK. Wales shows a reasonable performance across most indicators, but particularly for formal spin-offs with no Higher Education Provider (HEP) ownership, staff and graduate start-ups. For some of these indicators, Wales accounts for more than 15% of spin-offs and start-ups in the UK.

Table 5.4: Start-up and spin-off activities at Wales’ HEIs, 2021/22

	Established in 2021/22		Still active which have survived for 3 years		Active firms	
	Wales	% of UK	Wales	% of UK	Wales	% of UK
Spin-offs with some HEP ownership	7	4.7%	69	6.2%	75	4.9%
Formal spin-offs, not HEP owned	2	7.7%*	33	9.7%*	39	9.8%*
Staff start-ups	3	5.5%*	73	16.8%*	84	14.4%*
Student/Graduate start-ups	362	7.6%*	1,427	15.9%*	2,245	12.5%*
Social enterprises	7	4.5%	13	3.1%	27	3.8%

Source: [Chart 1 - Spin-offs and start-up companies 2014/15 to 2021/22 | HESA](#)

Analysis by region and institutions shows the following:

- Spin-offs with some HE ownership are broadly spread across institutions and the two regions, although Cardiff University and UWTSD were the only institutions to record any new spin-offs in 2021/22.
- Cardiff University is the largest source of spin-offs with no HE ownership. There are 17 active spin offs from the university, or 44% of the total for Wales.
- UWTSD has a very large number of graduate start-ups. There are currently 1,634 active startups, equivalent to 46% of the total for Wales. The number of new starts ups established in 2021/22 was broadly spread across the institutions, with the University of South Wales being the strongest performer (123 new enterprises, just less than half of the total for Wales).

Table 5.5: Start-up and spin-off activities at Wales' HEIs, 2021/22

	Spin-offs with some HEP ownership		Formal spin-offs, not HEP owned		Staff start-ups		Graduate start-ups		Social enterprises	
	Number established 2021/22	Number of active firms	Number established 2021/22	Number of active firms	Number established 2021/22	Number of active firms	Number established 2021/22	Number of active firms	Number established 2021/22	Number of active firms
Cardiff University	2	21	1	17	0	7	34	188	0	3
Cardiff Metropolitan University	0	3	0	0	0	8	51	350	3	10
Glyndŵr University	0	0	0	5	0	0	20	73	3	3
Total East Wales	2	24	1	22	0	15	105	611	6	16
Aberystwyth University	0	4	0	8	0	5	0	3	0	0
Bangor University	0	9	0	0	0	4	24	70	0	2
Swansea University	0	29	0	5	3	28	59	173	1	3
USW	0	4	0	0	0	10	123	356	0	2
UWTSD	5	5	1	4	0	22	51	1,032	0	4
Total WWV	5	51	1	17	3	69	257	1,634	1	11

Source: [Chart 1 - Spin-offs and start-up companies 2014/15 to 2021/22 | HESA](#)

5.5. Chapter summary

Table 4.6 presents a summary of Wales' performance in relation to a range of research capacity indicators, and quantifies the additional requirement to achieve a 5% share of the UK (where relevant).

The analysis shows that Wales' HEIs still account for less than 5% of the UK's research income and research staff. There has been some closing of the gap since Sêr Cymru II was first launched. For example, Wales' share of research income has increased from 3.2% in 2015/16 to 3.7% in 2021/22, driven mainly by the strong growth in research income at Swansea University. However, caution is needed when looking at change between individual years. The performance of Wales' HEIs has fluctuated over time and there is not yet clear evidence of strong and consistent growth for most indicators. The one area in which Wales' HEIs are over-performing is in relation to interactions between business and Welsh institutions already accounting for 6.1% of collaborative research income and performing well in relation to spin off and start up activities.

It is also not yet clear from this high-level analysis how Sêr Cymru II has affected these research capacity indicators. Although there has been some growth in research income in the subject areas that have received funding through Sêr Cymru II, this is not on a large scale, particularly when compared with the research income recorded in monitoring data. This may be because the research income secured by Research Chairs has been spread across a number of subject areas or because it did not occur in the 2021/22 academic year. Chapter 8 provides a more detailed analysis of the impact of Sêr Cymru II on research income.

Table 5.6: Summary of Wales HEI's research capacity performance

Indicator	Current position	% share of UK	Additional annual requirement to achieve 5% share
Research income, 2021/22			
Total research income in Wales	£255m	3.7%	£94m
Research income per researcher	£44,200	n/a	£5,600*
STEMM research income in Wales	£217m	3.6%	£87m
Research staff (2021/22)			
Research staff	5,775	4.1%	1,230

STEMM research staff	3,335	3.9%	915
Research income and staff by STEMM subject, 2021/22			
Medicine, dentistry and health – research income	£80m	2.7%	£66m
Medicine, dentistry and health – research staff	1,315	3.5%	550
Agriculture, forestry and veterinary science – research income	£28m	8.6%	5% target exceeded
Agriculture, forestry and veterinary science – research staff	75	4.9%	2
Biological, mathematical and physical sciences – research income	£52m	3.4%	£25m
Biological, mathematical and physical sciences – research staff	1,005	3.9%	285
Engineering and technology – research income	£58m	4.4%	£8m
Engineering and technology – research staff	940	4.6%	80
Interactions between HE providers and businesses, 2021/22			
Collaborative research income	£115m	6.1%	5% target exceeded
Intellectual property income	£2.7m	1.2%	£8.4m
Spin-offs with some HEP ownership	7	4.7%	1
Formal spin-offs, not HEP owned	2	7.7%	5% target exceeded
Staff start-ups	3	5.5%	5% target exceeded
Graduate start-ups	362	7.6%	5% target exceeded

Source: HESA and HE-BCIS

*Additional income per researcher required denotes the value needed to achieve parity with the UK

6. Performance of Sêr Cymru II

This section assesses the performance of Sêr Cymru II based on analysis of monitoring data and assesses whether it has achieved the targets, aims and objectives set out in the business plan^[footnote23]. A full list of the variables this covered are included in Table 6.1.

The monitoring data was provided in July 2023. This was based on the final claim and captures all of the eligible outputs and results achieved by the programme between November 2016 and the end of the funding period in June 2023.

6.1. Headline performance

Table 6.1 shows how Sêr Cymru II has performed against the result and output targets for the operation. This distinguishes between:

- WEFO indicators – these are the core ERDF performance indicators reported to WEFO. All of these outputs and results have been verified by Welsh Government as being eligible and supported by complete evidence.
- Welsh Government indicators – these are the internal indicators used by Welsh Government to assess performance. These are not claimed with WEFO and, as such, are not subject to the same degree of scrutiny.

The table shows that Sêr Cymru II has exceeded its target to secure £45m of additional research income. According to the monitoring data, the operation had secured £78.8m by the end of the delivery period. The targets for research income were surpassed in both West Wales and the Valleys (WWV) and East Wales. The operation has also comfortably exceeded its targets for the number of new researchers, co-operations with enterprises, research publications, other jobs and PhD studentships and societal benefits.

The only targets which were not met were commercialisable outcomes^[footnote24]; the number of research fellows taking up a permanent role in the institution and the number of STEM ambassador activities.

For the ‘number of researchers taking a permanent role’ indicator, there is evidence to suggest that the monitoring data does not fully capture all of these outputs and that the operation has also exceeded this target. This is explained in more detail below.

Footnotes

[23] This is with reference to the latest business plan, dated February 2021

[24] It should be noted this is a lagging indicator which may take some time to achieve, particularly for those awards which have only been completed recently.

Table 6.1: Headline performance of Sêr Cymru II (based on claims to WEFO)

WEFO/ Welsh Gov	Indicator	Indicator type	West Wales & Valleys		East Wales		Total	
			Target	Achieved	Target	Achieved	Target	Achieved
WEFO indicators	Amount of research income secured (£m)	Output	27.38	51.23	17.70	27.60	45.08	78.83
	No. new researchers in supported entities	Output	60	81	42	99	102	179
	No. partners cooperating in research projects	Output	73	130	40	66	113	196
Welsh Government indicators	No. research publications	Output	27	473	25	233	52	706
	No. other jobs and PhD studentships created by/linked to the new posts	Output	27	72	25	29	52	101
	No. commercialisable outcomes†	Output	5	3	5	0	10	3
	No. societal benefits†	Output	5	372*	5	3	10	375
	No. research fellows taking up permanent role in host institution†	Output	13	12	13	8	26	20**
	No. STEMM ambassador activities†	Output	27	13	25	8	52	21
	No. research fellows undertaking activities outside of standard postdoctoral role†	Output	10	46	10	0	20	46

Source: Welsh Government monitoring data

* There was no requirement for HEIs to evidence this output indicator. Therefore it is not possible to comment on the validity of these outputs or explain why the figure is so high for WWV. However it should be noted that 221 of these outputs were claimed by a single Research Chair.

**There is evidence that this underestimates the total number of researchers taking up a permanent role (see paragraph 0 to 0)

† There was no requirement for HEIs to evidence these output indicators

As noted above, the WEFO results and outputs could only be claimed if they were found to be eligible and supported by complete evidence. There were also a large number of outputs and results reported by grant recipients which were found to be ineligible or unsupported by evidence. This particularly related to research income and partners cooperating in research projects (see Table 6.2).

Claims for research income could be deemed ineligible or incomplete for a range of reasons:

- The research grant was not awarded through competitive process.
- Award is outside claim period/after project is finished.
- Award pre-dated the ERDF funded project.
- The link between the research grant and the ERDF funded activity is not clear.
- Funding was for ineligible activities other than research (travel, training etc)
- Insufficient details provided for how joint grants were apportioned.
- No award letter provided, or the award letter does not name university or researcher^[footnote25].

While some of these provide valid reasons for excluding the research income from the monitoring data (e.g. funding for activities other than research or the award pre-dating Sêr Cymru II), in other cases there is a strong justification for including it as counting towards programme achievements (e.g. award was made after the claim period or after the project is finished). In other cases it is not clear from the evidence available whether the output should be counted towards achievements or not. As a result, the true figure is likely to lie somewhere between the WEFO claimed income and the total reported by grant recipients.

The reasons for co-operations with partners in research projects being found to be ineligible include:

- The nature of the co-operation being too informal and inconsistent with ERDF definitions.

Footnotes

[25] In some cases universities were restricted from providing certain details of awards because of conditions in NDAs. In these cases the evidence was too redacted to confirm eligibility.

- The co-operations table not being fully completed or lacking some details (in some cases this needed to be redacted due to sensitive nature of research)
- Insufficient evidence being provided from partners to support the claim.

Again, it is reasonable to assume that the true figure lies between the WEFO claimed outputs and the total reported by grant recipients.

Table 6.2 shows the performance of the operation against these result and output targets when all outputs reported by grant recipients are included. The total research income increases from £78.8m to £99.6m, while the total number of partners cooperating in research projects increases from 196 to 338.

Table 6.2: Research income and co-operations for Sêr Cymru II

	Amount of research income secured (£)			No. partners cooperating in research projects		
	West Wales and the Valleys	East Wales	Wales total	West Wales and the Valleys	East Wales	Wales total
Target	27.38	17.70	45.08	73	40	113
WEFO claim	51.23	27.60	78.83	130	66	196
All reported outputs	66.15	33.39	99.55	257	81	338

Source: Welsh Government monitoring data

6.2. Research income

Table 6.3 shows how much research income was secured by the different Sêr Cymru II awards and compares this to the targets in the business plan, the number of awards and the total value of the award (this includes the ERDF grant and the match funding from universities).

This shows that Research Chairs have been highly successful at securing research income and have been the main reason for the operation's strong performance. The six Chairs secured between £70.2m and £72.8m in research income depending on which measure is used. This is more than double the target in the business plan for £34.5m and represents between 73% and 89% of total research income for Sêr Cymru II.

In general there was much greater inconsistency between the two measures of research income for SCII+ awards than there was for the original Sêr Cymru II awards. However, consultations with a number of these grant recipients and analysis of the quarterly

monitoring reports suggest a large proportion of this claimed income can justifiably be counted towards programme achievements even if it does not meet WEFO reporting requirements. For example, some progress reports provide a detailed list of successful grant applications, including the funding body, name of the project, partners involved, date of award etc. These awards are also listed on the university's website and in some cases on funding bodies' websites. However a number of these have not been claimed because of insufficient evidence being provided^[footnote26]. This suggests the research grants are genuine but are not supported by the formal evidence required by WEFO.

If the higher estimate of research income is used, the data shows many of the SCII+ awards have performed strongly against their targets for research income, particularly Capacity Building Awards and Infrastructure Awards. Infrastructure Awards also secured the highest research income per pound invested (£4.30), followed by Research Chairs (£3.43), indicating these have delivered good value for money.

Other awards and fellowships have delivered much lower levels of research income (Research Fellowships, Rising Stars, Recapturing Talent, PMF, Strategic Partnership Awards and NRNs). However, it should be noted that the business plan did not identify specific targets for most of these as it was not expected that this would be a primary outcome of the awards. The one exception to this is Rising Stars which had a target to secure £2.5m of research income (based on the assumption that each would secure £250,000 on average). The data indicate that this target has been narrowly missed.

Footnotes

[26] For example, the grant recipient did not provide the award letter, or the award letter only confirms the value of the overall grant rather than the value for the Welsh university.

Table 6.3: Research income secured by Sêr Cymru II awards

Sêr Cymru Phase	Award type	Total value of award (£000)	Number of awards	Target for research income	Research income - claimed with WEFO (£000)	Research income – total (£000)	Research income per award (£000)*	Research income per £ invested*
Original SCII	Research Chair	21,253	6	34,500	70,226	72,818	12,136	3.43
	Rising Star	8,494	10	2,500	2,188	2,355	235	0.28
	Recapturing Talent	628	3	-	32	50	17	0.08
	Research Fellowship	5,845	30	-	2,595	3,554	118	0.61
	PMF	614	4	-	10	46	12	0.08
SCII+	Industrial Fellowship	851	5	2,500	978	1,719	344	2.02
	Infrastructure Award	2,681	8	5,000	1,162	11,527	1,441	4.30
	Strategic Partnership Award	265	4	-	64	199	50	0.75
	Capacity Building Award	3,510	7	6,000	1,579	7,280	1,040	2.07
	National Research Network	549	3	-	-	-	-	-
	Grand Total	44,689 †	80	50,500	78,833	99,549	1,244	2.23

Source: Welsh Government

*based on the total reported research income.

†£3.9m of this was unclaimed due to some projects underspending and some fellows leaving the programme early.

Closer analysis shows that a high proportion of the research income has been achieved by just two of the Research Chairs and their research groups. These are:

- Sêr Sam (Sustainable Advanced Materials) at Swansea University. This secured £38m in research income. £30m of this was secured through a single capital research grant which funded the Centre for Integrative Semiconductor Materials (CISM)^[footnote27].
- The Medicines Discovery Institute (MDI) which is led by two Chairs at Cardiff University. This has secured £23m in research income, all of which was from charities, research councils or UK government.

Consultees from Swansea and Cardiff universities reported being highly satisfied with the progress made by these Chairs, with both described as major success stories. Their strong performance was attributed to the vision, qualities and track record of the individuals involved, and their ability to build and lead a research team from scratch.

Although other Chairs have secured less research income, it should be noted that:

- the Chair in Bovine Tuberculosis at Aberystwyth University was appointed much later than the other Chairs and the research was further delayed by the Covid pandemic and the setting up of the research laboratories, which meant they could not carry out the research needed to underpin grant applications until towards the end of the project.
- the Chair of the Earth Observation and Ecosystem Dynamics (EOED) research group (also at Aberystwyth University) only received funding from Sêr Cymru II for a 2.5 year period, ending in June 2021. Since then, they have been funded by Welsh Government and have played a key role in influencing policy.
- the Nuclear Futures Institute at Bangor University was initially established as a dual-chair position and was also slow to start; achieving little for the

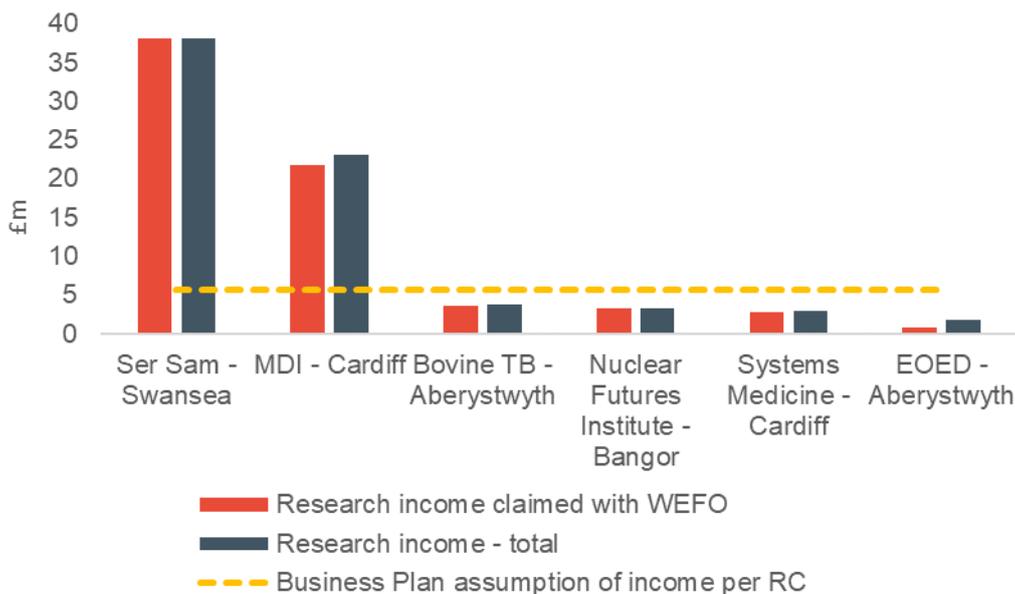
Footnotes

[27] This funding was secured through the UK research partnership investment fund (UKRPIF). This is a UK-wide competitive grant funding scheme run by Research England on behalf of the UK's four HE research councils. This includes HEFCW, a Welsh Government sponsored body. Therefore this income does include funding from Welsh Government and is not external. Nevertheless, it is a competitive scheme run across the UK, and is not awarded on a proportional basis. Furthermore, a condition of UKRPIF is that universities must attract a further £2 from non-public sources for every £1 invested by the fund. Therefore CISM attracted a further £60m from other sources, including funding from semi-conductor companies and other industry partners. The income has been included here as it was considered to be eligible by WEFO but it should be noted that this is not external income.

first three years. One of the Chairs then left their position and the remaining Chair re-designed how funding could be used to align with research priorities. Since then, this research group has made significant progress.

Consultees from Aberystwyth and Bangor University both reported being highly satisfied with the early progress made by each of these Chairs given the shorter amount of time they have had to generate research income..

Figure 6.1: Research income secured by Research Chairs



Source: Welsh Government monitoring data

Similarly, the vast majority of research income secured by Rising Stars was achieved by just two grant recipients, one of whom is also part of the Sêr Sam research group at Swansea University.

Consultees from the host universities acknowledged that a number of the other Rising Stars had underperformed compared to their original expectations for research income. There are a number of possible reasons for this. Firstly, the progress reports show that four of the Rising Stars did submit grant applications which were unsuccessful^[footnote28]. This to be expected (given the competitive nature of the research funds) but the Rising Stars are still likely to have gained valuable experience from this. Secondly, the Covid pandemic delayed the progress of a number of the Rising Stars as they lost access to laboratories for

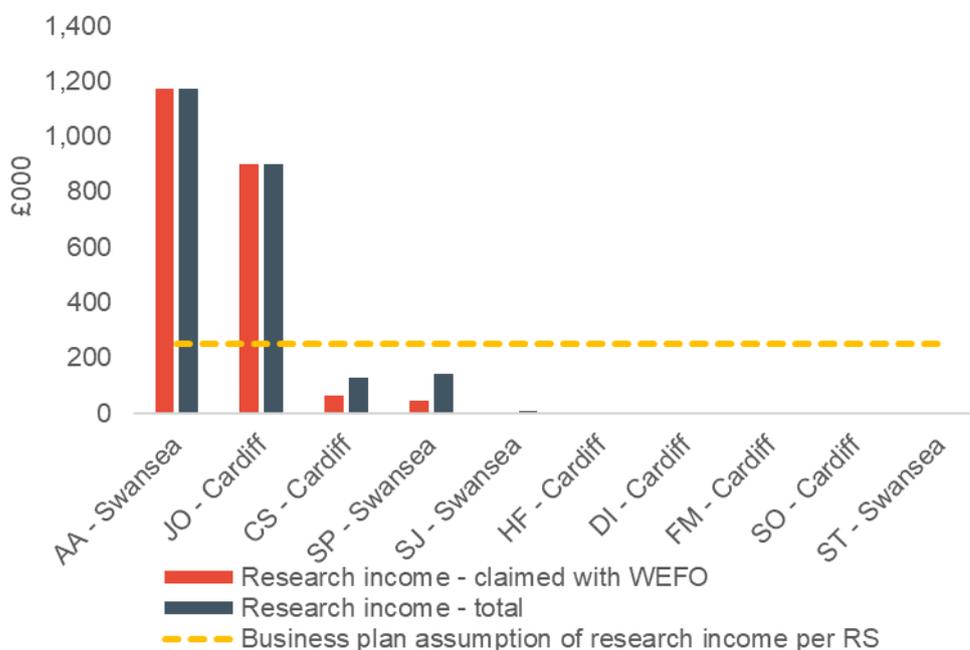
Footnotes

[28] It is not always clear from the other progress reports for Rising Stars whether they submitted grant applications. Therefore this may be an underestimate.

long periods as well as the ability to meet face to face with colleagues or attend conferences. This meant that a number of the grant applications had only recently been submitted or are due to be submitted soon, meaning the outcomes are still not known and are not reflected in monitoring data.

However consultees also believed some Rising Stars had initially struggled to adjust to leading a programme of research independently and it took them longer than expected to make progress. The destination forms for Rising Stars also suggest that some felt unsupported by their host institution and did not receive adequate training and mentoring (this issue was also raised by a number of consultees as part of the review of management and delivery processes, discussed in Chapter 6).

Figure 6.2: Research income secured by Rising Stars



Source: Welsh Government monitoring data

6.3. Outputs

6.3.1. Original Sêr Cymru II awards

Table 6.4 shows the outputs achieved by the original Sêr Cymru II awards. The business plan did not state specific output targets for each of these awards but did provide an indication of whether they expected different awards to contribute to different output indicators. The key points to note are as follows:

- Partners cooperating in research projects: Research Chairs have accounted for a large share of these outputs (between 44% and 74%

depending on which measure is used). These have been far more evenly spread across the six Chairs than is the case for research income. The business plan did not state whether Welsh Government expected other awards to deliver a large number of co-operations. However, consultees reported that they would expect most outputs to be delivered by Chairs as early career researchers are less likely to have established links with industry or partners in other academic institutions.

- Number of new researchers in supported entities: Research Chairs account for half of the new researchers delivered by Sêr Cymru II. On average each Research Chair recruited 15 new researchers, which is much higher than the assumption in the business plan (five researchers per Chair). All of the Chairs met this target, but the highest number of new researchers was achieved by the MDI (40.9 FTE researchers). The business plan also stated that each Rising Star was expected to create two research posts per award. This target was also exceeded; on average there were 3.3 researchers per award, with all but one of the Rising Stars achieving the target of two researchers. It was not expected that the other awards would result in additional researchers over and above the grant recipient themselves. It should be noted, however, that the business plan assumed there would be 12 Recapturing Talent awards but only three were achieved. This was due to Welsh Government receiving very few applications for these fellowships.
- Number of publications: the number of publications was more evenly distributed across the different awards, with a significant proportion achieved by Rising Stars and Research Fellowships (17% and 25% respectively). The business plan stated: "it is more likely that the 'Rising Stars' and Research Chairs will produce the majority of these papers but it is highly possible that the fellows will be writing and submitting articles to journals at some point during their fellowship". On this basis it can be concluded that the Research Fellows have exceeded the expectations in the business plan. Although the large number of publications suggests the assumptions on which these expectations were based were too cautious. Only three of the Research Fellows did not have a paper published and

these all left their fellowship before the funding period ended. On average there were 5.9 published papers per Research Fellow.

- Number of other jobs and PhD studentships created: the business plan did not indicate which awards were expected to achieve these outputs but the monitoring data shows these have been evenly spread. Several consultees reported that this had been done through the KESS 2 scheme, a European Social Fund operation which ended in December 2023^[footnote29]. They expressed concern that this will make it far more difficult to recruit PhD students in future. Other consultees expressed frustration that they could not recruit PhD students using ERDF funding and said this should be changed on future rounds of Sêr Cymru which will not be constrained by EU funding rules.

Footnotes

[29] This raises a question about whether the PhD studentships should be attributed to Sêr Cymru II or KESS2. This is difficult to answer since the two schemes have complemented each other. It was Sêr Cymru II which created the 'need' for the PhD students, but KESS2 provided the funding mechanism since ERDF cannot be used to fund PhD studentships. Therefore, arguably, the PhD studentships would not have gone ahead in the absence of either programme.

Table 6.4: Outputs achieved by original Sêr Cymru II awards

Output indicator	Research Chair	Rising Star	Recapturing Talent	Research Fellowship	PMF	Total for Sêr Cymru II*
Total grant award (£000)	16,146	6,138	520	4,260	407	34,763
No. projects	6	10	3	30	4	80
Co-operations with partners - claimed with WEFO	146	10	0	4	0	196
Co-operations with partners - total	149	10	0	26	0	338
Number of new researchers in supported entities	91	33	3	26	4	180
Publications	290	118	13	177	10	706
Other jobs and PhD studentships created	28.2	21	1	20	4	101
No. commercialisable outcomes	0	1	0	2	0	3
No. societal benefits	257	104	10	3	1	375
No. research fellows taking up permanent role in institution	9	5	1	4	1	20
No. STEMM ambassador activities	0	0	0	21	0	21
No. research fellows undertaking activities outside of standard postdoctoral role	0	0	35	11	0	46

Source: Welsh Government monitoring data

*this column provides the total for the whole Sêr Cymru II operation including SCII+ rather than just the awards shown in this table

As noted above, according to the monitoring data, Sêr Cymru II has failed to meet its target for the number of research fellows taking up a permanent role in their host institution (26). This was an important indicator, given that the key objective of Sêr Cymru II was to build capacity in STEMM research in Wales.

The data shows only 20 researchers have been retained, with nine of these being researchers that were recruited by Research Chairs. According to the monitoring data, five of the ten Rising Stars have been retained (50%) and only five of the other fellowships^[footnote30] have been retained (13.5%).

The business plan noted the difficulties in securing a permanent position following a postdoctoral role and set a 'conservative' target for five Rising Stars and eight fellows to secure a permanent position by the end of the programme. On this basis, the Rising Stars awards have performed in line with expectations and the other fellowships have slightly underperformed.

However, there is strong evidence to suggest that the monitoring data underestimates the number of fellows who have secured a permanent position following their Sêr Cymru II fellowship. For example, the destination survey suggests the retention rate for Research Fellowship, Recapturing Talent and PMF fellows was 60%; significantly higher than the 13.5% implied by the monitoring data.

To arrive at a more robust estimate of the number of retained researchers, Welsh Government requested that each of the participating universities confirm the number of researchers that are still employed. Table 6.5 shows that, of the 180.7 FTE researchers recruited by Wales' HEIs as a result of the Sêr Cymru II programme, 74 are still in post. This means the retention rate of researchers is currently 41%. However this rate varies significantly for each of the universities; only 22% of researchers at Swansea University are still in post, while Aberystwyth University has retained 78% of its researchers.

It is not possible to say why there is such variation, but this could be explained by differences in the level of support offered to researchers, and whether the researchers were aligned with, and integrated into, existing research groups with sustainable income streams. Consultees from Swansea University noted that too many of the fellows were not well integrated and, as such, lacked supervision and a supportive network. Many of these

Footnotes

[30] Including Recapturing Talent, Research Fellowships and Precision Medicine Fellows

fellows ended up leaving Swansea University once the Sêr Cymru II funding period had ended.

Table 6.5: Number of Sêr Cymru II researchers still employed at their host institutions (FTEs)

HEI	Number of new posts created	Still employed on fixed term contract	Still employed on permanent or open ended contract	Still employed - total	% retained
Cardiff	98.6	16	24	40.0	40.6
Aber	14.6	6	5.35	11.4	77.7
Swansea	41.0	6	3	9.0	22.0
USW	4.5	3	0	3.0	66.7
Bangor	22.0	9	1.6	10.6	48.2
Total	180.7	28	32.35	74.0	41.0

Source: University HR records, collected November 2023 – January 2024.

6.3.2. Sêr Cymru II+ awards

Table 6.6 shows the number of outputs achieved by the SCII+ awards. The business plan only provided output targets for:

- the total potential grant income generated (this has been analysed above in Table 6.3).
- the number of new researchers (FTEs)
- the number of partners cooperating in research projects.

It provided no information on the expectations for other indicators, including research publications and PhD studentships.

The data shows that the overall target for 16 new FTE researchers was exceeded (21.25), but this was achieved because one of the Infrastructure Accelerator Awards resulted in the recruitment of eight new researchers, which had not been expected in the business plan. In contrast, the business plan set a target for six new FTE researchers through Industrial Fellowships, but only 0.75 was achieved^[footnote31].

The data on co-operations shows a large discrepancy between the outputs claimed with WEFO and the total reported by grant recipients. If the lower estimate is used, the data suggests that all of the awards have underperformed against their targets, with the

Footnotes

[31] It is not clear why the business plan assumed that Industrial Fellowships would result in new researchers since these were designed to facilitate knowledge exchange between existing Welsh researchers and industrial partners rather than the recruitment of new researchers.

exception of Capacity Building Awards. However, if the higher estimate is used, they have all comfortably exceeded their targets with the exception of Strategic Partnership Awards^[footnote32].

In most cases the discrepancy was due to the grant recipients not providing the required level of evidence or incomplete information. However, based on the consultations undertaken with grant recipients and analysis of the progress reports, the evaluators are satisfied that many of these should be counted as genuine collaborations.

For example, a number of the progress reports provide details of the names of the partner enterprises, the nature and outcomes of the collaboration. However these have not been counted because the relevant forms have not been signed by the partner enterprises confirming the co-operation. It therefore appears that collaboration has taken place but it is not supported by the formal evidence required by WEFO. As described in the following chapter, a number of consultees stated that they were deterred from claiming outputs because of the amount of paperwork that this would involve, and therefore the monitoring data understates their achievements.

Many of these awards were made in early 2020 meaning a large number were badly affected by the Covid pandemic. This placed restrictions on laboratory access, face-to-face collaboration and international travel and meant there was a long delay for many researchers in being able to undertake their planned activities. As a result many of the outputs for SCII+ were delayed and several consultees said they still have research papers due to be published which are not captured in the monitoring data. Given these challenges, the publication of 94 research papers can be considered to be a significant achievement.

Footnotes

[32] Part of the reason for this is that the business plan assumed five Strategic Partnership Awards would be funded, but only four were in practice.

Table 6.6: Outputs achieved by Sêr Cymru II+ awards

	Co-operations in a research project			No. of new researchers		Research publications	Other jobs and PhD studentships created
	Target in Business Plan	Claimed with WEFO	Total reported	Target in Business Plan	Achieved		
Industrial Fellowship	12	8	36	6	0.75	30	2.6
Strategic Partnership Award	10	4	6	-	0	26	1
Capacity Building Award	3	19	79	10	12.5	8	7.5
Infrastructure Award	5	0	23	-	8	30	11.49
NRNs	-	0	4	-	0	0	3
Total	30	31	148	16	21.25	94	25.59

6.4. Conclusions

Sêr Cymru II has successfully met almost all of the targets in the business plan, and in many cases has significantly overachieved. This includes the target for research income (the result target and one of the main measures of success of the operation).

Research Chairs have performed particularly well. These have comfortably exceeded all of the targets in the business plan and have accounted for the majority of several output and result indicators, including research income, partners cooperating in a research project and the number of new researchers. Two of the research groups established by Research Chairs have performed particularly well; Sêr Sam at Swansea University and MDI at Cardiff, which have both significantly overachieved against their targets for research income and new research staff.

Although Rising Stars have not met the targets for research income identified in the business plan, there are signs that this will increase in the future. At least 50% of the Rising Stars have secured a permanent position and all have performed well in terms of research publications and new researchers, indicating they have gained valuable experience of leading a programme of research independently. Several have also recently submitted grant applications. This suggests there are likely to be a number of legacy benefits from Rising Stars that are not captured in the monitoring data.

The success of the other fellowships (Research Fellowships, Recapturing Talent and PMF) is more difficult to judge based on the available monitoring indicators. These were mostly early career researchers and were not expected to make a significant contribution to grant income or co-operations with partners. The most relevant performance indicators are arguably research publications and retention of research fellows. On both measures, the fellowships have performed well; 177 research papers have been published and 15 fellows (40%) have been retained at their host university which exceeds the expectations in the business plan. However, these should be considered alongside other metrics which have not been monitored by Welsh Government but which are assessed in Chapter 8 through the use of survey data. This includes skills and career development, network building, confidence about leading research projects independently and experience of grant applications.

The monitoring data also suggests the SCII+ awards have also performed well despite the challenges imposed by the Covid pandemic. Although there is some uncertainty about the total value of research income secured and partner cooperations, there are credible

reasons to conclude that the outputs claimed with WEFO significantly understate the achievements of these awards (e.g. research grants which are listed on university and funding body websites but have not been claimed with WEFO due to insufficient evidence being provided by the grant recipient).

7. Management and Delivery Review

This chapter assesses the effectiveness of management, delivery and monitoring processes for Sêr Cymru II and identifies how these could be improved for future programmes. It draws on:

- the views of 30 interviewed stakeholders including Welsh Government officers involved in the design, delivery and management of Sêr Cymru II (four consultees), WEFO officers (four consultees), evaluation panel members (six consultees) and HEI stakeholders (16 consultees^[footnote33]).
- the findings of the destination survey (60 completed responses),
- the web survey of funded fellows (19 completed responses) and
- 32 interviews with grant recipients from all strands of the operation (a breakdown by the different awards is provided in Chapter 2).

The mid-term evaluation provided a detailed critique of the application and award process. Therefore the main focus of this report is on management, delivery and monitoring of the programme in the post-award stage.

7.1. Management and governance of Sêr Cymru II

7.1.1. Management arrangements

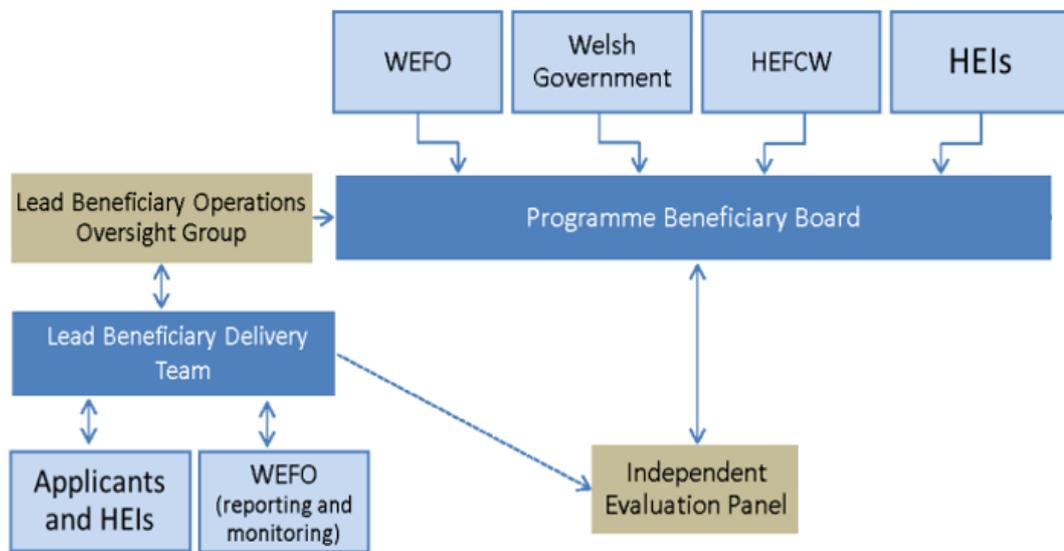
The organisational and governance arrangements for Sêr Cymru II are summarised in

Footnotes

[33] A number of the interviews with HEIs involved multiple participants from the university. The large number of HEI stakeholders means that they had a higher representation in the process review than other stakeholder. However this reflects the fact that five different universities were involved in the programme, and in each institution there were a number of different staff involved (e.g. officers involved in administration and monitoring and those in strategic or managerial roles).

Figure 7.1. Sêr Cymru II has continued to be managed by the Welsh Government who oversaw the competitive bidding process for awarding funding. An Independent Evaluation Panel considered all the funding applications and made recommendations to the Programme Beneficiary Board to approve. Individual proposals for funding were reviewed by international external peer reviewers. This was the original model for awarding funding to fellows during the initial funding rounds (reviewed in the mid-term evaluation) and has continued to be used for the Sêr Cymru II+ awards.

Figure 7.1 Sêr Cymru II Governance Structure



Source: Sêr Cymru II ERDF Business Plans

Once all awards had been made, a different team in Welsh Government was responsible for delivery and management of the grant process, including checking and processing of claims, monitoring progress of awards and ensuring all of the funding is spent. The management team organogram in the business plan shows many of the officers involved in the ‘pre-award’ team no longer had any role in the ‘post-award’ phase. This includes the Head of Research Programme Development, the Programme Manager and Senior Science Officer. The ‘post-award’ phase was led by the Programme Manager for Finance and Audit who oversaw a team made up of officers in monitoring roles or Relationship and Compliance Managers.

The business plan for Sêr Cymru II provides more detail about the respective roles of Welsh Government and host institutions in the implementation phase besides administration, monitoring and claims. These include:

- Academic supervision: each fellow had a supervisor in their host institution who was responsible for supporting and facilitating the fellow’s research and supporting their career development.
- Fellowships training: it was the intention that each fellow would agree a Personal Career Development Plan with their supervisor which would identify their training needs and would be updated annually. The host institution would then be responsible for providing the relevant training. It was also the intention that the Welsh Government delivery team would

arrange its own training programme. This would “be a comprehensive series of events designed to develop an individual’s skills as a research fellow, whilst looking forward to addressing the skills needed for the next step on the career pathway – leading successful research teams”. It added that this would have “the added value of developing a community of Research Fellows who can share and debate research issues together”.

- **Networking:** the business plan stated that “the Delivery Team will organise annual events for the Fellows to meet and network together and with the wider local research community. There will be opportunities to present their science but also to be able to discuss less formal matters with other Fellows and share experiences at social events”.
- **Dissemination and awareness raising:** grant recipients would be expected to communicate and disseminate their own research, however the business plan also identified a role for Welsh Government. It stated that significant advances, achievements and milestones would all be disseminated via press releases or social media platforms. It also stated that “the Delivery Team will generate annually a summary resource that will capture and promote the activities going on in the programme.... These catalogues will be topic-centred and also explore the societal challenges being addressed”. Furthermore, “the Programme Beneficiary Board will ensure that an annual summary of research activities and their impact is disseminated to policy-makers with a view to informing evidence-based policy making”.

7.1.2. Management of Sêr Cymru II

The online survey of Research Fellows, Recapturing Talent and Rising Stars beneficiaries found that overall, most believed Sêr Cymru II had been managed well or fairly well (see Figure 7.2). Beneficiaries were particularly positive about how it had been managed by their host university; respondents were more likely to say it had been managed very well by their host institution than by the Welsh Government or WEFO. The reasons for this were not given in the survey, but several consultees expressed positive views about how their host institutions had helped them with administration, claims queries and monitoring reports.

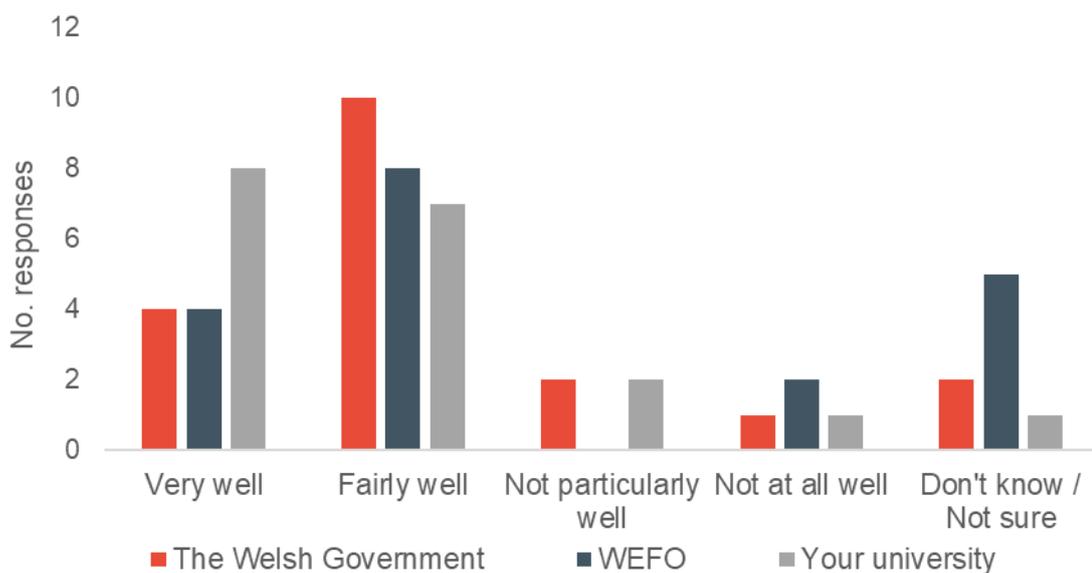
Consultees were also broadly positive about the management of the operation by Welsh Government. They recognised that the delivery team had worked extremely hard, communicated well with universities and had listened to feedback to try and make processes more flexible. A number of the beneficiaries who received funding through SCII+ were particularly positive about the flexibility and responsiveness shown by the delivery team when the Covid pandemic started in 2020, just when many of these projects were starting.

However, two themes were consistently raised in interviews:

- The delivery team were severely under-resourced in the post-award stage, and at times struggled to cope with the administrative requirements of the operation. It was also noted that there had been a high turnover of staff.
- There were very few people in the post-award delivery team with a scientific background to manage an operation of this nature. The original Programme Manager for the operation during the pre-award stage had this background, and was widely praised by consultees, with one describing them as the “driving force” of Sêr Cymru II. This officer left and was not replaced with similar skills and expertise, which many considered to be a significant loss.

Many of the key findings about the management and delivery of the operation, described in this chapter, can ultimately be traced back to these two issues.

Figure 7.2: Views of grant recipients on the overall management of Sêr Cymru II by different organisations (n=19)



Source: OB3 web survey of funded fellows

7.1.3. Leadership and governance

As well as the project manager leaving the operation, the operation was also reported to have been hampered by the original CSA leaving their role in 2017. This CSA had developed the science strategy for Wales and helped to design Sêr Cymru II. It was reported their departure left a void in terms of the strategic leadership of Sêr Cymru II and maintaining a strong link between Welsh Government and Welsh universities.

Several consultees stated that senior level engagement between Welsh Government and universities had decreased since the early stages of the operation. There was reported to be a very strong relationship between the Office of the CSA and HEIs during the pre-award stage, but “this has fallen by the wayside over time”.

University stakeholders and members of the panel also described how the Programme Beneficiary Board had not engaged with the Pro Vice Chancellors with responsibility for research and had made insufficient effort to bring them together to discuss strategic priorities since the early stages of the operation. It was acknowledged that there had been significant turnover across the four research-led HEIs in Wales; all four have new Pro VCs, which means this engagement would not have been easy. However, given that Welsh Government’s main role in the innovation ecosystem is to [provide leadership, convene stakeholders and co-ordinate effort](#), it was reported that Welsh Government could have done more to bring the new post-holders together.

Others reported that the Programme Beneficiary Board had become less effective since the award stage. Consultees reported that it did not meet often enough and was too focused on ‘rubber stamping’ the awards approved by the Evaluation Panel as opposed to maximising the strategic impact of Sêr Cymru II.

7.2. Delivery processes

7.2.1. Application and selection processes

Panel members compared the systems in place for Sêr Cymru II favourably to other competitive bidding processes. This was considered to be more partnership based than some other research funds, with a high calibre of participants bringing together expertise across a wide range of STEMM areas. They also thought the award process had worked quickly, particularly during the Covid pandemic when funding decisions were made within a three-month period. Members of the Evaluation Panel as well as Welsh Government

officials thought the process for awarding further funding through SCII+ had been consistent with the early funding rounds and had continued to work effectively. Most applicants for funding through SCII+ also believed the process worked efficiently.

However, other consultees said the selection process had not been strategic enough. They thought the operation had funded a large number of different research projects on the basis of their scientific excellence, but with insufficient regard paid to how this builds on HEIs' strengths and the potential to deliver economic and social benefits to Wales (although some accepted this had been given greater weight for the SCII+ awards). It should be noted that the criteria used to assess applications (according to the business plan) included 'enhancement of the research capacity in Wales' and 'enhancement of links from research to innovation and commercialisation'. Therefore, it is not true to say that these issues were not considered as part of the award process. However, it was the view of a number of stakeholders that they had not been given sufficient weight.

An important related point was that a number of the funded fellows' research was not strongly aligned with existing research groups in the host universities. This meant that these fellows lacked supervision and a supportive network around them, leaving several feeling isolated. Although all fellows were allocated a supervisor, these were often very busy and the model only appears to have worked where the fellow had colleagues who were invested in the fellow's success. It was reported that this needs to be considered more in any future selection processes; there should be more rigorous processes in place to ensure there is a 'good fit' between the fellow and the host university, and that there are clear supportive networks in place to ensure they can assimilate.

7.2.2. Role of Welsh Government in delivery

A number of university stakeholders believed that the resource constraints in Welsh Government and lack of scientific expertise had affected their ability to maximise the benefits and achievements of Sêr Cymru II. It was noted that, in the post-award stage, all of Welsh Government officers' time had been spent on process related issues such as monitoring, processing claims and trying to ensure that all funding was committed. Many believed this had come at the expense of communicating with grant recipients, discussing their research and progress, helping them to network and collaborate and to identify funding opportunities.

It should be noted that these duties were never intended to be the main responsibility of Welsh Government. Each fellow was given a supervisor in the host institution who was

responsible for guiding their research and supporting and facilitating their development. The main responsibility therefore lay with universities themselves.

This suggests there was some confusion about the roles and responsibilities of Welsh Government in the post-award phase, and the nature of their engagement with beneficiaries. This may have arisen because of a number of factors:

- Before the Programme Manager left their role, it was reported they engaged widely with the grant recipients. They regularly met with fellows, discussed their research and made introductions to others. Many university stakeholders saw this as a valuable role as the Programme Manager had a background in scientific research but also an understanding of Welsh Government and WEFO processes and could therefore offer good support and advice. They were also seen as being very passionate about the programme and keen to maximise its benefits. When this officer left and was not replaced, many stated that this was a loss to the programme.
- A number of consultees were comparing Sêr Cymru II to other funding programmes such as those awarded by UKRI and research councils where there are regular meetings to discuss the research, which is often constructive.

Nevertheless, there was a clear role for Welsh Government to monitor the performance of the programme and individual grant recipients to ensure they are making the progress expected. For example, in relation to Rising Stars, the business plan stated “the Delivery Team will monitor progress regularly and any issues that are identified will be managed accordingly, with advice taken from the independent Evaluation Panel and the PBB”. Consultees reported that this had happened in the early stages of the programme but was not sustained after the original Programme Manager left their role. It should be noted that the universities were often very delayed in submitting their quarterly reports which made the process of monitoring progress much harder for Welsh Government. Nevertheless, consultees from Welsh Government acknowledged that there was a lack of scientific expertise within the monitoring team that would have allowed them to carry out this role effectively.

The business plan also stated that Welsh Government would help to raise awareness of the programme’s achievements (see paragraph 0). However, both university stakeholders

and grant recipients reported that little had been done to promote or celebrate the successes of Sêr Cymru II, particularly since the pandemic^[footnote34]. This was cited as a lost opportunity; some consultees noted that Welsh institutions do not enjoy the same profile as HEIs in other parts of the UK. Sêr Cymru II offered a chance to rectify this by providing a platform for some of the outstanding work being carried out by Welsh universities, but this had not been seized. It was acknowledged by HEI stakeholders that the universities could do more to sell themselves. However they also believed there was an important role for Welsh Government to advocate on behalf of Welsh science.

7.2.3. The claims process

The administrative burden of SCII was a common concern raised by consultees from universities. Key issues raised included:

- Initially 100% of the evidence submitted with claims had to be fully audited. This was subsequently reduced to 40% but is 100% for the final claim.
- The processes for getting expenses approved (e.g. travel expenses) were longwinded and time consuming. Fellows were required to give three months of warning to get travel expenses approved.
- The systems and processes for providing evidence were onerous. To prove one salary for one month was reported to involve 12 sheets of paper. Uploading data and evidence to the indicator spreadsheet also took a long time when there were so many outputs.
- There was limited flexibility for funded fellows to reallocate funding from one activity to another (e.g. from staff costs to travel for conferences).

It was noted that the administrative requirements were unavoidable as these were necessary to ensure that Welsh Government was legally compliant with EU funding requirements. Nevertheless, it was clear that this presented a burden for all stakeholders, including:

- The delivery team in Welsh Government: Capacity issues meant there were delays in approving some claims, although this was often made worse by universities not providing the required evidence. Several

Footnotes

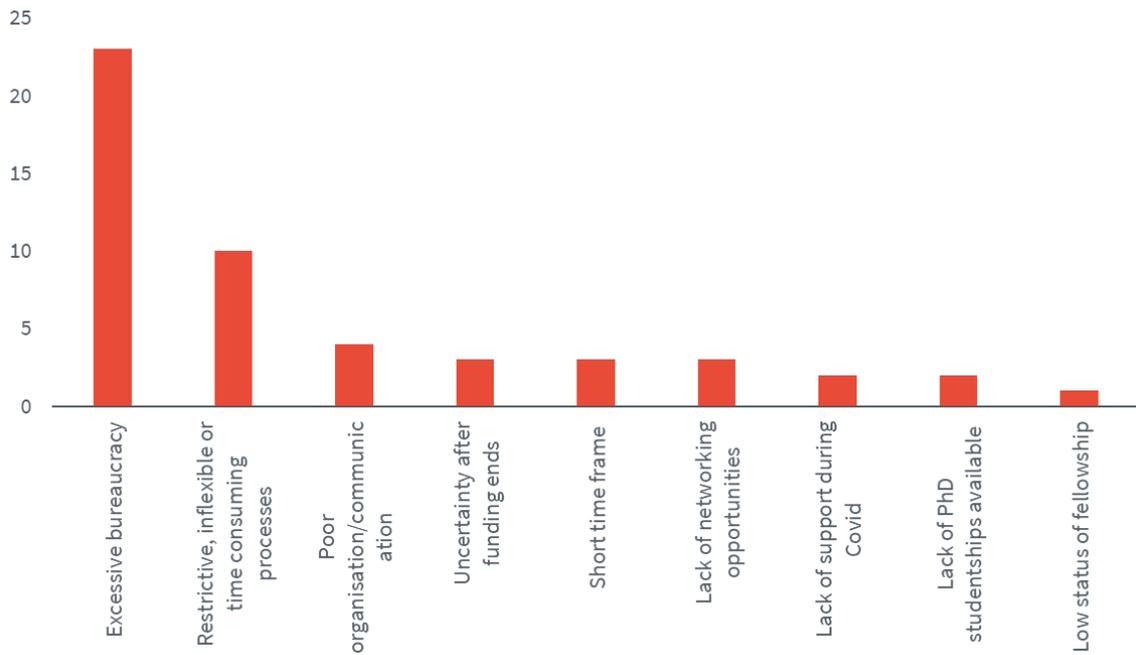
[34] A Sêr Cymru II celebration event was arranged before the pandemic

consultees described the team in Welsh Government as being completely overwhelmed.

The grant recipients: Many of the grant recipients were navigating EU funded schemes for the first time. This is evidenced by the beneficiary survey which found that “excessive bureaucracy” and “restrictive, inflexible or time-consuming processes” were the most common themes when asked “what was the worst thing about Sêr Cymru II?” (see

- Figure 7.3). Beneficiary interviewees were, however, very positive about the support they received from their host institutions when dealing with claims queries.
- Administrators in the host institutions (e.g. compliance and finance officers). Many reported that the requirements of the scheme had created an enormous workload, which in turn led to a number of the universities being very late to submit their claims. A further issue reported by universities was that no dedicated resources were made available for the administration of the scheme, so universities had to provide this themselves (although two payments with a total value of £290,000 were made to cover some of the costs).

Figure 7.3: What is the worst thing about Sêr Cymru II? (n=60)



Source: Sêr Cymru II Destination Survey

At its worst, this resulted in universities stopping submitting outputs because it was considered to not be worth the time spent on administration, with one stating "We have hit our targets. It is not worth our time to submit additional outputs because we will then have to go through a verification process and we don't need to prove more now". One of the academics that had received funding also said they had been advised by their host institution not to claim for outputs over and above their targets and this meant that the monitoring data held by Welsh Government "significantly under-estimates our achievements".

Others noted that the requirements became less stringent over time, with audit checks reduced to 40% of the evidence submitted with claims (although this was still considered to be too high) and more flexibility for claiming expenses. One consultee also noted that processes improved after Welsh Government introduced dedicated officers for each university, where previously it could be any officer raising queries about a university's claims. This change meant that the officer could become more familiar with the systems adopted by each university and that communications between Welsh Government and the universities was much clearer.

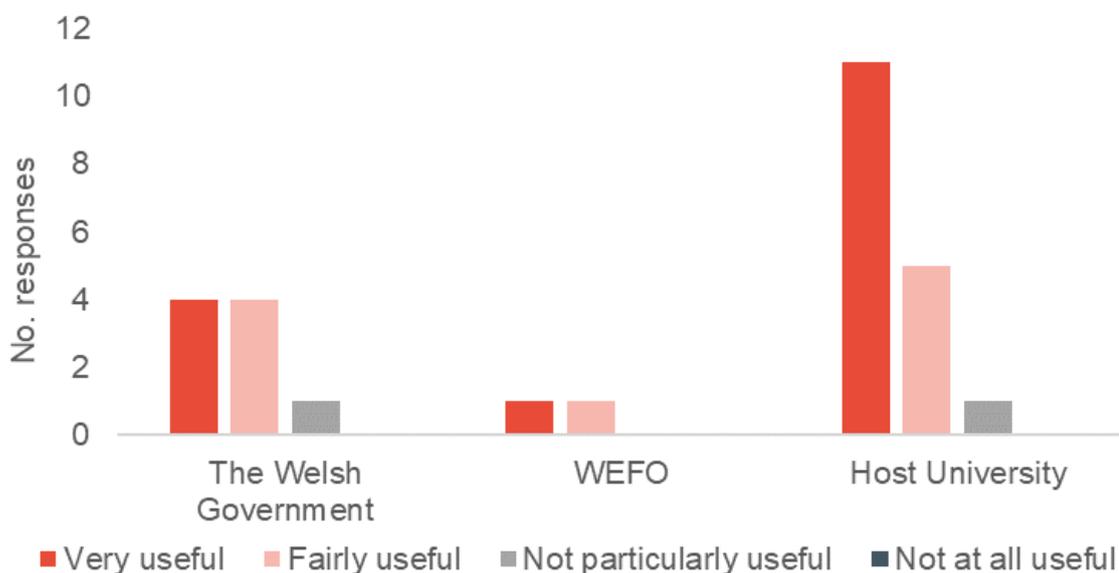
7.2.4. Training

Responses to the web survey of funded fellows shows most training was provided by host universities. 18 of the 19 respondents said they had received training from their host institution, which covered a wide range of topics including ‘getting started in teaching’, continued professional development (CPD courses), bid writing, research ethics, line manager training and research management. Nine said they had received training from Welsh Government, with subjects including public engagement, leadership training, networking and commercialisation. Only two respondents said they had received training from WEFO but did not provide details.

Overall, this training was well received by beneficiaries, particularly the training provided by universities, with eleven of the 17 respondents who answered the question saying this was “very useful” (see Figure 7.4).

Respondents were also asked what additional training they would have found useful (if any). Only seven provided a response, with the most common answer being further support with research grant applications (three responses) and management or leadership training (two responses).

Figure 7.4: Usefulness of training (n=19)



Source: Fellows web survey, OB3

Interviews with fellows and university stakeholders believed the training on offer from Welsh Government had decreased over time. Some noted that Welsh Government had initially been pro-active and forward thinking about training requirements; fellows were encouraged to identify the training that would be most beneficial to them. However the

officer responsible for planning and co-ordinating training provision had also left their role, and after that it was reported that relatively limited training had been offered to Sêr Cymru II researchers.

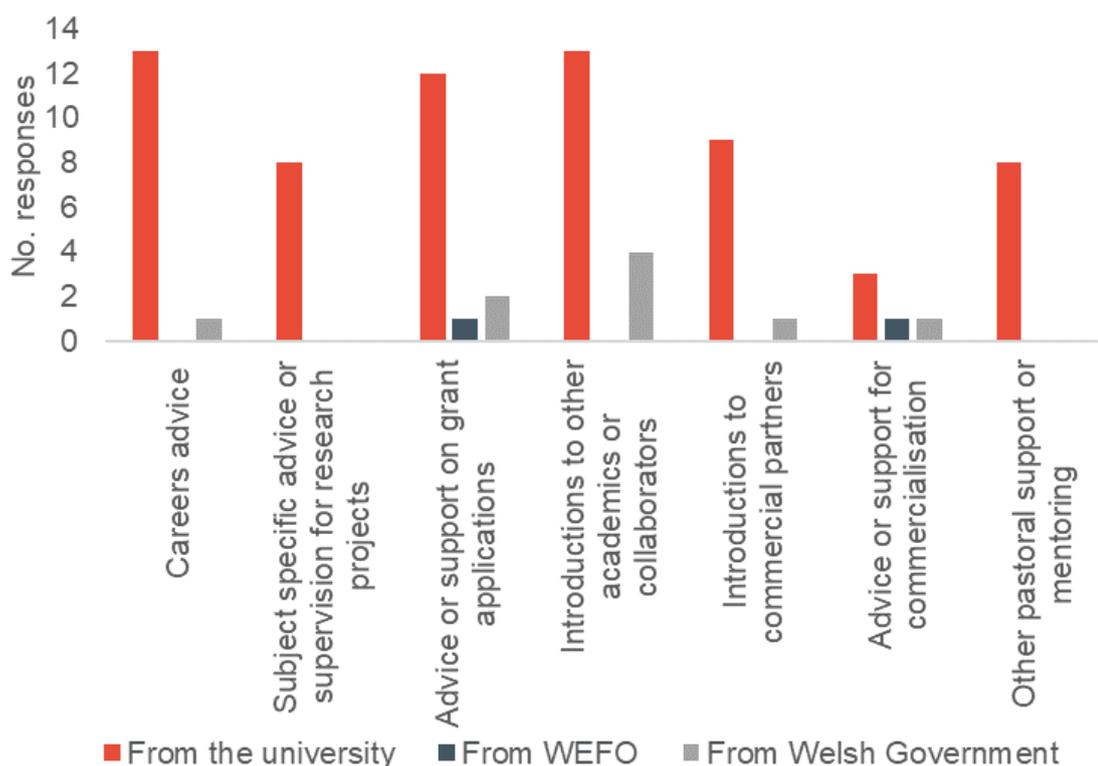
7.2.5. Other support for fellows

Fellows also reported receiving a wide range of other types of support, with the most common being introductions to other academics or collaborators (17 respondents), advice or support on grant applications (15 respondents) and careers advice or mentoring (14 respondents). In all cases, most fellows received this support from their host institution rather than Welsh Government or WEFO, which is to be expected.

It is perhaps surprising that only eight respondents (less than half) said they had received subject specific advice or supervision, given that all fellows were supposed to be given a supervisor. It is also notable that those who reported they had received this supervision were far more likely to say that their host university had managed the programme well. Seven of the eight respondents who received supervision said their university had managed the programme 'very well'. In contrast, only one of the eleven who did not receive supervision said it had been managed very well and three people said it had not been managed well. This highlights the importance that careful thought is given to who supervises fellows and that host universities ensure they are providing the necessary support and guidance.

The number of fellows that received other pastoral support or mentoring was also relatively low (eight respondents, seven of whom are the same respondents who reported receiving supervision). Again, there is a clear correlation between people who received this support and positive views about how well their university managed the process.

Figure 7.5: Types of support received (n=19)



Source: Fellows web survey, OB3

A high proportion of those who said they had received support from their host institution said this had been very useful or fairly useful.

Table 7.1: Usefulness of support received from host institutions (n=19)

	Very useful	Fairly useful	Not particularly useful	Not at all useful	Total
Careers advice	5	6	2	0	13
Subject specific advice or supervision for research projects	6	2	0	0	8
Advice or support on grant applications	6	5	1	0	12
Introductions to other academics or collaborators	6	6	1	0	13
Introductions to commercial partners	6	2	1	0	9
Advice or support for commercialisation	3	0	0	0	3
Other pastoral support or mentoring	4	4	1	0	9

Source: Fellows web survey, OB3

When asked what additional pastoral support fellows would have welcomed (if any), the most common response was access to a mentor, either within the department, external to the university or a past research fellow. This was consistent with responses to an open

question in the destination survey which asked: “how could Sêr Cymru II be improved?”. Better mentoring or support was the third most common answer (after reduced bureaucracy and more flexible processes), cited by nine respondents. This represents 15% of all responses to the destination survey. However this also included the SCII+ award beneficiaries and Research Chairs, many of whom are not early career researchers. If we restrict the sample to Research Fellows and Recapturing Talent beneficiaries, 29% identified a need for more or better mentoring. Example responses included:

- Recapturing Talent fellow: “Only by the final 6 months had I managed to understand how to submit appropriate applications and found somebody prepared to guide me through this process. I felt alone and unsupported by my host institution in terms of my career development”.
- Research Fellow: “If possible some sort of mentorship scheme would be very helpful. I have had access to mentorship programmes through my Royal Academy of Engineering funding and these have been very helpful in my development”.
- Research Fellow: “I think the programme needs to provide additional support in the form of 1 to 1 meetings throughout the programme to discuss progress, provide guidance and to help problem solve issues that the fellow is facing”.
- Research Chair: “do not allow ECR fellows to be left unsupported by their host institutions”.

This theme was also picked up in several consultations with university stakeholders and Research Chairs. Consultees emphasised the importance of mentoring in nurturing ECRs and reported that Welsh universities generally do not offer a supportive environment. On Sêr Cymru II they believed this has been “hit and miss”. As noted above, fellows who had been part of emerging or established research groups (often under Research Chairs) have been well-supported and nurtured. However those that are not part of these wider teams have received very little support.

7.2.6. Networking

As noted in paragraph 0, the business plan stated that the delivery team would arrange a number of events to help fellows build their networks and encourage collaboration.

There is good evidence that Sêr Cymru II has helped grant recipients to build their network:

- Of the 19 respondents to the online survey, 16 agreed or strongly agreed that the programme had helped them to widen their network (although two respondents strongly disagreed).
- 15 respondents to the destination survey (25%) mentioned collaboration or networking opportunities as one of the best things about Sêr Cymru II.

Nevertheless, a common theme in many of the interviews was the lack of networking opportunities with other Sêr Cymru II researchers and the limited number of programme events and conferences. Again, this is something which consultees said had started well but fallen away over time. Clearly the pandemic was a major factor here, as it meant there could be no face-to-face networking for a long period of time. However many were disappointed that none had been arranged since the pandemic.

This was reported to be a significant loss as the early events had been good for networking, but also celebrating the work of fellows and making them feel like they were part of an exciting and prestigious programme, which was more likely to make the most successful 'stars' stay in Wales. Again, this was pointed to as an example of how the operation has not met its full potential. One Research Chair described how the lack of any events had made it feel like the programme has been "winding down for some time". Another Accelerator Award recipient said the programme has "fizzled out without any fanfare. Lots of people wouldn't know it was still happening over the last couple of years, which is a shame because it was really exciting in the early stages".

7.3. Monitoring

7.3.1. Progress reports

All grant recipients had to prepare quarterly progress reports which were submitted to Welsh Government. The format and coverage of the forms changed over time, but included sections on financial progress, output progress, impact of research, sustainability of the research and CCTs. Consultees from Welsh Government reported that the forms were designed to be consistent with progress reports for other funders such as Research Councils.

Many fellows found the forms to be excessively onerous and a distraction from their research. 25% of the destination forms (15 out of 60) identify the quarterly reports as being "one of the worst things about Sêr Cymru", with several complaining about the requirements changing over time and the requirement to provide quarterly reports being too frequent. However, this was not the consensus view and was more common among early

career researchers than more experienced academics, who were more likely to accept it as a necessary condition of funding.

The responses to the web survey also show very diverse views on the appropriateness and relevance of the forms and reporting requirements (see Table 7.2). A majority of respondents understood why the information was required, agreed that the type of information was relevant and the frequency of reporting was reasonable. A majority also stated they received adequate guidance and support from Welsh Government and their host institution in meeting the reporting requirements. However there was a significant minority who disagreed with a number of these statements.

A major frustration for many was that many beneficiaries did not receive feedback or any follow-up on their quarterly reports, leading many to question what they were being used for. This was also mentioned by a large number of respondents to the destination survey when asked about the most negative aspects of Sêr Cymru II. For example, "preparing on average a 34-page document progress report once a quarter took a lot of time to prepare, and there was never any feedback or evaluation on the quality of the research that I had come to expect from funders and my time in industry".

Table 7.2: Views on monitoring requirements of Sêr Cymru II (n=19)

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
It was clearly explained why Welsh Government require this information	4	11	3	1	0
The type of information we were expected to provide to Welsh Government was relevant	2	8	8	0	1
The level of detail we were expected to provide to Welsh Government was reasonable	2	7	3	4	3
The frequency of reporting to Welsh Government was reasonable	1	10	2	3	3
I always received feedback or a follow-up from Welsh Government on the monitoring reports I submitted	2	2	4	4	7
I received adequate guidance from Welsh Government to meet the programme's reporting requirements	2	8	6	2	1
I received adequate guidance or support from my university to help meet the reporting requirements	5	6	4	1	3

Source: online beneficiary survey, OB3

Consultees contrasted their experience of Sêr Cymru II with that of other funding programmes such as the Science and Technology Facilities Council (STFC). Reporting is

less frequent, but there are regular progress meetings which include a representative from STFC with a scientific background. These were reported to be constructive meetings because the STFC is well-informed and interested in the science, but they are also helpful because the academics feel that their work and achievements are being recognised. This was considered to be missing from the Sêr Cymru II operation.

Again, this may reflect resource constraints in Welsh Government and the departure of key members of staff with a scientific background. The original Programme Manager for Sêr Cymru II reported that they read all of the monitoring reports in the early stages of the implementation period (the post-award stage), and this often resulted in follow-up, including introductions to other academics and invitations to relevant conferences and seminars. However it appears this was not sustained after this officer left the operation.

7.4. Conclusions

The evaluation has identified a number of areas where the management and delivery of Sêr Cymru II could have been improved.

A recurring theme was that the robust and effective leadership and management in place at the start of the operation was not sustained after the pre-award phase. This was critically influenced by the departure of the CSA who was in place when the operation was developed and the original programme manager, both of whom had played key roles in the design and early momentum of the operation. After their departure, the main focus of the delivery team was on administration of the operation and ensuring all funding was spent. The nature of EU funding requirements and the large number of awards meant this was a huge undertaking, and the challenge was compounded by the delivery team being under-resourced for long periods.

The focus of resources on administration came at the cost of maximising the strategic impact of Sêr Cymru II and engaging with the scientific research that had been funded. There was limited follow-up to progress reports and few meetings with Rising Stars and Research Chairs after the early phases of the operation. This meant Welsh Government lacked a clear sense of which awards were performing strongly and which were not, what further support was needed and how benefits could be maximised.

This also means opportunities were missed to celebrate the successes and achievements of Sêr Cymru II and use this to raise the profile of Welsh science. This is particularly important given Wales' poor track record of securing research income from UKRI and

Research Councils, and the UK government's commitment to increase spending on RD&I outside the South East of England.

The management and delivery review also raises questions about the criteria used to select projects. This placed significant weight on scientific excellence, but gave less consideration to how research builds on existing strengths, how it could contribute to Welsh Government objectives and how researchers could be embedded into existing research teams and support networks to maximise their chances of success. Given that resources will be more constrained on future rounds of Sêr Cymru, it is recommended that these considerations are given greater weight in future.

8. Outcomes and Impacts of Original Sêr Cymru II Awards

This section assesses the outcomes and impacts of the original Sêr Cymru II awards including Research Chairs, Rising Stars, Recapturing Talent, Research Fellowships and PMFs. These are assessed separately to the SCII+ awards, many of which have only recently completed meaning there has been less time for outcomes and impacts to have emerged. These are assessed in Chapter 10.

8.1. Impact assessment method and challenges

The aim of impact evaluation is to assess the *additional* outcomes and impacts that can be attributed to a policy or programme. There are two main methods for doing this:

- Counterfactual impact evaluation (CIE): these methods compare the change in outcome and impact indicators after an intervention with what would have happened in the absence of that intervention. In economic development interventions this is often done using quasi-experimental techniques which compare the change in outcomes for beneficiaries (the treated group) with a group of individuals that did not receive support but who are as similar as possible to the treated group (the control group).
- Theory based approaches: these draw conclusions about an intervention's impact through rigorous testing of whether the causal chains thought to bring about change are supported by sufficiently strong evidence. This is a less robust approach to measuring attribution and additionality than quasi-experimental methods, but is often the only technically feasible option due to the nature of the intervention or limitations of the available datasets.

The research objectives for the evaluation of Sêr Cymru II specify that the impact assessment should include a counterfactual analysis of the operation's impacts on research quality and capacity.

The inception evaluation for Sêr Cymru II considered some of the challenges in using CIE methods and recommended the most appropriate and feasible approach to assessing the impact of the operation. This concluded that it may be possible to use CIE to assess the impacts of Sêr Cymru II on some outcome indicators, namely the number of research publications and citations (as a proxy for the quality of the research), but this would be dependent on gaining access to the Scopus database. This is a commercial database of bibliographic data owned by Elsevier containing detailed information on individual

researchers, including their characteristics, publishing record and affiliations with institutions. The inception evaluation stated that this could be used to construct a control group of researchers who have similar characteristics to Sêr Cymru II fellows, and to compare the number of research publications and citations achieved by both groups over time.

However, the database does not include comprehensive information on research grants^[footnote35], meaning it is not possible to assess this without cross-referencing or supplementing Scopus with other data sources. While it is straight forward to obtain grant information for grant recipients (from project monitoring data), this is more challenging for researchers in the control group; HESA researcher income is not available at the level of individual researchers or research groups.

The evaluators have revisited this topic as part of the final evaluation, including further discussions with Elsevier and Welsh Government evaluation leads. Although this identified some methods for estimating research income (e.g. by matching researchers to published information on the various awards made by funding bodies) this information is not available for all funding bodies so would only be a partial assessment. It may also introduce bias to the assessment; for example, if a Sêr Cymru II researcher and a comparator won the same amount of research income but the Sêr Cymru II researcher won a higher proportion of their income through sources where awards data is published, it would give the misleading impression that they have performed better than the comparator. Other potential options included a survey of researchers in the control group to collect information on how much research income they have secured. This was not feasible within the budget of the evaluation and, in any case, is likely to have resulted in a low response rate.

8.2. Impacts on research income and numbers of researchers

8.2.1. Method

Given the challenges described above, the evaluation has instead used the approach recommended in the inception evaluation for assessing impacts on research income. This was based on a comparative benchmarking exercise at the level of individual STEM subject areas in HEIs. This approach compares the change in research income over time (before and after the Sêr Cymru II operation) in subject areas that have received support

Footnotes

[35] Scopus does include information about awarded grants at individual researcher level. However, this element of the platform is a relatively new feature and is offered in 'Beta' status.

with comparators across the UK, and assesses whether there is a significant difference which can be attributed to Sêr Cymru II.

The following criteria were used to identify comparators:

- Research income for the subject area^[footnote36] at the start of the operation. This has used the total research income over the period 2015/16 to 2016/17 according to HESA data. A two year period is used as the level of research income in some subject areas can experience large fluctuations from year to year.
- REF ranking for the relevant subject area, using REF 2014 (the most recent before the start of Sêr Cymru II).

HEIs were ranked for each of these indicators and the percentile rank calculated. The evaluation then aimed to identify comparators that were within ten percentiles of the supported HEI for each of the indicators. Where this was not possible, for example where a university's 2014 REF ranking was much higher than the ranking for research income and number of researchers, this was widened to 15 percentiles.

The evaluation also tried to match on the basis of:

- the number of research staff in relevant subject areas at the start of the Sêr Cymru II period.
- past trends in research income. This is important for this type of analysis as the method assumes that, without Sêr Cymru II, the HEIs in Wales and matched institutions would follow the same trend in research income.

It was not possible to match on the basis of the number of research staff as access to this data at this level of detail is more restricted and it was only possible to access the data for HEIs in Wales via HEFCW and not for comparator institutions in other parts of the UK.

In relation to past trends in research income, it proved very challenging to identify comparators that satisfied this criterion in addition to having a similar baseline level of research income and quality. It was also not possible to access data for HESA cost centres (subject areas) for academic years before 2015/16.

While trends in research income have not been used to identify comparators, the analysis below does show the trend from 2015/16 onwards. Although the Sêr Cymru II operation

Footnotes

[36] This uses HESA cost centres

started in the 2016/17 academic year, the monitoring data shows that the funded projects did not start generating significant amounts of research income until the 2019/20 academic year. Therefore any change in research income before then is unrelated to Sêr Cymru II and can be used to compare the trajectory of supported and comparator institutions.

This benchmarking approach has a number of limitations including, but not confined to, the following. Due to the nature of HESA data it is only possible to undertake the analysis at a more aggregated level than the level at which support has been provided (for subject areas rather than individual researchers or research groups). In this context, the more aggregated the level of assessment gets, the more difficult it becomes to disentangle the different factors influencing change in research income and attributing change to Sêr Cymru II.

The method also does not control for the other interventions which could influence changes in research income in Wales (e.g. other ERDF interventions delivered through Priority Axis 1 of the WWV and EW Operational Programmes). This means that any differences in the change in research income between supported HEIs and comparators could be due to reasons other than Sêr Cymru II. The method is therefore less robust than matched control group approaches undertaken at the level of researchers.

Finally, time-lags in publishing HESA data mean it is only possible to assess changes in research income up to the 2021/22 academic year. Time-lags are even longer where the research grant was for capital investment as the income is only recorded when the asset is capitalised (i.e. when the infrastructure becomes an asset on the university's balance sheet rather than a liability). This means that major research grants such as for CISM (£30m grant from the Research Partnership Investment Fund) will only appear in HESA's financial tables in 2022/23 and are therefore missing from the analysis below.

8.3. Results for research income

The analysis of changes in research income has focused on those subject areas in HEIs where we would expect to see an additional effect as a result of Sêr Cymru II i.e. those subject areas where funded researchers have secured large amounts of research income according to the monitoring data. This includes:

- Biosciences at Cardiff University, home to the Research Chairs which established the MDI.
- Physics at Swansea University, home to the Sêr Sam research group established by the Research Chair which also includes one of the Rising

Stars and a Capacity Building Accelerator Award (although the latter did not secure any research income).

- Engineering at Bangor University, which includes the Nuclear Futures Institute established by the Research Chair. This has also received funding for a Strategic Partnership Accelerator Award and an Infrastructure Accelerator Award, although most of the income secured by the latter was in 2022/23.

The evaluation also analysed change in veterinary science at Aberystwyth University. This is home to the Chair in Bovine TB which secured over £3m in research income to date. However the HESA data shows no research income in this cost centre for any year. This is for the following reasons:

- £1.9m of the income was a capital grant from Welsh Government in 2019/20 which will only appear in financial tables when the asset is capitalized in 2022/23.
- £1.7m was only awarded in 2022/23 and therefore does not appear in the HESA data yet.

8.3.1. Bioscience at Cardiff University

Table 8.1 shows the comparators identified for biosciences at Cardiff University based on their starting research income and REF ranking in 2014.

Table 8.1: Comparators for Bioscience at Cardiff University

	Research income 2015/16 to 2016/17		REF ranking for Biosciences, 2014	
	Total (£000)	Percentile rank	Rank	Percentile rank
The University of Leeds	27,837	16%	15	34%
The University of Sussex	24,937	18%	10	23%
Cardiff University	23,655	19%	13	30%
The University of St. Andrews	18,953	21%	16	36%
The University of Leicester	17,560	23%	16	36%
The University of Birmingham	17,410	24%	14	32%

Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#). REF data downloaded from [REF 2014: results by subject | Times Higher Education \(THE\)](#)

Figure 8.1 compares the change in research income for biosciences at Cardiff University and comparator institutions. This is presented as an indexed line chart where 2018/19 = 100. This is because the vast majority of research income secured by Sêr Cymru II funded researchers was secured from 2019/20 onwards. 2018/19 can therefore be treated as the baseline year^[footnote37]. The data for earlier years is shown to compare the trend in research income at these institutions before the operation started generating research income.

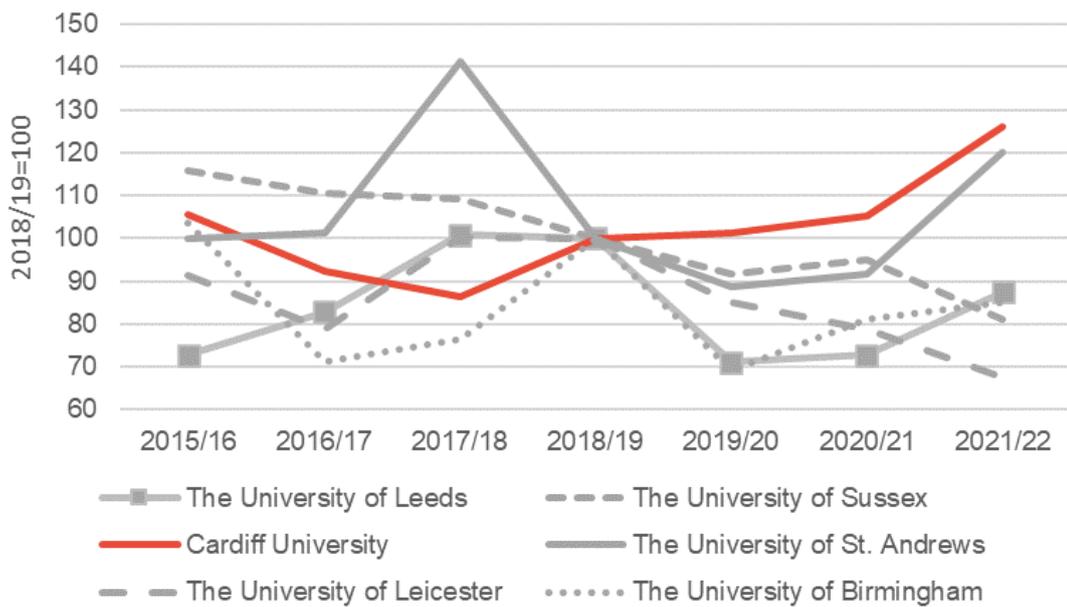
In this case, it shows that all of the institutions were on a very different trajectory in terms of research income prior to 2018/19, with several experiencing large fluctuations from year to year. This is quite typical for HESA data at this level of analysis, which makes it very difficult to identify comparators on a similar trend to Cardiff University.

Nevertheless, it shows that biosciences at Cardiff University experienced a significant increase in research income between 2018/19 and 2021/22 (+26% or nearly £5m). This was higher than all of the comparator institutions, all but one of which experienced a fall in research income over the same period.

Footnotes

[37] Research income from 2019/20 will have been affected by the Covid pandemic. Although all universities will have been affected by the pandemic, the impact on research income is likely to vary depending on the nature of research and the extent to which this was affected by the measures put in place to stem the spread of the virus. However it is very difficult to control for this in this analysis.

Figure 8.1: Indexed change in research income in biosciences at comparator institutions, 2015/16 to 2021/22 (2018/19 = 100)

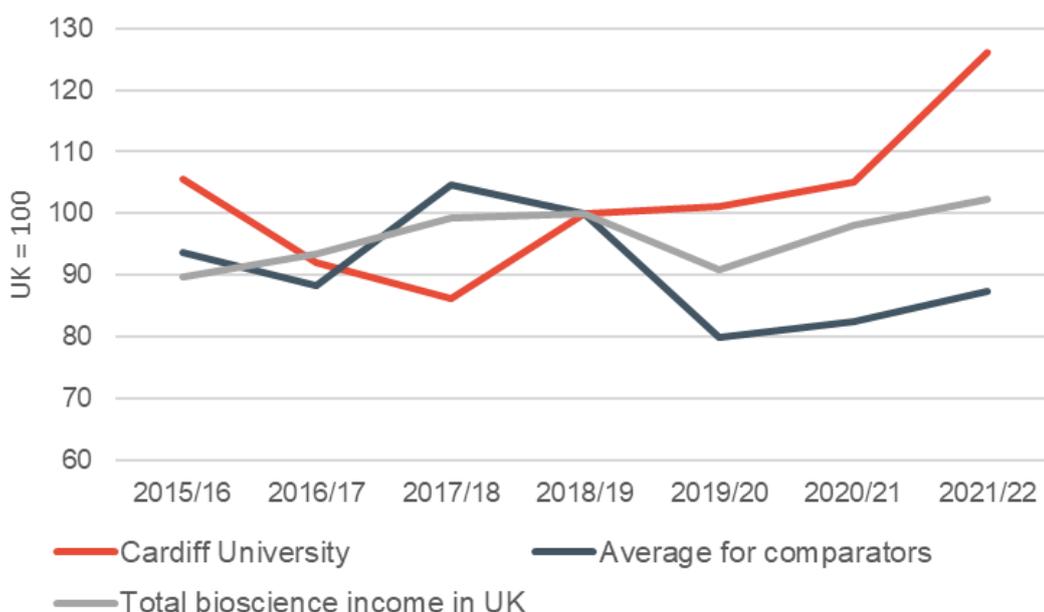


Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

Figure 8.2 compares Cardiff University’s performance with the mean average for all of the comparator areas and the total change in bioscience research income for all institutions in the UK. It shows that the change in research income was substantially higher at Cardiff University than either of these comparators (38 percentage points higher than the change in comparator institutions and 24 percentage points higher than the average for all institutions).

This provides some evidence that Sêr Cymru II has had an additional effect on research income in biosciences at Cardiff University. That is, the change in research income is likely to have been substantially lower in the absence of the operation. However, this would need to be tested with Cardiff University to understand whether there are other factors which could explain the strong performance.

Figure 8.2: Indexed change in research income in biosciences compared to averages, 2015/16 to 2021/22 (2018/19 = 100)



Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

8.3.2. Physics at Swansea University

As noted above, a substantial proportion of the research income secured by the Research Chair at Swansea University (£30m) has been for CISM, a capital investment which will not appear in HESA’s financial statements until 2022/23^[footnote38]. This leaves £8m which should appear in HESA data.

However, a further challenge is that it is unclear which HESA cost centre the research income secured by Sêr Sam is allocated to. Although the research group is based within the Physics Department, the Research Chair noted that the research income could have been allocated to a number of different cost centres including general engineering, chemistry, electrical and electronic engineering and materials engineering. The last three of these can be ruled out as the HESA data shows either no research income or minimal research income for each cost centre at Swansea University.

This means the income is likely to have been allocated to either physics or general engineering. If the latter, it may be difficult to assess the impact of Sêr Cymru II on research income through the approach described above. This is due to the large amount of research income allocated to general engineering at Swansea University and the fact that it

Footnotes

[38] As noted on page 74, this income was secured from UKRPIF which is co-funded by HEFCW, a Welsh Government sponsored body. Therefore it is not external funding and may not be recorded as such in financial statements.

fluctuated significantly over the study period. For example, research income increased from £24m in 2017/18 to £45m in 2018/19 and then decreased again to £25m in 2019/20. This may be explained by a large capital research grant which was capitalised in 2018/19. These large fluctuations make it difficult to assess the changes which can be attributed to Sêr Cymru II.

For this reason, the analysis has only been undertaken for physics. Table 8.2 shows the comparators identified for this cost centre based on the baseline level of research income and the REF ranking for 2014.

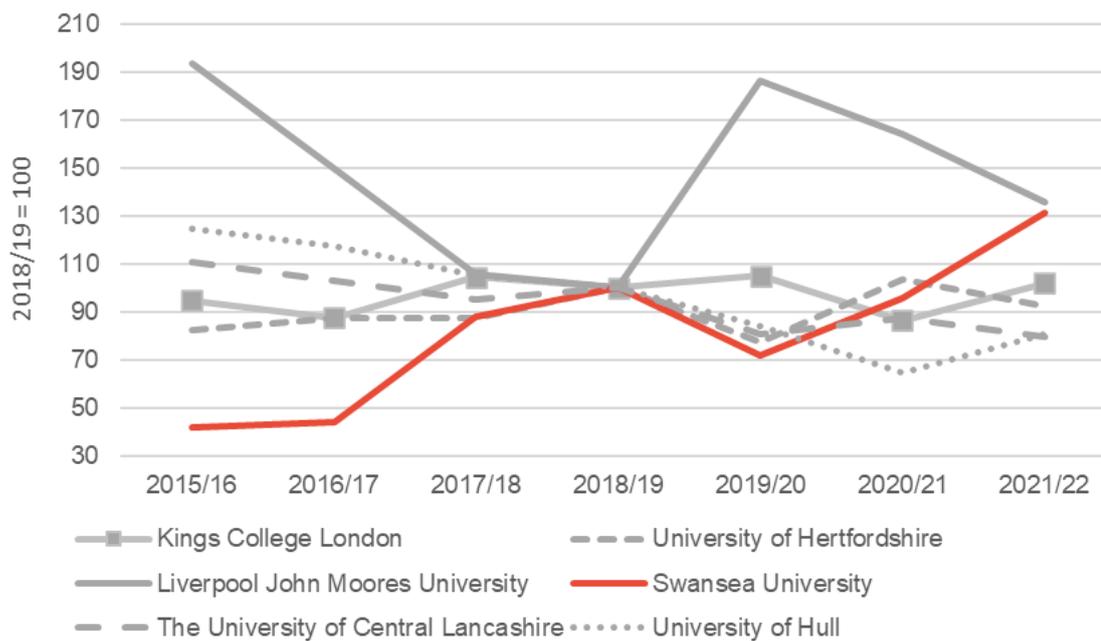
Table 8.2: Comparators for physics at Swansea University

	Research income 2015/16 to 2016/17		REF ranking for Physics	
	Total (£000)	Percentile rank	Rank	Percentile rank
Kings College London	6,089	62%	30	68%
University of Hertfordshire	3,790	67%	36	82%
Liverpool John Moores University	3,521	72%	28	65%
Swansea University	2,512	74%	35	80%
The University of Central Lancashire	1,559	83%	38	86%
University of Hull	848	89%	30	68%

Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#). REF data from [REF 2014: results by subject | Times Higher Education \(THE\)](#)

Figure 8.3 shows research income in physics at Swansea University increased by 30% between 2018/19 and 2021/22 (from £2.9m to £3.5m). This increased at a faster rate than all comparators except Liverpool John Moores University (although the level of research income at this institution is prone to large fluctuations from year to year). It should be noted however that research income started from a low base and was already on an upward trajectory prior to 2018/19, suggesting other factors could explain the rise.

Figure 8.3: Indexed change in research income in physics at comparator institutions, 2015/16 to 2021/22 (2018/19 = 100)



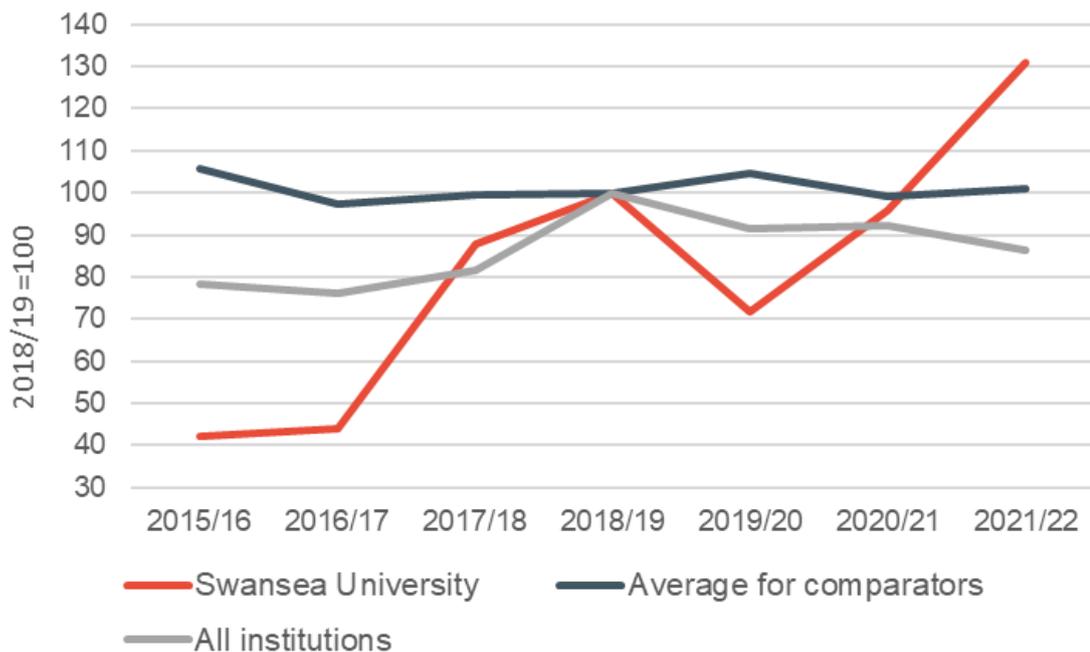
Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

Figure 8.4 shows research income in physics at Swansea University increased at a faster rate than the average for all comparators and all institutions in the UK.

Again, this offers some evidence that Sêr Cymru II has resulted in net additional research income in key subject areas that would not have occurred in the absence of the intervention. However, again, this would benefit from cross-checking with the physics department at Swansea University about the other grants secured over this period and whether the increase is likely to be due to Sêr Cymru II.

It should also be noted that, in this case, there is added uncertainty about where research income has been allocated. The Research Chair has been awarded a number of different research grants which may have been allocated to different cost centres. If a large proportion of the research income was allocated to general engineering, other factors are likely to explain the increase in research income in physics.

Figure 8.4: Indexed change in research income in physics compared to averages, 2015/16 to 2021/22 (2018/19 = 100)



Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

8.3.3. Engineering at Bangor University

There is also some uncertainty about the exact cost centre that income secured by the Research Chair at Bangor University was allocated to. This Research Chair has established the Nuclear Futures Institute focused on nuclear science and engineering. However, given the nature of the research grants, there is confidence that income will have been allocated to one of the engineering cost centres. Therefore the analysis focuses on engineering as a whole.

Table 8.3 shows the comparators for engineering at Bangor University. There were fewer comparators in this case as it was more difficult to identify comparators that were similar in respect of the ranking for starting research income and REF ranking.

Table 8.3: Comparators for engineering at Bangor University

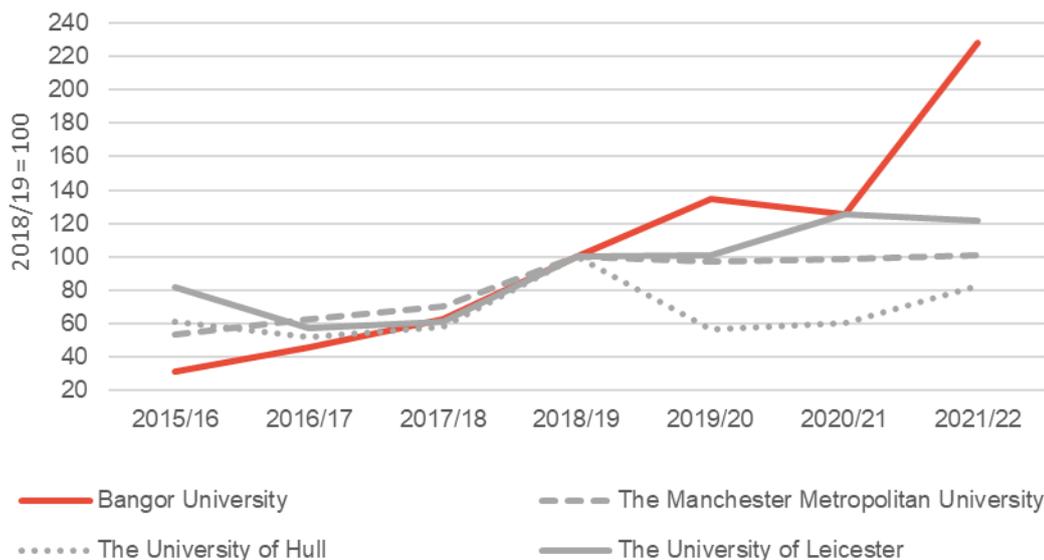
	Research income 2015/16 to 2017/18		REF ranking 2014	
	Total (£000)	Percentile rank	Rank	Percentile rank
The University of Leicester	4,355	53%	33	37%
The Manchester Metropolitan University	3,977	58%	50	56%
The University of Hull	3,504	60%	44	49%
Bangor University	3,225	64%	39	44%

Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#). REF data from [REF 2014: results by subject | Times Higher Education \(THE\)](#)

Figure 8.5 shows research income from engineering more than doubled at Bangor University between 2018/19 and 2021/22, increasing from £2.3m to £5.3m. This was significantly higher than all comparator institutions. The chart shows that income from engineering was already on an upward trajectory at Bangor, however the same is also true of a number of the comparator institutions.

The monitoring data shows that the Chair secured £3.0m in research income, all of which was awarded in 2021/22. This is consistent with the HESA data which shows a large increase in 2021/22.

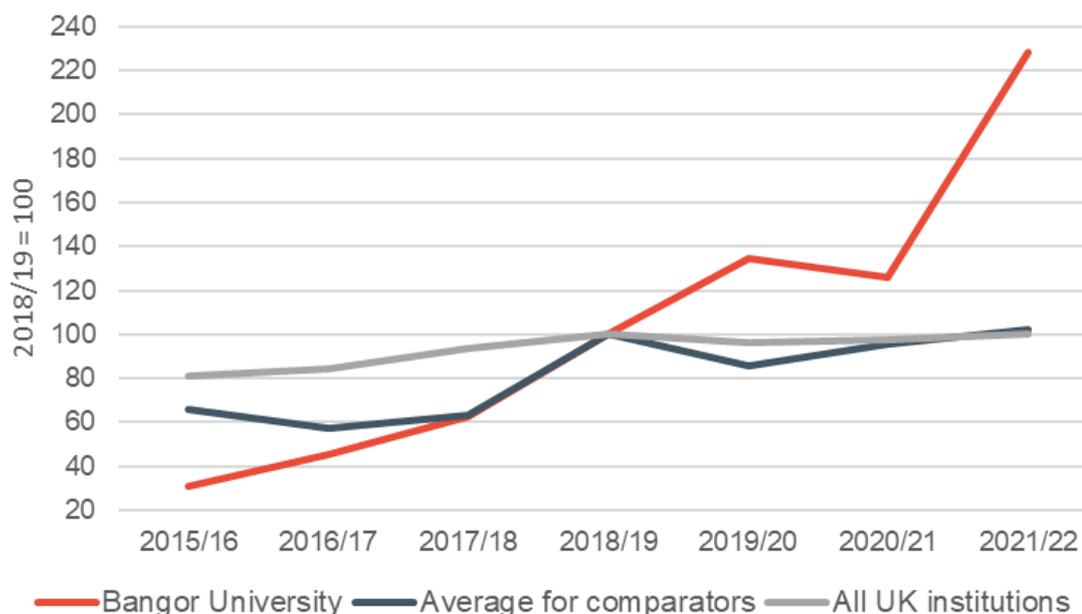
Figure 8.5: Indexed change in research income in engineering at comparator institutions, 2015/16 to 2021/22 (2018/19 = 100)



Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

Figure 8.6 shows the increase in research income from engineering at Bangor between 2018/19 and 2021/22 was substantially higher than the average for comparators and the average for all UK institutions. It is likely that a high proportion of this can be attributed to Sêr Cymru II and would not have occurred in the absence of the intervention.

Figure 8.6: Indexed change in research income in engineering compared to averages, 2015/16 to 2021/22 (2018/19 = 100)



Source: Research grants and contracts – breakdown by source of income and HESA cost centre. Downloaded from: [What is the income of HE providers? | HESA](#)

8.4. Results for research staff

It has not been possible to undertake a similar analysis for changes in the number of researchers over the same time period. This is because it has not been possible to access the data for comparator institutions in other parts of the UK.

Instead the evaluation has analysed the change in the number of researchers in relevant subject areas and compared this to the UK average.

8.4.1. Cardiff University

Given the nature of awards and fellowships undertaken at Cardiff University, we would expect impacts on the number of researchers to be most significant (and detectable) in the bioscience and clinical medicine subject areas. The monitoring data shows there were 75 new researchers in these two subject areas at Cardiff University, accounting for 81% of these outputs, although not all of these will still be employed at Cardiff.

However the HESA data shows that these subject areas experienced a decrease in the number of researchers over the Sêr Cymru funding period. In bioscience, the number of staff on research or research and teaching contracts decreased by five FTEs^[footnote39]

Footnotes

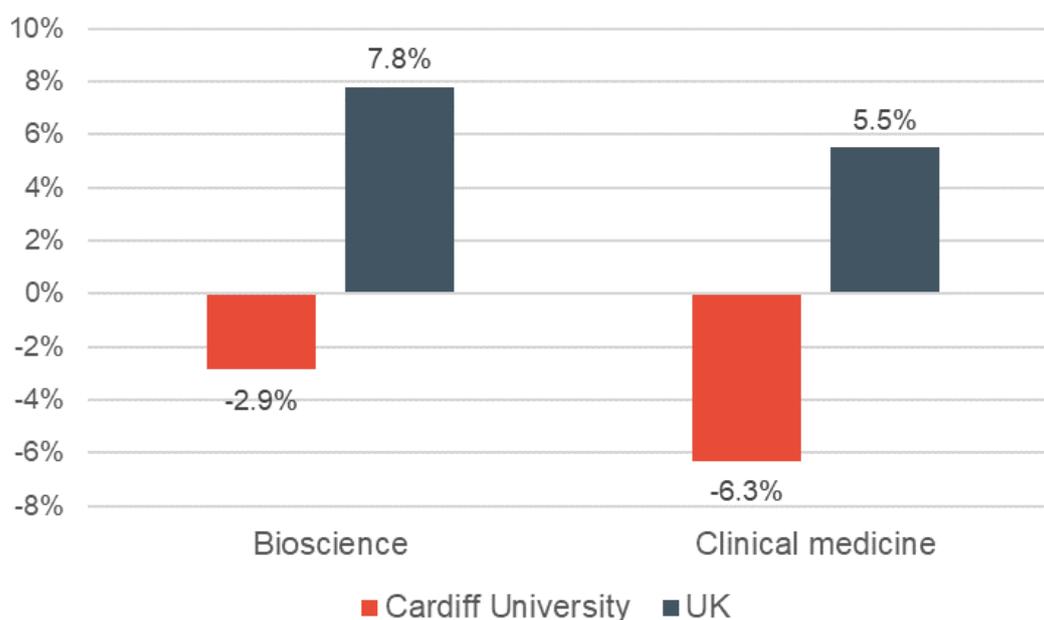
[39] HESA data on research staff is rounded to the nearest 5 for disclosure reasons

between 2017/18 and 2021/22, or -3%. The number of research staff in clinical medicine decreased by 30 FTEs or -6%. This compares unfavourably to the average for all institutions in the UK where the number of bioscience researchers increased by 5% and the number of clinical medicine researchers increased by 7%.

This suggests that any gains in research capacity, for instance at the MDI, have not been great enough to offset the loss of other researchers in the same subject areas. However this does not mean that Sêr Cymru II has not had an additional effect; consultees from Cardiff University were clear that the Research Chairs have assembled large teams of researchers that would not have happened without the Sêr Cymru funding. This suggests that the loss of research staff would have been higher were it not for Sêr Cymru II, meaning the intervention has still had an additional effect.

However, further engagement with the relevant departments would be needed to a) verify that the data is correct and b) understand the factors which explain these trends, and why Cardiff University has been more negatively affected than other institutions in the UK.

Figure 8.7: Change in number of research staff, 2017/18 to 2021/22



Source: HESA data provided by HEFCW

8.4.2. Swansea University

The monitoring data shows Swansea University recruited fewer researchers than Cardiff (28.5 FTE new researchers compared to 75 at Cardiff University) and these have been spread across a wider range of subject areas, including physics, bioscience, chemistry, clinical medicine and a number of engineering disciplines. Furthermore, at least eight of

these are no longer employed at Swansea University according to their web profiles. This makes it more difficult to assess the impact of Sêr Cymru II on the number of researchers. Any effects are likely to be most detectable in physics, the department which hosts Sêr Sam. The monitoring data shows there are 11.5 new FTE researchers in this research group and the Chair confirmed that these could not have been achieved without the Sêr Cymru II operation. This suggests that all of the roles are additional.

According to the HESA data, the number of researchers in the physics cost centre at Swansea University increased by 5 FTEs (from 35 to 40 FTEs) between 2017/18 and 2021/22. This represents an increase of 14% which is higher than the 10% increase for the UK as whole. It should be noted, however, that this comparison is less meaningful given the low base and the fact that all FTEs are rounded to the nearest 5 in HESA data. Nevertheless it provides some evidence that Sêr Cymru II has made a modest additional contribution to research capacity at Swansea University.

Consultees noted some factors which had made it difficult to retain researchers in this research group. They noted that all of the COFUND fellows that had been part of this group were not offered roles at the university after the funding period ended despite the efforts of the Chair. This was reported to be due to financial challenges facing Swansea University.

8.4.3. Bangor University

The monitoring data shows almost all of the new researchers at Bangor University^[footnote40] were achieved by the Research Chair (21) and therefore should be allocated to an engineering cost centre. Again the Chair confirmed that these could not have been achieved without the Sêr Cymru II funding, suggesting that all of these roles are additional.

According to HESA, the number of research staff in engineering increased from 35 to 55 (+20 or 57%). This is much higher than the average for the UK (+11%), although caution is needed when comparing these due to the low base for Bangor.

This suggests Sêr Cymru II has had an additional effect on engineering research capacity at Bangor University.

Footnotes

[40] There was one other research fellow at Bangor but they are no longer employed at the university.

8.4.4. Aberystwyth University

The monitoring data shows there are 14.6 new FTE researchers at Aberystwyth University, 8 of which were achieved by the Chair in Bovine TB. Again, they confirmed that none of the new roles could have been created without the Sêr Cymru II funding.

It would be expected that these roles would be allocated to veterinary science, however this cost centre shows no researchers at Aberystwyth. This suggests the jobs have been allocated to a different cost centre; most likely bioscience. The data for biosciences shows a fall in the number of researchers, from 125 to 100.

This means any increase in employment due to the Chair has been offset by a fall in research posts in other areas. Nevertheless, the fact that the Chair reports none of these roles would have been created without the research funding suggests they are additional.

8.5. Other impacts achieved by Research Chairs

8.5.1. Profile raising and reputation benefits

Several consultees from HEIs believed the Chairs had raised the profile and reputation of the university or specific departments, noting the high volume of research publications many of which have been in top international journals and contributing to universities' REF submissions.

Consultees believe Sêr Sam at Swansea University is one of the leading research groups in the world for sustainable advanced materials research. This is evidenced by its state-of-the-art facilities, its strong track record of publications in peer reviewed journals and collaborations with leading researchers and institutions from around the world including the University of Queensland, the University of Cambridge, the University of Oxford, Imperial College London, and the National Physics Laboratory. The Chair has been recognised for their achievements by being appointed to the EPSRC Strategic Advisory Network and has been awarded an OBE for services to Semiconductor Research and Innovation. The successful award for CISM was also reported to have further enhanced Swansea's reputation for being a leader in cutting edge engineering research, which will help to attract more funding, industry partners and students.

Similarly, the Chairs in Bovine TB at Aberystwyth and Nuclear Energy at Bangor were considered to have put their respective universities "on the map" for these subjects. The Chair in Bovine TB is a globally recognised expert in the subject and an expert advisor to the UK government, which consultees believed would increase the university's profile and attractiveness to students. Consultees were equally positive about the Nuclear Futures

Institute and the credibility this has gained in the nuclear industry. This was evidenced by the fact that the Institute is in discussions with industrial partners to provide half the funding for a number of academic positions.

Related to this, both Aberystwyth and Bangor Universities have introduced new undergraduate degree courses, in veterinary science and engineering respectively, to build on the success of the Chairs and their enhanced profile.

8.5.2. Commercial and economic benefits

Although it is too early for the economic impacts of Sêr Cymru II to have emerged, a number of stakeholders pointed to some of the longer term commercial and economic opportunities related to the work of the Research Chairs. This includes:

- The MDI has been granted a number of patents for new treatments, including for a potential new treatment for schizophrenia which has now successfully completed the first phase of a Phase 1 clinical trial.
- Sêr Sam has developed close links with the semi-conductor industry in South Wales, one of the fastest growing sectors in Wales and a key priority for both the UK and Welsh Government. The development of CISM, which is supported by a number of industry partners, will play a key role in supporting research and innovation for these companies and will provide an added competitive advantage for semiconductor manufacturing in the region.
- The ARTHUR project, being led by Welsh Government Office for Science, with input from the Nuclear Future Institute, would see the creation of a public sector national laboratory for the supply of medical isotopes, needed for the diagnosis and treatment of diseases such as cancer. This would be based in North Wales and would bring substantial economic benefits for the region, including creation of many high skilled jobs. This has been identified as a priority project by the Welsh Government although it is conditional on receiving funding from the UK government.

8.5.3. Legacy benefits

All of the Research Chairs have been retained now that the Sêr Cymru II programme has finished and have secured further funding that will allow them to continue to build on their

research and that of their research groups. Stakeholders believe this will leave a lasting and sustainable legacy from Sêr Cymru II.

8.6. Impacts on quantity and quality of research

8.6.1. Method

The method used to assess impacts on the quantity, breadth and quality of research by Ser Cymru II researchers combines two statistical techniques; matching and difference-in-difference (DiD) analysis^[footnote41]:

- Matching is a technique used to create a comparable control group for a group who have received some form of support or intervention (the treatment group) using data on their observable characteristics. It aims to balance these characteristics so they are as similar as possible to the treatment group. In this case, the characteristics included the gender of the researcher, the number of years of experience, the similarity of the affiliated institution, the research interests and the number of publications prior to the start of the Ser Cymru II programme.
- DiD is a method used to estimate the causal effect of a treatment, policy or intervention by comparing changes in an outcome variable over time between a treatment group and a control group. The key assumption is that, in the absence of the treatment, the two groups would follow parallel trends over time.

Combining these techniques can improve the robustness of control group analysis. By introducing a time element through DiD, it provides a way of controlling for unobservable differences between treatment and control groups that cannot be addressed through matching alone.

The analysis focused on the following outcome variables:

- Number of research articles published per researcher per year
- The number of subject areas in which a researcher's publications have appeared

Footnotes

[41] A detailed method statement is provided in Annex A

- Number of publications in journals which are ranked in the top 10% of journals by CiteScore
- Percentage of publications in journals ranked in the top 10% by CiteScore
- Number of publications that are in the top quartile for citations in a given year.
- Percentage of publications in the top quartile for citations.

The DiD analysis compares change in these variables over two time periods relating to the commencement of the Ser Cymru Programme in 2016:

- Pre-treatment: the average over the period 2012 to 2015
- Post-treatment: the average over the period 2016 to 2022.

The DiD is estimated by first calculating the difference between the pre-treatment annual average and the post treatment average for each group (the control group and the treatment group). This is the first difference. Then calculating the difference between these two figures (the second difference):

DiD = (post treatment average of treatment group - pre-treatment average of treatment group) - (post treatment average of control group - pre-treatment average of control group)

If the DiD is positive it indicates that the treatment had a positive effect on the outcome compared to the control. If this difference is statistically significant (e.g. at the 1%, 5% or 10% level), this means it is unlikely to have occurred by random chance alone. This increases the statistical confidence that the treatment had an additional positive effect (i.e. there was an additional impact which can be attributed to Sêr Cymru II) which would not have been achieved in the absence of the programme.

The analysis was undertaken for all of the original Ser Cymru II grant recipients (including Research Chairs, Rising Stars, Recapturing Talent, Precision Medicine Fellowships and Research Fellowships). However the results below exclude Research Chairs from the analysis^[footnote42]. This is because:

- Research Chairs are all highly experienced professors, and therefore have different characteristics to other Sêr Cymru II fellows, the majority of whom are in the earlier stages of their career.

Footnotes

[42] The full results including Research Chairs are included in Annex A

- Research Chairs already had a very high publication rate prior to the start of the programme (ranging from 7 to 9 articles per annum compared to only 1 to 2 articles per annum for other fellows). They were therefore starting from a higher base and there is likely to be a limit to how many additional publications they could contribute to, given their resource constraints.
- Although the number of research publications and citations is an important success measure for all Sêr Cymru II participants, it is arguably more aligned with the objectives for non-chair fellowships which were focused on attracting stellar researchers and supporting them to develop their research capabilities. The main goal of Research Chairs was to build new research teams and attract new research funding for their host universities which could reduce the rate of publications in the short to medium term. The number of publications and citations was therefore a secondary measure of success.

8.6.2. Results

The results of the DiD analysis are shown in Table 8.4^[footnote43]. The key points to note are as follows:

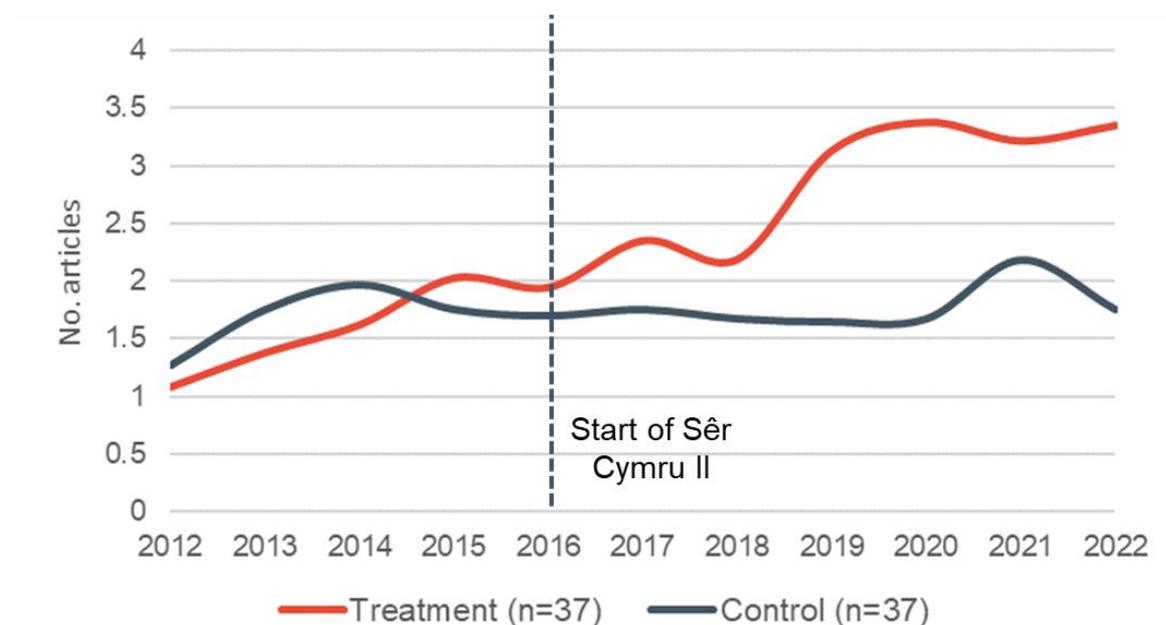
- Sêr Cymru II had a significant, positive additional impact on the number of research publications of the supported research fellows. The average number of publications per annum by Sêr Cymru II fellows increased by 1.27 between the pre-treatment and post-treatment periods. Of this, it is estimated that 1.19 was attributable to the Sêr Cymru II programme.
- There is some evidence the programme increased the breadth of subject areas covered by fellows' research. The average annual number of subject areas in which fellows' publications appeared increased by 2.55 between the pre-treatment and post-treatment periods, but declined slightly in the control group. The DiD was estimated to be +2.76. However this finding requires some caution as the number of subject areas covered by Sêr Cymru II researchers was already increasing at a faster rate than the control group prior to the start of the programme, and therefore could be explained by other factors.

[43] Annex A provides a more detailed analysis of the findings

- There is mixed evidence about the impact of the programme on the quality of research by fellows. The programme had a significant, positive impact on the number of publications in journals ranked in the top 10% by CiteScore. While the number of articles in the top quartile for citations also increased by more than the control group, the difference was not statistically significant. Similarly, there was no significant difference in the change in the proportion of outputs in top journals or in the top quartile for citations.

Figure 8.8 shows visually the impact of Ser Cymru II on the annual average number of publications by fellows. Prior to the start of the programme, fellows were on a similar trajectory to the control group, but this increased after the start of Ser Cymru II and has remained consistently higher than the control group, indicating the programme had a significant effect on their research outputs.

Figure 8.8: Average number of publications per researcher, 2012-2022



Source: Hatch analysis of Elsevier data

Table 8.4: Summary of Difference-in-Difference analysis for outcome variables

Outcome indicator	Control group			Treatment group			DiD
	Pre-treatment average	Post-treatment average	Change	Pre-treatment average	Post-treatment average	Change	
Average number of research publications per researcher per annum	1.69	1.77	0.08	1.53	2.8	1.27	1.19***
Average number of subject areas in which a researchers publications have appeared	3.83	3.63	-0.2	2.99	5.54	2.55	2.76***
Average number of publications in journals ranked in the top 10% by CiteScore	0.93	0.92	-0.01	1.07	1.79	0.72	0.73***
Percentage of publications in journals ranked in top 10% by CiteScore	58%	55%	-3pp	60%	62%	2pp	5pp
Average number of publications in the top quartile for citations	1.07	1.05	-0.02	1.02	1.57	0.55	0.57
Percentage of publications in top quartile for citations	60%	53%	-7pp	58%	52%	-6pp	1pp

Source: Hatch analysis of Elsevier data. Significance levels are 1% (***), 5% (**) and 10% (*).

8.6.3. Personal and career development impacts

The online survey of Sêr Cymru II fellows was used to assess the personal and career development benefits of the operation. As noted previously this survey received 19 responses. This included seven Rising Stars, eight Research Fellows, three PMFs and one Recapturing Talent fellow.

Table 8.5 shows that, overall, a high proportion of respondents agreed that Sêr Cymru II had provided a number of benefits for participants, including improved research skills, increased confidence about securing research grants, career development, widened networks and reputational benefits.

Table 8.5: Level of agreement with statements about career and personal development

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Not relevant / Don't know
Given me more confidence about securing research grants in future	6	9	0	2	1	1
Helped me to develop the skills needed to lead a research project independently.	5	9	1	3	0	1
Helped to develop my career as a researcher	7	8	2	0	1	1
Helped me to restart my career in academia	1	3	2	2	1	10
Helped me to build my profile and reputation	6	11	2	0	0	0
Helped me to become an expert or leader in my field	4	10	3	0	1	1
Widened my network	8	8	1	0	2	0
Form new collaborative relationships	7	7	4	0	1	0
Improved my leadership or management skills	5	10	2	2	0	0

Source: online survey of Ser Cymru II fellows

These findings were consistent with the destination survey which asked respondents to describe how their award has benefitted them. This elicited a wide range of responses, which are shown in Figure 8.9. The most commonly cited benefit (cited by 32 of the 60 responses) was that the programme had allowed them to become an independent

researcher, with the freedom to pursue the areas of research that most interest them. Several gave examples of how this has enabled them to establish their own research group and become leaders in their field. This was a particular benefit for Research Fellows (17 of the 20 respondents cited this as a benefit) and Rising Stars (five of the seven responses). The other major benefits (which are often linked to the above) were that Sêr Cymru II has supported their career development (30 respondents) and helped them to form new networks or collaborations (15 responses).

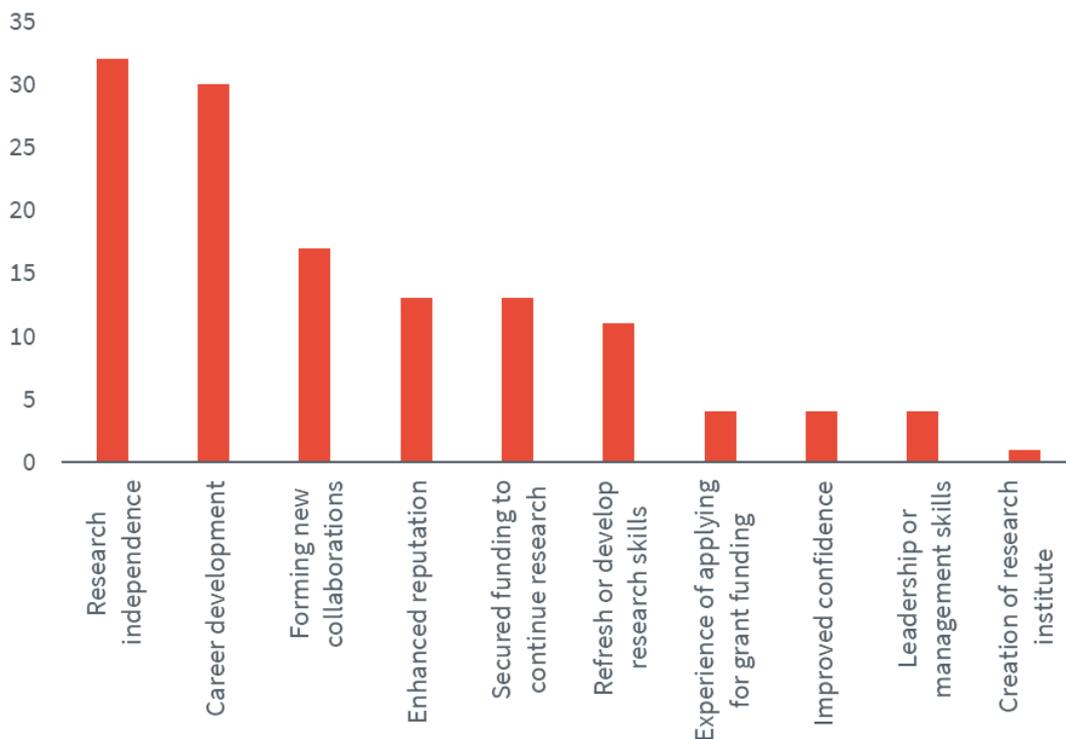
The following example quotes illustrate how respondents say the programme has benefitted them:

- "The Ser Cymru award has allowed me to take ownership of my research area and to learn how to lead a research project independently. It has also allowed me to start building a research team through the recruitment of two PhD studentships, which has helped to drive my managerial development and research goals. My international reputation has also grown as a result of this award through seminar/ conference invitations and new connections that have been made. On a personal note, I feel that this award has really helped boost my confidence in my abilities and spurred me on in my journey to becoming a leader in my research field."
- "The Ser Cymru fellowship allowed me to develop my independent research skills, supported my research and allowed the formation of multiple collaborations. Included in this is several collaborations for which the work has been published or is prepared and in the process of submission. It also created a stable base to apply for further funding from. This directly led the opportunity carry out training and development to improve my skill base and ultimately make me a suitable candidate for the role of lecturer."
- "The fellowship provided me with an opportunity to work with leading experts in my field, this greatly enhanced my molecular and bioinformatic skill set and broadened my understanding of antimicrobial resistance. I have had multiple opportunities to present research at meetings/seminars and at a national Microbiology conference, thereby raising my portfolio and profile. Research findings will be published in peer reviewed journals in the near future. Long-term my career goals are for independence. This

research has generated data to support a BBRSC Industrial Partnership Award grant application (I am the named researcher/Co-Investigator). This will enable me to continue my research at Cardiff University, and to become a leading expert (in my field)."

- "Ser Cymru II Fellowship programme is an excellent building-block opportunity for early career researchers to gain their initial experience in independent research. Being an international researcher I personally feel that getting Ser Cymru II fellowship within first year of my career here in UK gave me significant recognition in the field of cancer research in Cardiff University as well in other national scientific communities. Ser Cymru programme provided me enough time to gain confidence to achieve my scientific independence as an early researcher".

Figure 8.9: "How has your Sêr Cymru award benefitted you?"



Source: Destination survey

8.6.4. Conclusions

The evaluation finds Sêr Cymru II has had a significant impact on the research income secured by supported institutions. Those subject areas that received support, including biosciences at Cardiff University, physics at Swansea University and engineering at Bangor

University, have all experienced an increase in research income which is higher than selected similar institutions and the average for all institutions in the UK.

Although there are limitations to this analysis, it does suggest that Sêr Cymru II has had an additional effect on research income which would not have occurred in the absence of the intervention. This is reinforced by consultation evidence, particularly Research Chairs and stakeholders from the host institutions, all of whom said the increase in research income would not have been possible without Sêr Cymru II funding. All of the Research Chairs have been offered permanent positions at their host institutions, and a number have overseen the development of new infrastructure which should provide lasting legacy benefits in the future.

The counterfactual analysis of Elsevier data also shows that the programme had a significant, positive impact on the number of publications by fellows and on the number of publications in top ranking journals. This indicates the programme had significant benefits for the research experience and career development of participating fellows, which is confirmed by other sources including the destination survey and online survey.

The findings in relation to research capacity (as measured by the number of research staff) are more uncertain. Although the monitoring data shows the operation recruited 180 new researchers, less than half of these are still employed by their host institution (83), and there is only limited evidence that this has boosted research capacity in those subject areas that have received support through Sêr Cymru II, with some subject areas experiencing a fall in the number of research staff. Although these losses could have been higher in the absence of Sêr Cymru II. Overall this suggests the operation has had only modest impacts on research capacity in STEMM subject areas.

Although the research groups assembled by Research Chairs are still largely in place, consultees described the difficulty of retaining high quality researchers after the funding period ended, citing both the continued strain on university finances after the pandemic and uncertainty about the future of Sêr Cymru. This resulted in a number of researchers leaving and restrictions on any future recruitment.

It was also noted that a number of those who have stayed at their host institutions have done so in either lecturing or in combined lecturing and research roles. These have come under pressure to spend more time lecturing since the pandemic as universities have sought to increase student numbers as a means of growing income. In contrast, it was noted that some Vice Chancellors and heads of department do not see research “paying its way”, and therefore see it as less of a priority when finances are constrained. This has

meant Sêr Cymru II fellows have had less time for research and some have become disaffected, increasing the chances that they will leave in future.

9. Outcomes of Sêr Cymru II+ Awards

This section assesses the emerging evidence on the outcomes and impacts of SCII+ awards. Many of these awards have only recently completed meaning there has been limited time for outcomes and impacts to have emerged. It is therefore not possible to assess impacts using a counterfactual approach as most of the impacts on research income or research capacity will not be recorded in HESA data.

Instead, the evaluation has used a theory-based approach which assesses whether the anticipated short term outcomes in the theory of change described in Chapter 3 have been achieved and whether these can be attributed to Sêr Cymru II. This draws upon the programme monitoring data, consultations with grant recipients and analysis of progress reports.

9.1. Industrial fellowships

Consultations were undertaken with three of the five industrial fellows and two industrial partners.

Chapter 6 showed that industrial fellowships have underperformed against the original targets identified in the Business Plan, with only one meeting its target for new research income. The consultations suggest that the Industrial Fellowships have enjoyed mixed success. Although there have been some significant achievements, others have not performed in line with the theory of change.

The most notable success was the fellowship which funded collaborative research between applied mathematicians at Aberystwyth University and Rockfield Global, a Swansea based business which provides digital solutions for the geomechanics industry. The research has developed algorithms which have strengthened Rockfield's existing software for analysing fluid driven fractures on geo-engineering projects. This has a range of potential applications, including identifying sites suitable for carbon capture and underground storage.

Both parties report this was a highly successful collaboration, which has generated, or is expected to generate, the following outcomes:

- **Business benefits:** the research has enabled Rockfield to improve its simulations of carbon capture and storage projects which it can apply on future projects. As a result of the research Rockfield have secured a large

contract looking at suitable CO₂ storage sites in Northern Europe. There have therefore been direct commercial benefits for a Welsh business.

- Learning benefits: the fellowship has enabled the employment of a PhD student as a research assistant, working closely with Rockfield and carrying out research in an industrial setting. This will improve the relevance of their research in future.
- Enhanced profile for Aberystwyth University: the research publications have been included in Aberystwyth University's REF submission, and the research itself has attracted global attention in the geomechanics field. The lead at Aberystwyth University has been invited to present at a number of international conferences.
- Further collaboration with industry and academia: related to the above, the high profile of the research has enabled the leads to form relationships with a number of global experts from academia and industry. These have already led to collaborative research projects which build on the research funded by Sêr Cymru II and is expected to lead to further collaborations in the future. This includes newly established links with numerous academics in the EU and Switzerland and Shell Oil and Gas in the US.
- Research funding: five research grant applications were submitted as a direct result of this fellowship, two of which were successful. This has secured £800,000 in research funding, however the new relationships formed with global experts are expected to lead to further collaborative funding bids in the future.

All of these benefits can be attributed to the Sêr Cymru II funding. The fellow from Aberystwyth University confirmed that they could have done some of the research, but the major value has been the collaboration with Rockfield, none of which would have been possible without the funding.

Another successful industrial fellowship involved an academic from Swansea University and Diamond Light Source, a not-for-profit limited company funded as a joint venture between UKRI and Wellcome Trust. A new state-of-the-art nanoparticle beam instrument was developed by scientists at Swansea and installed at the Diamond Light Source's facility at Harwell Science and Innovation Campus in Oxfordshire, where it could be used by existing researchers of the facility alongside the researcher from Swansea University.

The focus of the research was on finding methods to synthesise ammonia using less energy than the traditional method (the Haber-Bosch route) which has a very large carbon footprint.

The research undertaken was successful and resulted in the research lead leaving their role at Swansea University to establish a spin-out company. They have also submitted two patent applications (both pending). The spin-out company has also raised \$3 million in seed funding to scale up its green ammonia technologies. However the company is now permanently based at Harwell in Oxfordshire and therefore any future economic benefits will not be realised in Wales.

Similarly, one of the industrial fellows from Cardiff University is no longer in Wales, having taken up a new role at the University of Liverpool. This fellowship was a collaboration with Jacobs (a large multi-disciplinary engineering company) which funded research into engineered logjams which can promote floodwater storage as part of natural flood management systems. It was anticipated that this could develop equations which could be used to improve Jacobs' flood modelling software.

The fellow reported having a good relationship with their main contact at Jacobs, and that the experience had significantly improved their translational skills and understanding of how to work with industry. However the collaboration was hampered by contractual issues on Jacobs' side and the fellow reported being unsure how the company had used the research. Jacobs was reported to have limited interest in implementing the equations in its software and there has been no further collaboration or engagement since the funding came to an end.

This fellow was successful in securing additional research income through a Royal Academy of Engineering (RAEng) fellowships, however this was already in train and cannot be attributed to Sêr Cymru II and has therefore rightly not been claimed with WEFO. The fellow was not offered a permanent position at Cardiff University and moved to the University of Liverpool to continue with their RAEng funded research.

Interviews were not conducted with the other industrial fellows. However the monitoring data indicates that one of these has been successful. This provided funding for an employee of Qioptiq to collaborate with researchers at Bangor University. This explored manufacturing processes for using metamaterials to develop new products. This has resulted in seven research publications, four collaborations with industry and £215,000 in additional research income.

9.1.1. Summary

The findings indicate that industrial fellowships have enjoyed mixed success. All of the projects reviewed have effectively facilitated knowledge exchange, improved knowledge of industry practices on the part of the fellow and in some cases, this is already resulting in commercial applications. However, of the three fellows interviewed, only one is still in their role at a Welsh institution, meaning there are unlikely to be any lasting benefits for Wales.

Figure 9.1 provides a summary of achievements against the short-term outcomes anticipated in the theory of change for industrial fellowships.

Figure 9.1: Summary of short-term outcomes achieved by Industrial Fellowships

Knowledge exchange between academics and industry partner		Reported as an outcome by all consultees
Acquisition of practical skills and improved knowledge of industry practices		Reported for all projects
Research advancements due to improved access to industry data, resources & expertise		Reported for two of the three projects interviewed
Increased relevance and applicability of research by academic secondees		Reported for the collaboration between AU and Rockfield Global only
Enhanced ability of industrial partner to leverage academic research for practical applications		Reported for the collaboration between AU and Rockfield Global only
Development of joint funding bids with industry partner		Reported for collaboration between AU and Rockfield Global and Qioptiq and BU

9.2. Strategic Partnership Accelerator Awards

Consultations were undertaken with three of the four recipients of SPAAs.

As described in Chapter 6, SPAAs were severely hampered by the Covid pandemic, which placed restrictions on international travel and therefore limited the ability to arrange secondments with universities around the world. Despite these challenges, a number of the awards have been delivered successfully and have achieved outcomes in line with the theory of change.

Two of the projects managed to successfully deliver a number of collaborations with international universities by undertaking all research meetings online. One of these was a partnership involving the Advanced Reasoning Group at Aberystwyth University and

Northwestern Polytechnical University (NWPU) in China. This has resulted in the publication of 18 joint research papers (compared to an original target of six), several of which have been in prestigious journals or for leading international conferences. The partnership has also secured £185,000 in research income. The progress report describes the partnership as 'exceeding all expectations'. Furthermore, they have built off the initial success to extend the strategic partnership to academics from a large number of other universities around the world.

The second was a partnership between medicinal chemists at Swansea University and Universiti Putra Malaysia (UPM). This was reported to have worked "exceptionally well" despite their inability to meet face to face, and has resulted in the publications of three research papers in prestigious international journals. One of these papers, published in the journal ChemMedChem, was highlighted by reviewers as a "very important paper" within the top 10% of articles published by the journal. All three have also been viewed thousands of times and have received a large number of citations.

This collaborative research has also strengthened the relationship between Swansea University and UPM. A funding application has been submitted for continuation of the research which involves both universities and the University of Oxford.

There have also been learning and career development benefits for the grant recipient and the research associate at Swansea University. The award enabled the grant recipient to oversee a programme of research for the first time and establish themselves as an independent scientist. This was credited with them securing a new academic position at Swansea University.

The SPAA at Bangor University has also provided significant learning opportunities for early career researchers at the university. This funded extended research placements for three PhD students and a research visit for seven academics from Bangor's Nuclear Futures Institute (also developed with funding from Sêr Cymru II) at the Los Alamos and Oak Ridge National Laboratories (LANL and ORNL) in the USA. These are global leaders in nuclear power research, with particular expertise in the development of new nuclear materials. Although senior academics at Bangor already had relationships with the National Laboratories, it was hoped that these links could be strengthened by allowing students and early career researchers to spend time learning about the cutting edge research that takes place there, expanding their networks and collaborating with the National Laboratory scientists. Although the placements were delayed as a result of the pandemic, these did eventually go ahead in 2022 and 2023.

These placements and research visits have been highly successful, resulting in the following outcomes:

- Two research papers published, which are both collaborations with LANL scientists.
- Skills development: all of the students were reported to have acquired new skills and an understanding of new research approaches. For example, one student has become proficient in molecular dynamics modelling as a result of the placement which they are using in the remainder of their PhD.
- Profile raising: the senior academics gave a seminar about Bangor University's research and the history and future of nuclear facilities in North Wales. This was broadcast to all staff at the National Laboratories. There were also numerous other opportunities on the trip for the Bangor scientists to advertise their capabilities.
- Network and relationship building: both the students and senior academics made a large number of new contacts, enabling them to share knowledge and plan possible future collaborations in the future. Both parties also discussed possible funding opportunities to allow the co-operation to extend beyond the life of the award. It has also been agreed that LANL will sponsor a new PhD student at Bangor.
- Knowledge exchange: there were numerous opportunities for sharing knowledge and insights with relevance to a number of the research areas at Bangor including additive manufacturing and nuclear kernel fuel production. Of particular note was that the Bangor scientists were able to visit an isotope production facility at ORNL and discuss the proposals to develop a medical isotope generating reactor in Bangor, having close synergies with the ARTHUR project. As well as learning about the hardware, this allowed the researchers from Bangor to make new contacts, and learn about the skill requirements and timescales required to bring ARTHUR to fruition.

The major benefit of this SPAA is that it has ensured the relationship with LANL and ORNL is now shared across almost the whole of the team at the Nuclear Futures Institute instead of one or two senior academics. This has led to immediate benefits in the form of multiple

collaborations and expansion of networks, but should also help to ensure that the relationship between Bangor and the National Laboratories endures in the future.

The remaining SPAA aimed to foster links and knowledge exchange between neuroscience researchers at Cardiff University and the University of Western Ontario in Canada. This was more severely affected by the Covid pandemic which hampered its ability to achieve intended outcomes. This originally intended to fund four research placements for PhD students from Cardiff and ten visits for Principal Investigators (PIs), with the aim of establishing a joint data sharing platform to initiate and develop collaborative projects across the two institutions. Western University also intended to fund four placements for its own PhD students to study in Cardiff.

These plans were severely curtailed as a result of the pandemic; These have resulted in a number of collaborations and learning benefits for the researchers involved. However this was not on the scale originally envisaged and there have been no collaborative research publications as a result of this SPAA.

9.2.1. Conclusions

Despite the challenges presented by the Covid pandemic, the SPAAs have been very successful, with evidence for most of the short-term outcomes anticipated in the theory-of change.

The SPAAs can be divided in to two categories:

- the awards for Swansea and Aberystwyth Universities which carried out a defined programme of research with an international partner, and
- the awards for Bangor and Cardiff Universities which were broader in scope and intended to widen networks, facilitate knowledge exchange and strengthen links with the international partner on a number of levels.

The former projects were able to successfully navigate the challenges brought by the pandemic to achieve their original objectives. Most notably, these awards have resulted in 21 joint research publications and joint applications for further research grants. Both also have plans for further collaborations in the future.

The latter projects were more severely affected by the pandemic. Nevertheless, the award at Bangor University can be deemed to have been successful. This has facilitated knowledge exchange, network building and collaborative research for both early career researchers and more senior academics. In doing so, it has widened and strengthened

links between Bangor University and the National Laboratories. While it is difficult to assess the longer term outcomes of this relationship, consultees were able to identify clear examples of how it is already benefiting the work of the Nuclear Futures Institute and therefore complementing other Sêr Cymru II investments.

Figure 9.2: Summary of short term outcomes achieved by Strategic Partnership Accelerator Awards

Knowledge exchange between academics from both institutions		Reported as an outcome by all consultees and progress reports
Increased cultural awareness and experience of different research culture		Achieved on BU visit to National Laboratories but other projects hampered by Covid restrictions
Formation of new international networks for ECRs and PIs		Reported as an outcome by all consultees, including those hampered by Covid restrictions
Collaborative research with academics from partner institutions		25 joint research papers published to date plus a number of conference presentations
Development of plans to extend collaborative activities		Further collaborations with partner university planned for all four awards
Generation of research results for joint grant submissions		Two projects have already submitted joint grant applications, one of which was successful

9.3. Infrastructure Accelerator Awards

Consultations were undertaken with four of the eight recipients of Infrastructure Award funding. All four of these have been successful, having met all of their targets for research income and achieved a number of the other intended outcomes.

AccelerateAI was a multi-university award which invested in state of the art hardware needed for advanced machine learning, which was integrated in to the existing Supercomputing Wales network (this received funding through both the current ERDF programme and the 2007-13 ERDF programme). The infrastructure was not restricted or reserved for any specific group; it was intended to be used as widely as possible to enhance the research conducted in Wales' HEIs in a number of areas. To date it has been used for a wide range of research where artificial intelligence can be deployed. This includes medicine (genomics, brain tumour research), improving manufacturing processes and nanomaterials. It has been used by researchers from Swansea, Cardiff and Aberystwyth Universities.

To date this award has resulted in £3.4m of additional research income, 19 co-operations and 27 research publications. None of the research income or co-operations have been claimed with WEFO due to there being “no clear link” between the funded project and the award. However, according to the consultee, very few of these outputs could have been achieved without the infrastructure award. The award has opened new research avenues which would not be possible without access to this advanced hardware, and the ability to use these machine learning techniques underpinned all of the successful grant applications.

The consultee also described how having access to the infrastructure was pivotal to Swansea University joining a consortium of universities (including Sheffield, Brunel, Cambridge and Warwick) which has secured a £4.5 million grant through the Made Smarter Innovation programme run by UKRI. This is exploring how advanced digital technologies can improve innovation and efficiency in the manufacturing sector. Swansea University’s specific role relates to its expertise in artificial intelligence which relies on having access to this technology. The immediate benefit is that Swansea has secured £600,000 of this grant award. However this is expected to lead to many more opportunities in the future and has meant that Swansea has established strong collaborations with some of the leading academics in their field.

The Infrastructure Award at Aberystwyth University funded a ‘Controlled Environment Agriculture Research and Development Facility’ which allows researchers to study and experiment with growing plants in controlled environments. Its specific goal was to allow them to carry out research which is more applicable to industry thereby contributing to the development of local, low carbon and sustainable food production systems in Wales.

The research group has met almost all of its targets for the award, with the only exception being research papers published. This was due to delays in being able to conduct research using the facilities during the Covid pandemic. However these are expected to be achieved in due course. Access to this facility has underpinned several grant applications, one of which has been successful (£2.1m from BEIS) which will fund research in to ‘speed-breeding’, a technique to accelerate the growth and development of plants. This is expected to sustain the research activities of a number of researchers beyond the funding period for Sêr Cymru II and has allowed the team to recruit additional researchers. This grant has also not been claimed with WEFO despite the consultee claiming the infrastructure was essential for the research.

The major benefit of this facility has been as an enabler for engaging and building closer links with industry. The consultee described how it has 'opened the door' to several relationships as industrial partners can now access the cutting-edge facilities as well as the academic expertise. As a result they have exceeded their target for seven collaborations with industry (ten, according to the consultee although these have not been claimed with WEFO). There are discussions ongoing about collaborative research ventures with three of these industrial partners, although it is taking some time to develop into formal proposals. If these are implemented, in the longer term there may be a number of commercial and innovation opportunities, with both economic and environmental benefits for Wales.

The Infrastructure Award at Bangor University was awarded to the Nuclear Futures Institute and therefore complemented other Sêr Cymru II funded investments including the Research Chair and SPAA described above. This funded the acquisition of a simultaneous thermal analyser (STA), a scientific instrument used to study the physical and chemical properties of materials when subjected to controlled heating or cooling. This is essential for understanding their performance and safety in nuclear reactor systems.

This was described as having a transformative impact on the work of the Nuclear Futures Institute. The original budget for the Research Chair only allowed a limited budget for laboratory equipment. However, as the research group grew, a need was identified for specialist equipment for experimental research. According to the consultee, the STA was "one of the most used pieces of kit" in the facility and the 'cornerstone' of much of the research which has taken place at Bangor. It was also crucial in securing £520,000 in further funding from industry, national laboratories and UKRI, and supporting 2 PDRA projects and 4 PhD projects. It also enabled collaborations with academics from the KTH Royal Institute of Technology in Sweden. Two of the six research articles published as a direct result of this equipment are collaborations with KTH. The work has also been presented at a number of international conferences which has enhanced the profile and reputation of the institute.

A fourth Infrastructure Award funded a 'Dark Genome' analysis suite at Cardiff University. Specifically, this was a highly advanced DNA Sequencer that allows researchers to analyse the human genome in a much higher level of detail than earlier technologies^[footnote44]. The researchers have a particular interest in neurological disorders, so the technology has been optimised to sequence Huntington's Disease and Parkinson's Disease among others.

^[footnote44] The 'dark' genome refers to the parts of DNA which could not be analysed using earlier technologies.

Cardiff University is also encouraging other universities to use the technology, although this has not happened to date.

Again, the research was severely delayed by the pandemic and laboratory closures. It then took some time to learn how to use the technology and interpret the data, meaning the project has only been able to generate good quality data relatively recently. Nevertheless, even in this short period of time, the technology has improved the quantity and quality of research undertaken, resulting in four high quality research publications to date. These have been mostly focused on Huntington's Disease and have allowed the researchers to analyse the genetic change which causes the disease in a way which was not possible using previous methods and allowed them to understand why people develop the disease at a certain age.

The University has received £100,000 in funding to date, which has been mainly from the National Institutes of Health in the USA and is linked to an international consortium of which Cardiff University is a partner. This is funding sequencing of patients with neurodevelopmental disorders and is directly linked to the new technology. Cardiff has also received funding for two PhD students, both focused on using the Dark Genome Analysis Suite.

9.3.1. Conclusions

The evidence suggests that the infrastructure awards have been highly successful and have achieved all of the short-term outcomes anticipated in the theory of change, including improving the quality of research, new partnerships with industry and other HEIs and new grant applications.

Although there is some uncertainty about the amount of research income secured by these awards, consultees claimed that these research grants would not have been possible without access to the infrastructure.

Figure 9.3: Summary of short term outcomes achieved by Infrastructure Accelerator Awards

Increase in quantity and quality of research by Wales' HEIs		30 research papers published so far. Enabled all consultees to explore new research avenues
Increase in quantity and competitiveness of research grant applications		6 out of 8 awards have secured further research funding (£11.5m in total)
Increased engagement, knowledge sharing & collaboration with other HEIs		Reported as a major benefit by 2 consultees, including high profile research partnerships
Increased engagement, knowledge sharing and collaboration with industry		Reported as a major benefit on 3 awards, including collaborations with NHS and food producers
Improved learning opportunities for students due to access to technology		Reported by all consultees

9.4. Capacity Building Accelerator Awards

CBAAs were specifically designed to enable Wales' HEIs to be better positioned to compete for funding from UKRI and Research Councils, an area where Wales' HEIs has historically underperformed (and particularly the smaller institutions).

The analysis of performance in Chapter 6 shows there is some uncertainty about how much income has been secured by the projects to date. Based on what has been claimed with WEFO, the seven projects have secured £1.6m in research income. However this increases to £7.3m if all of the income claimed by grant recipients is included. This is mostly due to grant recipients not providing enough evidence to support the claims. Nevertheless, the data shows that all but one of the awards have been successful in securing some additional research income, indicating that these awards have been successful in their original aims.

Three of the CBAAs were at USW^[footnote45]. This is one of the smallest universities in Wales in terms of research income and has historically secured very limited funding from UKRI and Research Councils. Consultees from USW acknowledged this and said their main aim was to build their experience of applying for funding through these prestigious and competitive funding bodies. The university also has a strategy to focus research on the theme of 'sustainable environment' so all three of the CBAAs were intended to support this. All three have successfully secured research funding from these sources.

Footnotes

[45] Consultations were undertaken with two of these

One of these awards has been extremely successful. This was led by USW but also involved Bangor and Aberystwyth Universities and was focused on building capacity in biopolymers research and their industrial production/processing. This has resulted in both USW and Bangor University forming strong collaborations with industrial partners (it is estimated that they have collaborated with 60 partners to date compared to an original target of nine). This has resulted in a large number of collaborative research proposals, several of which have been successful, including several awards from UKRI and Innovate UK.

According to the grant recipient this project secured £3.3m in research income for Bangor and USW, of which only £865,000 has been claimed towards the WEFO target due to missing evidence such as award letters. However these do appear to be genuine awards, with a detailed, itemised list of all of the grant applications submitted provided in the progress reports. They have also submitted a large number of unsuccessful research proposals with a combined value of £14m. A number of these received high scores, so they intend to re-work and resubmit these proposals which could in turn secure even more research income in the future.

Other successful outcomes from this award include:

- Increased research capacity, including investment in new facilities and cutting-edge equipment and the recruitment of three additional researchers.
- Ten research papers expected to be published by summer 2023.
- Numerous successful collaborations with industry, which has facilitated knowledge exchange and, in turn, could lead to increased levels of innovation and commercialisation of research in Wales.
- Longer term, the research has the potential to lead to wide ranging environmental benefits including a reduction in CO2 and use of plastics.

Consultees from USW were in agreement that none of these outcomes could have been achieved without the funding from Sêr Cymru II.

A second CBAA at USW was focused on the activation of carbon dioxide and its transformation into valuable chemicals which can be used in a number of sectors and industrial processes. The funding for this award was only approved in 2021 and the start of the research was further delayed by difficulties recruiting international researchers and setting up a new laboratory for the research. This meant that the results of the research

were only generated very recently. Nevertheless, this CBAA resulted in one successful funding application for £228,000 which was a collaboration with Sheffield Hallam University and two research papers published in top ranking journals by the Royal Society of Chemistry and the American Chemical Society. The PI for the research expects to submit three further publications with the research results and has two further grant applications in progress (both to UKRI or Research Councils). Again, the consultee said these outcomes could not have been achieved without the Sêr Cymru II grant.

Given USW is still developing its reputation and experience as a research-led university, these examples demonstrate that CBAAAs have been highly successful at building its capacity in strategically important areas, strengthening the university's experience of bidding for research contracts through UK funding bodies and improving the success rate of these bids.

CBAAAs were also designed specifically to align with other Sêr Cymru II awards and allow them to build on their successes by enabling them to explore new research avenues where there may be funding opportunities. Only one of the awards has done this. This was awarded to a Rising Star who works alongside the Research Chair as part of the highly successful Ser Sam research group at Swansea University. The CBAA funded research into the development of new low-embodied energy photovoltaics (PV) and the creation of low power consumption optoelectronics. The grant enabled the PI to recruit new postdoctoral research associates (PDRAs) and expand the laboratory capabilities at Swansea. This has resulted in five publications in respected journals, a new collaboration with one of the leading developers and manufacturers of printed organic solar cells (Epishine in Sweden) and helped to establish Swansea University as one of the leading research groups for indoor photovoltaics; it is the only group in the country that can test indoor photovoltaic devices in accordance with National Physics Laboratory (NPL) protocols. The PI submitted an application for a five-year EPSRC Open Fellowship that would have allowed them to build on the research, however this was unsuccessful.

It was not possible to interview the recipients of other CBAAAs, but the progress reports show a number of the other awards have also been successful in their main aim of improving the capacity of Wales' HEIs to bid for research grants from UK funding bodies:

- A project at Cardiff University sought to establish a new centre of excellence for mixoplankton^[footnote46] research. At the time the progress

report was written, the PI had successfully secured £213,000 in additional research income, including grants from UKRI and the Natural Environment Research Council (NERC). They expected that this will support continued mixoplankton research for the next two years after Sêr Cymru II funding ended.

- A second CBAA was awarded to Cardiff University’s Crime and Security Research Institute. This funded a programme called OSCAR (the Open Source Communications Analytics Research) which undertakes research in to the security challenges and potential applications associated with public open source communications data. Following the breakout of war in Ukraine, the whole OSCAR programme was adapted to focus on how it could support the UK government response. The Sêr Cymru II funding is credited as “playing a vital role in providing us with staff capacity to respond quickly to the unfolding situation”. OSCAR has also been successful in securing an additional £2.5m in research funding that will extend its work until March 2025, although the source of this funding is not disclosed due to the national security sensitive nature of the work. Nevertheless the progress report states: “the uplift in capacity and capability that the Sêr Cymru funding enabled has put the OSCAR project in a strong position to support its longer term viability. For in addition to the above funding, there is a healthy pipeline of new bids to the value of approximately £5m stretching out to around 2029 if awarded”.

9.4.1. Conclusions

The CBAAAs have been successful in their primary goal of positioning Wales’ HEIs to better compete for research funding from UK funding bodies. The awards have secured at least £7.3 to date, a significant proportion of which was from UKRI or Research Councils. This could rise further if future research proposals based on the Sêr Cymru II funded research are successful.

Other successful outcomes achieved by the CBAAAs include an increase in the quantity and quality of research conducted in Wales’ HEIs, the advancement of research in areas of

[46] These are organisms that can make their own food from sunlight via photosynthesis or by eating other small organisms. They therefore have both ‘plant like’ and ‘animal like’ qualities. This research has potential applications in biofuels and ecosystem preservation.

strategic importance to Wales, the development of new partnerships with industry and academia and profile raising for research teams.

Consultees were unanimous in stating that these outcomes could not have been secured without the Sêr Cymru II funding, meaning the vast majority of outcomes are attributable to Sêr Cymru II.

Figure 9.4: Summary of short term outcomes achieved by Capacity Building Accelerator Awards

Recruitment of skilled researchers into research teams		13 researchers recruited to date according to MI and progress reports
Increase in quality and quantity of research in key areas		21 research papers submitted or published including several in high-ranking journals
Increase in number of grant applications to UKRI and RCs		At least 33 applications submitted to date, with more planned
Increase in value of research income secured from UKRI and RCs		£7.3m awarded to date – at least £4m from UKRI or RCs
Development of partnerships with industry and academia		79 collaborations reported by grant recipients in total

9.5. National Research Networks

Interviews were conducted with two of the three NRNs.

A key focus of each of the NRNs has been on maintaining the networks and relationships formed during phase one. This has been done through a number of networking events, newsletters and websites. There was one cross-NRN event focused on Sustainable Agriculture. This was hosted online during the Covid lockdown but involved speakers from all of the NRNs. Each of the NRNs has also arranged its own networking events, often involving a guest speaker, although these were severely curtailed as a result of the Covid pandemic. Many of the events were hosted online and attendance was reported to be very low in some cases.

While consultees reported that these activities have been well received, they noted that it was difficult for them to monitor what impact this is having. They are reliant on attendees to report any follow-up collaborations or connections, but getting this feedback was often difficult. One consultee from the Life Sciences Network offered the anecdotal example of a company that had got in touch with the network looking for a potential collaborator. This

was advertised in the newsletter and resulted in the company receiving large numbers of enquiries. It was suggested that there may be lots of examples of this following their events or communications, but the NRN managers do not hear about them.

Consultees were also confident that the continued work of the NRNs had helped to improve researchers' understanding of what other researchers in Wales are doing, which could pave the way for collaborations in future. This was noted as being very important for some NRNs, such as the Low Carbon Energy and Environment network (LCEE NRN), as there is no single institution that has a critical mass in an area, meaning the need to work together across institutions is vital. It was reported that LCEE NRN is supporting this by facilitating discussions and networking between researchers.

Another key focus has been on showcasing the work of the NRN members and to raise their profile among key stakeholders, including Welsh Government, industry partners and funding bodies. All of the NRNs contributed to a briefing document which mapped the work of NRN researchers to the priorities in the Senedd's Programme for Government. They also collaborated on a case making document which highlighted the successes of the NRNs and made the case for why they are an effective and efficient vehicle for supporting the growth of Welsh research. The mapping document was shared with the First Minister and was reported to have generated a lot of interest.

Other activities which showcase the work of researchers include:

- The LCEE NRN has created a video series entitled "Small Nations, Big Ideas" which promotes and celebrates the work of researchers.
- The LCEE NRN also facilitated an event at the COP to promote and showcase the work of Welsh researchers in environmental science and climate change. This was supported by extensive communications including films of researchers and a social media campaign. The feedback was reported to be excellent and managed to promote what Wales was doing at a UK and international level.
- The Life Sciences Network hosted a Joint Research Showcase with MediWales which highlighted the outstanding work of researchers. This had 50 attendees, including a number of industry partners and Welsh Government officials. Again, the feedback was reported to have been very positive.

Again, it was very difficult for consultees to evidence the impact these activities have had. However there was confidence that the work being done to showcase Welsh research should help to improve knowledge and appreciation of what is taking place in Wales, including amongst potential funding bodies such as research councils.

In summary, there is insufficient evidence to demonstrate the impact of NRNs on outcomes such as recruitment of researchers, new collaborations, or research income. The main outcomes are less tangible and more difficult to evidence, but are likely to include:

- Improved understanding amongst Wales' researchers about the research landscape across the country
- Improved knowledge of external stakeholders about the networks and the work being done by researchers.

10. Cross Cutting Themes

This chapter assesses Sêr Cymru II's contributions to Cross Cutting Themes (CCTs). These are the general principles which require action in multiple fields across programmes and operations. The three CCTs are:

- Equal opportunities and gender mainstreaming (including the Welsh language), and
- Sustainable development
- Tackling poverty and social exclusion.

For each of these, the evaluation first summarises the main objectives, aspirations and progress indicators identified for each theme in the business plan. It then assesses the extent to which this has been achieved in practice, and the factors which constrained or enhanced this.

The chapter concludes by assessing the operation's contributions to the Well Being of Future Generations Act.

10.1. Equal opportunities and gender mainstreaming

10.1.1. Aspirations and objectives in the business plan

The business plan for Sêr Cymru II stated that the operation's main contribution to CCTs was likely to be to the equal opportunities and gender mainstreaming theme. The Recapturing Talent fellowships were designed specifically to support researchers returning from career breaks, for example because of caring responsibilities, ill health or maternity leave. It was therefore anticipated that these awards would support women to restart their careers in academia. It was originally anticipated that 12 of these fellowships would be awarded.

The business plan set out a number of other measures for promoting equal opportunities and ensuring that no applicants would receive less favourable treatment on the grounds of their protected characteristics. This included:

- monitoring the demographic characteristics of applicants and their progress to ensure recruitment and assessment processes did not put certain groups at a disadvantage.
- ensuring host institutions had measures in place to promote equal opportunities and allow an appropriate work life balance.

- providing unconscious bias training to the Evaluation Panel.

The business plan identified a number of measures which could be used to assess progress:

- The gender split for applicants and the number of researchers funded through Sêr Cymru II. It stated that it would aim for a 50:50 split but set a minimum target for 40% of applicants and researchers to be female.
- Monitoring the progress of the Recapturing Talent fellows (e.g. numbers of research papers published, grant applications) and how this compares to Research Fellows. The destination survey could also be used to understand their experiences and whether they were adequately supported.

In relation to the Welsh language, the business plan stated “as the scheme is aimed at the international academic labour market, Sêr Cymru II is likely to have a limited impact on the Welsh Language agenda”. Nevertheless, the delivery team would ensure that all materials and support are available in Welsh should fellows require it. They would also explore ways in which the Welsh language could be promoted, such as identifying fellows who are Welsh speakers and approaching them to do scientific presentations in Welsh.

10.1.2. Achievements and contributions of Sêr Cymru II

28 of the 81 Sêr Cymru II awards were awarded to projects where the lead applicant was female (this includes SCII+ awards where the application was often on behalf of a research group including men and women). This means 35% of awards were issued to female researchers which is below the target in the business plan (40%). Of the original awards, those with the lowest representation of females were Research Chairs (0%), Rising Stars (30%) and Research Fellowships (32%). All three of the Recapturing Talent fellows and three of the four PMF fellows were female.

Table 10.1 shows the gender split of new researchers that have been claimed as outputs for Sêr Cymru II in the monitoring data (this includes those researchers that have been recruited by research teams as well as the grant recipients). It shows 74.8 of the FTE researchers were female, representing 42% of all new research positions created by the operation. This exceeds the minimum target set in the business plan (40%).

The table shows that the HEIs with the highest percentage of female researchers were Aberystwyth and Cardiff universities (73% and 44% respectively). This was attributed to the following factors:

- The types of research projects funded, which have been in subject areas which tend to have a higher representation of female researchers such as bioscience and clinical medicine.
- The fact that the Evaluation Panel received training in unconscious bias, and that this was also embedded into university's recruitment practices. For example, the gender of applicants is not revealed to recruitment panels when short-listing at Cardiff University.
- Both institutions believe that they offer an environment for women to thrive. For example, consultees from Aberystwyth University said that they offer part time, job share and term-time only working arrangements which appeals to many female applicants. Consultees from Cardiff noted that their pro Vice Chancellor had been a vocal champion for female researchers and had gone to great lengths to ensure that the university offers them a supportive and flexible work environment.

It should also be noted that the overall retention rate was higher for female fellows than male fellows. 61% of the female researchers that received one of the original Sêr Cymru II awards are still employed at their host institution compared to 55% of male researchers^[footnote47].

Table 10.1: Percentage of new researchers* who are female

	Male researchers	Female researchers	% female
Aberystwyth	4.0	10.6	73%
Bangor	16.0	6.0	27%
Cardiff	55.4	43.2	44%
Swansea	25.5	14.0	35%
USW	4.5	1.0	18%
Total for Sêr Cymru II	105.4	74.8	42%

Source: Welsh Government monitoring data

The operation was less successful in relation to the award of Recapturing Talent fellowships. Only three of these fellowships were awarded, which is some way short of the

Footnotes

[47] This relates only to Sêr Cymru II fellows. It does not include the researchers recruited by Research Chairs and Rising Stars. It is not known how many of these have been retained as this has not been recorded accurately in the monitoring data

original target for 12. This was due to the operation receiving very few applications for these fellowships. The mid-term evaluation found there had been a lack of interest in these fellowships which stakeholders attributed to the entry criteria being too stringent. The End of Programme CCT Report prepared for WEFO notes that “at least nine fellows supported via other strands of Sêr Cymru II could have been eligible for a recapturing talent award but had applied through other routes which, if taken into consideration, would meet the target number of fellows”. This may be true, however it would have made limited difference to the gender split for the operation as a whole if they had received a different award.

The monitoring data shows the three Recapturing Talent fellows that were funded have performed reasonably well. These achieved 13 research publications (4.3 per fellow) which is slightly lower than the average for the Research Fellowships (5.9). Two of the Recapturing Talent fellows secured additional research income, but only relatively small amounts, in line with Research Fellowships. Two of the three fellows are still employed in a Welsh HEI (one at their host institution, one has moved to another institution in Wales and one has retired).

The destination forms suggest that the Recapturing Talent fellows were satisfied with their experience of Sêr Cymru II (two report being satisfied and one reports being very satisfied). They cite a range of benefits including restarting their career in academia, building their network and improved confidence. However, two of the fellows said they would have welcomed more support and mentoring, particularly given that they had spent a long time out of academia.

The quarterly monitoring reports can also be used to understand the contributions to CCTs. Not all of the monitoring reports include a section on CCTs. This was introduced half-way through the operation^[footnote48]. However, of those that did provide information on CCTs, 13 stated that they have contributed to equal opportunities by increasing female participation in STEMM or having female researchers in their team (see Figure 10.1).

A further six reports identified positive action measures that they have taken to encourage female participation in STEMM. Examples include:

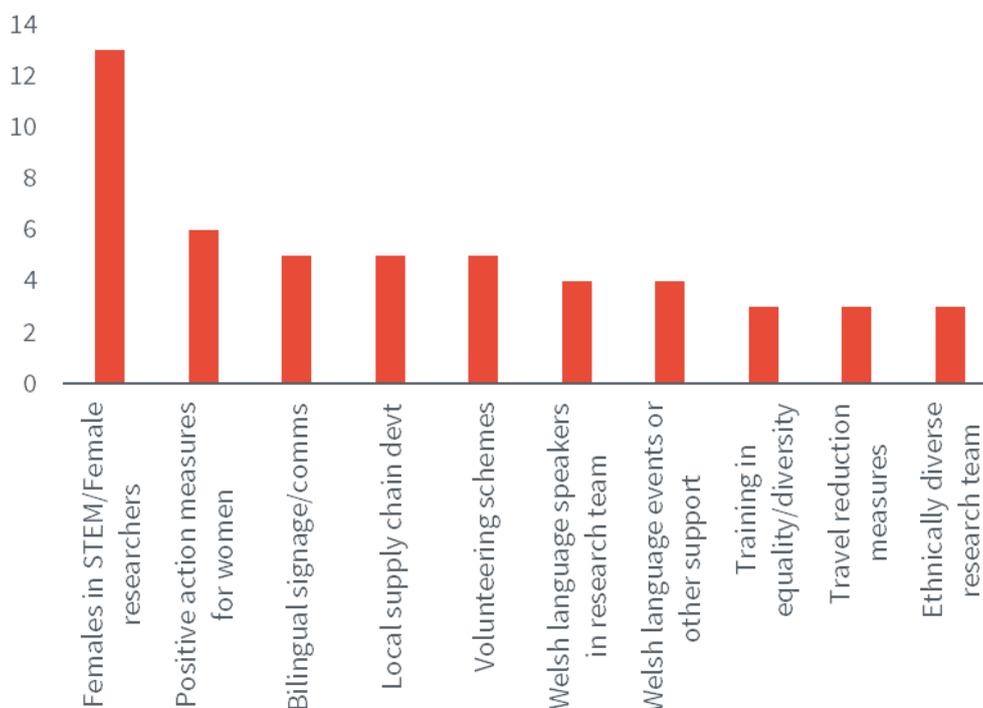
- Attendance or, in some cases, speakers at events that promote female scientists and their research (e.g. Soapbox Science) or which encourage more women to study STEMM subjects.

Footnotes

[48] Originally there was a separate CCT form to complete which had a low response rate. Therefore, Welsh Government later incorporated CCTs into the progress report.

- Other school outreach activities undertaken by female researchers, including those described below in paragraph 0.
- Organising writing retreats in response to the challenges of combining childcare and research during the Covid pandemic. Although not limited to women, 89% of attendees were female and all attendees who completed an evaluation form found the event to be beneficial.
- Creation of ‘women in STEMM’ societies or committees at Swansea and Bangor universities. These have held seminars and events showcasing the work of female researchers or discussing the barriers they face. These aim to create a more supportive environment for women working in STEMM.

Figure 10.1: Nature of contributions to CCTs described in progress reports



Source: Sêr Cymru II monitoring reports

Figure 10.1 also shows that three progress reports note that they have ethnically diverse research teams. The true figure is likely to be substantially higher than this given that a large number of researchers were recruited from all over the world, however the ethnicity of researchers was not recorded in the monitoring data.

Four monitoring reports state that they have Welsh language speakers in their research team. These reports also outline a number of positive measures that some projects have taken to promote the Welsh language. These include:

- A number of projects have undertaken outreach activities with local schools, which have been bilingual or in Welsh.
- One of the Research Chairs at Cardiff University was reported to be a strong advocate of the Welsh language. They have presented at the National Eisteddfod and also present in Welsh at the university. This Chair is also supervising a PhD which is being undertaken in Welsh and ensures that all staff undertake a Welsh Language awareness course at their induction and on an ongoing annual basis.
- The Nuclear Futures Institute includes Welsh speakers who have promoted the work of the institute in interviews on BBC Radio Cymru.
- The Low Carbon Energy and Environment Research Network was represented at the National Eisteddfod Science Pavilion held in Anglesey and set up an exhibition titled Golau Byw (Living Light). This was attended by over 20,000 people over a week.
- A number of reports state that all communications relating to Sêr Cymru II funded activities has been in both English and Welsh, and that all signage is bilingual.

Although the End of Programme CCT report stated that communications were sent to fellows making them aware of Welsh language support opportunities, only a fifth of respondents to the web survey could recall being encouraged to learn Welsh. Stakeholders from HEIs also said they were not aware of any support available from Welsh Government or whether this had been promoted to fellows.

10.2. Sustainable development

10.2.1. Aspirations and objectives in the business plan

Sêr Cymru II's main contribution to sustainable development was expected to be through the fellowships awarded in the Grand challenge area of low carbon and the environment. The business plan stated that the delivery team would particularly encourage research projects which have the potential "to develop and promote effective/innovative technologies to reduce the causes and effects of climate change". It also said the delivery team would promote sustainable behaviours wherever possible including the use of local supply chains, sustainable travel, waste reduction and water and energy efficiency.

The business plan did not identify any indicators for monitoring progress or contributions to this CCT.

10.2.2. Achievements and contributions of Sêr Cymru II

As shown in Figure 10.1, the most commonly cited contribution to sustainability in progress reports was the fact that the research funded through Sêr Cymru II was related to sustainability (cited in 6 progress reports^[footnote49]). In fact, the mid-term evaluation estimated that just under half of the original Sêr Cymru II fellowships were related to the low carbon, energy and environment Grand challenge area. A similar breakdown is not available for SCII+ awards, however it is estimated at least 13 of the 27 SCII+ awards (48%) are related to this Grand challenge area based on the descriptions in progress reports.

A large proportion of the awards therefore offered the potential to result in innovations or policy changes that could help to combat climate change or deliver other environmental benefits in the long run, although time lags mean very few are at the stage where the research is already delivering these benefits. Examples include:

- An industrial fellowship at Swansea University has developed a new process for synthesizing ammonia which is more energy efficient than the traditional method. If successful, this could result in substantial carbon savings.
- All three of the Capacity Building Accelerator Awards at USW are related to the 'sustainable environment'. One of these, focused on biopolymers research, has been highly successful so far and offers the potential to reduce plastic usage and carbon emissions.
- The Nuclear Futures Institute is playing a significant role in supporting plans for two new nuclear licenced sites at Wylfa and Trawsfynydd which will generate low carbon energy. Through the North Wales Growth Deal it is also developing Egni (a Low Carbon Energy Centre of Excellence).

Four progress reports also stated they are using local supply chains and three state they have put in place travel reduction measures, both of which could contribute to the

Footnotes

[49] Again it should be noted that only around half of the progress reports asked for information on CCTs so this is a minimum estimate of the number of projects relevant to sustainability.

sustainability theme. The End of Programme CCT report also provides a number of examples of these types of initiatives.

10.3. Tackling poverty and social exclusion

10.3.1. Aspirations and objectives in the business plan

The main contribution to tackling poverty and social exclusion was expected to be through the potential long term economic benefits that could arise through some of the funded research, particularly if this results in innovation, commercialisation of research and the creation of high skilled employment in Wales.

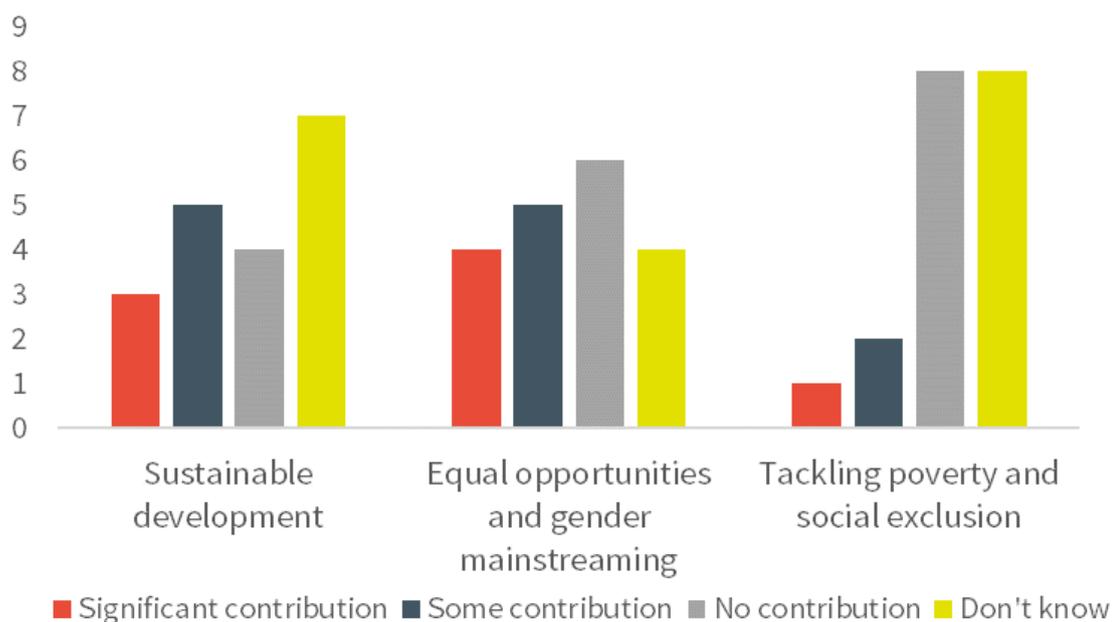
It was also anticipated that the operation could contribute to local employment by advertising the fellowships through local networks. This particularly applied to the Recapturing Talent fellowships which could offer opportunities for local people to re-enter the workforce and rebuild their career in academia.

The business plan did not identify any indicators for monitoring progress or contributions to this CCT.

10.3.2. Achievements and contributions of Sêr Cymru II

A range of information sources suggest contributions to tackling poverty and social exclusion have been more limited than for the other two themes. Figure 10.2 shows that a high proportion of respondents to the web survey said they were either unsure what contribution their project had made or that it had made no contribution.

Figure 10.2: How much would you say your project contributed to Welsh Government's cross cutting policy objectives?



Similarly, the review of the progress reports identified few examples of contributions to this CCT. The most common were the use of local supply chains for buying equipment or materials which supports local businesses and could contribute to poverty reduction, and volunteering schemes. Several of these related to school outreach activities, with examples including:

- An industrial fellow at Cardiff University participated in online outreach events, including ‘science busking’ and making a short ‘ask a scientist’ video.
- Cardiff School of Pharmacy and Pharmaceutical Sciences hosted two open days for Welsh primary school groups about the medicine discovery process.
- A researcher at the Nuclear Futures Institute volunteered to be a ‘Brilliant Club’ tutor, which involved the creation of a course based on materials science for school children and tutoring students during the course which ran during the Covid pandemic.

The evaluation has identified few examples of awards where the research funded through Sêr Cymru II has already led to economic benefits or reductions in poverty in Wales. The time lags involved in commercialisation of research mean that it is still too early to assess these types of impacts. However there are a number of projects where this could happen in the future. Examples include:

- The Chair in Bovine TB at Aberystwyth University is conducting cutting edge research which, if successful, could result in substantial reductions in cases. This is one of the major challenges facing many farmers and has substantial economic costs. A reduction in cases would make an important contribution to supporting rural communities in Wales and throughout the UK.
- The ARTHUR project, being led by the Welsh Government Office for Science, with input from the Nuclear Future Institute, would see the creation of a public sector national laboratory for the supply of medical isotopes, needed for the diagnosis and treatment of diseases such as cancer. This would be based in North Wales and would bring substantial economic benefits for the region, including creation of many high skilled jobs.

10.3.3. Factors constraining contributions to CCTs

Stakeholders identified two main factors which have constrained the ability of Sêr Cymru II to maximise contributions to CCTs or to evidence these appropriately.

Firstly, a number of stakeholders and grant recipients noted that the expectations around CCTs were never made clear. Most grant recipients could not recall being asked about CCTs on their application form or receiving information and guidance about how they were expected to contribute to CCTs on enrolment.

It was also noted by grant recipients that the early quarterly monitoring reports did not include a section on CCTs. This was added halfway through the programme, with limited guidance on how these sections should be completed. Welsh Government consultees clarified that there was originally a separate form and guidance document issued which specifically related to CCT data. However only a small number of these were returned, meaning CCTs were incorporated into the quarterly monitoring report.

Grant recipients also pointed to the lack of follow-up on any of the quarterly reports which meant they were unclear whether their responses were sufficient or whether they were expected to provide additional information or evidence. This led one recipient of a Capacity Building Award to note: “it felt like a bit of an afterthought. I am sure most fellows could think of a way their research was ticking one of the CCT boxes, but I am not sure what value that is adding”. Clearer advice and feedback may therefore have helped to increase contributions to CCTs.

Secondly, capacity constraints in the delivery team in Welsh Government hampered their ability to monitor contributions to CCTs. The operation initially had a dedicated CCTs Champion who was responsible for monitoring contributions to CCTs. However this role has changed hands numerous times due to staff changes and resourcing challenges faced by the delivery team, and was vacant for a long period during the pandemic. As described in the End of Programme report: “These resourcing challenges have meant corresponding obstacles to embedding a structured and consistent mechanism for capturing of CCT information from projects”.

Both of these factors mean there was no consistent approach adopted for maximising and monitoring contributions to CCTs. Although the progress reports provide some examples, these are not likely to capture all of the contributions.

10.4. Contributions to the Wellbeing of Future Generations Act

The Wellbeing of Future Generations Act is a Welsh law that requires public bodies to do things in pursuit of the economic, social, environmental and cultural wellbeing of Wales in a way that accords with the sustainable development principle. This section assesses how Sêr Cymru II has contributed to each of the seven connected wellbeing goals included in the Act.

10.4.1. A Prosperous Wales

This goal aims to create an innovative, productive and low carbon economy which generates wealth and provides employment opportunity.

Sêr Cymru II has directly contributed to this goal by increasing the number of new research positions in Wales’ HEIs, which are high quality jobs offering above average salaries. Over the longer term, it offers the potential to lead to further economic benefits as the scientific research funded by Sêr Cymru II leads to new discoveries, inventions and technological breakthroughs, which can drive economic growth and job creation.

As noted above, it is still too early to assess these benefits of Sêr Cymru II due to the time-lags involved. Nevertheless, the evaluation has identified a small number of examples where the funded research is already leading to commercial benefits, such as the industrial fellowship at Aberystwyth University. Other projects have filed patent applications (e.g. the MDI at Cardiff University) or created spin-off companies, indicating that these projects have moved closer to realising economic benefits.

Over the longer term, there is clear potential for innovation and economic benefits. This is evidenced by the large increase in the quantity and quality of research undertaken in Wales' Grand challenge areas and the large number of collaborations with industry, indicating clear potential for commercial applications of the research.

10.4.2. A Resilient Wales

This goal aims to build a nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example, climate change).

Around half of the awards funded through Sêr Cymru II have been related to the Grand challenge area of low carbon, energy and the environment and are therefore contributing to this goal. The operation has funded research that could contribute to the development of low carbon energy sources (e.g. the Nuclear Futures Institute at Bangor and photovoltaics at Swansea University), lead to a more sustainable production system (biopolymers research at USW, ammonia synthesis at Swansea), and find new ways to adapt to the adverse consequences of climate change (engineered logjams at Cardiff University).

Again, it is too early to provide concrete examples of how this research has led to innovations which could combat climate change or contribute to other environmental goals. However, given the quantity and quality of research funded, there is clear potential for these benefits to occur in the future.

10.4.3. A Healthier Wales

This aims for a society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.

The clearest examples of how Sêr Cymru II has contributed to this goal is through the Sêr Cymru II funded research which aligns with the Grand challenge area of life sciences and health. 44% of the original awards and 25% of the SCII+ awards are relevant to this area. Notable success stories include the MDI in Cardiff which has established a group of 40 new researchers, focused on the translation of biomedical research into new medicines, with a particular focus on neuroscience and mental health, and has already secured two patents for new treatments. The Dementia Research Institute at Cardiff University has also recruited two Sêr Cymru II fellows who have collaborated with industry on the discovery of new treatments.

10.4.4. A More Equal Wales

This aims to foster a society that enables people to fulfil their potential no matter what their background or circumstances (including their socio-economic background).

This was considered from the outset in the design of Sêr Cymru II. The Recapturing Talent fellowships were designed specifically to help women restart their careers in academia after a period outside the workforce. The operation also took a number of steps to ensure applicants were not disadvantaged by their characteristics including sex, ethnic background, sexual orientation or socio-economic background. This includes monitoring of characteristics of applicants and embedding unconscious bias principles into the selection process.

Although the operation did not meet its target for Recapturing Talent fellowships, the operation did meet its target for at least 40% of researchers to be female. Sêr Cymru II researchers also include a wide variety of ethnicities, although there is no data available on the demographic characteristics of these researchers.

10.4.5. A Wales of Cohesive Communities

This seeks to create attractive, viable, safe and well-connected communities.

It is less clear how Sêr Cymru II has contributed to this particular goal. The focus of the operation has been on STEMM subjects aligned with the Grand challenge areas. It has not funded research in social sciences, architecture or planning subjects which may have a stronger and more direct link to this goal. Nevertheless, there are a small number of examples where there may be indirect community benefits:

- The Chair in Bovine TB could contribute to the viability and vibrancy of rural communities should it result in a marked reduction in the burden associated with this disease.
- The OSCAR project at Cardiff University could contribute to safer communities by providing evidence, insights and tools which can be used by police forces in Wales to improve community safety.

10.4.6. A Wales of Vibrant Culture and Thriving Welsh Language

This aims for a society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts, and sports and recreation.

Sêr Cymru II has made a modest contribution to this goal. Although it was never anticipated that the operation would make a substantial contribution to the promotion of the Welsh language, there are a small number of fellows who have been strong advocates for this and have led a range of activities. This includes outreach activities, speaking at the National Eisteddfod, publishing research papers and undertaking media activities in Welsh, and encouraging all new researchers to undertake Welsh Language awareness training.

10.4.7. A Globally Responsible Wales

This identifies a goal for Wales to be a nation which, when doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether doing such a thing may make a positive contribution to global well-being.

As noted above, the research funded through Sêr Cymru II has a heavy focus on the two Grand challenge areas of life sciences and medicine and low carbon, energy and the environment. These are both global challenges, and any breakthroughs relating to low carbon energy production, climate change mitigation, medicines discovery or treatment of Bovine TB would have social, economic and environmental benefits which would extend to many countries other than Wales.

11. Conclusions and Recommendations

This section provides the conclusions to the evaluation, which are structured around the evaluation objectives summarised in Chapter 1.

11.1. Need for Sêr Cymru programme

Sêr Cymru II was designed to help close the gap between Wales and the rest of the UK in terms of research capacity and research income, and contribute towards Wales' HEIs achieving a 5% share of both these measures. Although there has been some closing of the gap since the operation was first designed, Wales still only accounts for 3.6% of STEMM research income and 3.9% of STEMM research staff. Therefore the original challenge that Sêr Cymru II was designed to address still persists.

This then raises the question of whether the Sêr Cymru programme is the most appropriate response to these challenges, given that the gap with the rest of the UK still persists despite the delivery of the programme since 2016.

In answering this, it is first necessary to set realistic expectations about what Sêr Cymru II could have achieved. In order to close the gap with the rest of the UK, Wales' HEIs would need to secure an additional £90m in STEMM research income per annum and grow their STEMM research workforce by 900 FTEs. This was never realistic (or expected) given the scale of funding (£51.1m invested over seven years, or £7.3m per annum).

When the analysis is more focused at a more appropriate level i.e. on those HEIs and subject areas that have benefitted from Sêr Cymru II funding, there is evidence that this has helped them to grow their research income at a faster rate than comparator institutions and increase their share of UK research income in that subject area. This suggests Sêr Cymru II is an appropriate model for addressing the challenges above, but that the aims and objectives need to be more specific about what can realistically be achieved.

Secondly, the evaluation has showed there is considerable variation in performance across the programme, with certain awards being more successful than others (e.g. two of the Research Chairs, two of the Rising Stars and a number of the Accelerator Awards). Given that less funding is likely to be available, it suggests that future rounds of the programme will need to be more selective than was the case for Sêr Cymru II.

This will mean identifying those projects which offer the greatest potential to increase research income and to deliver strategic and economic benefits for Wales. There was widespread support for this approach among stakeholders, many of whom cautioned

against spreading resources too thinly. This was also highlighted by stakeholders in the consultation on the future of the Ser Cymru programme^[footnote50].

11.2. Strategic fit of Sêr Cymru II and the Sêr Cymru programme

The policy context in Wales and the UK continues to be highly supportive of the aims of Sêr Cymru II. Wales Innovates, the recent innovation strategy published by the Welsh Government explicitly states its ongoing support for the Sêr Cymru programme, and the UK Government's policy has set a target for increasing its investment in RD&I outside London and the South East of England.

However, the policies of both governments also suggest that future rounds of Sêr Cymru will need to be more selective and targeted than Sêr Cymru II. These stress the importance of public investment in RD&I being more strategic, commercially focused and mission-orientated. This will mean only funding investments in areas where Wales is internationally competitive, where it can contribute to national priorities, and where there is clear potential for economic and social benefits. This will maximise the chances of securing additional funding from UKRI and research councils.

The evaluation has shown that these factors were considered in the award process for Sêr Cymru II. However many stakeholders believed this was too focused on the quality of the research proposal, with too little weight given to building on existing strengths and contributing to economic growth through innovation and commercialisation of research. This resulted in Sêr Cymru II funding a wide range of investments, many of which were not clearly aligned with existing research groups or building on recognised strengths.

11.3. Performance in relation to aims, objectives and targets in the business plan

This evaluation shows that Sêr Cymru II has successfully met almost all of the targets in the business plan, and in many cases has significantly overachieved. This includes the target for research income (£78.8m^[footnote51] compared to a target of £45m) and the number of new researchers (180^[footnote52] compared to a target of 102) in supported institutions, which relate to the main objectives of the operation. This may understate the total achievements as it excludes those outputs that were unsupported by evidence. It is also

Footnotes

[50] see page 12 of this document: [Summary of responses \(gov.wales\)](#)

[51] Excluding the research income which was claimed but found to be ineligible or not supported by evidence

[52] Excluding the cooperations which were ineligible or not adequately supported by evidence

noted that some universities stopped reporting additional outputs once they had met their target due to their dissatisfaction with the claims process.

Research Chairs have performed particularly well and have accounted for the majority of the outputs achieved for a number of indicators, including research income and co-operations with enterprise. However the other fellowships, focused more on early career researchers, have also performed strongly against the expectations in the business plan. There is clear evidence that Sêr Cymru II has provided them with valuable experience of leading a research project and in many cases leading research grant applications. These fellowships have resulted in a very large number of research publications which vastly exceeds the expectations in the business plan (although these expectations arguably lacked ambition). 29 of these fellows are still employed at their host institution which also exceeds the target in the business plan (26).

The monitoring data suggests the SCII+ awards have also performed well despite the challenges imposed by the Covid pandemic. Although there is some uncertainty about the total value of research income secured and partners co-operating in research projects, there are credible reasons to conclude that the outputs claimed with WEFO understate the achievements of these awards and that the targets in the business plan have been met.

11.4. Impacts of Sêr Cymru II

11.4.1. Research Income

The evaluation has found evidence that Sêr Cymru II has had a positive impact on the research income secured by supported institutions. Those subject areas that received support, including biosciences at Cardiff University, physics at Swansea University and engineering at Bangor University, have all experienced an increase in research income which is higher than similar institutions. They have also increased their share of UK research income in that subject area.

Although there are some limitations to this analysis, it does suggest that Sêr Cymru II has had an additional effect on research income which would not have occurred in the absence of the intervention. This is reinforced by consultation evidence, particularly Research Chairs and stakeholders from the host institutions, all of whom said the increase in research income would not have been possible without Sêr Cymru II funding. All of the Research Chairs have been offered permanent positions at their host institutions, and a number have overseen the development of new infrastructure which should provide lasting legacy benefits in the future.

11.4.2. Research staff

The evaluation has found that the operation has had, at best, a modest impact on research capacity, although this is subject to uncertainty. The monitoring data shows that operation recruited 180 new researchers. Of these 74 are still employed by their host institution (41%). However there is limited evidence that this has boosted research capacity in the subject areas that have received most support, with some subject areas experiencing a fall in the number of research staff. Although these losses could have been higher in the absence of Sêr Cymru II.

Although the research groups assembled by Research Chairs are still largely in place, consultees described the difficulty of retaining high quality researchers after the funding period ended, citing both the continued strain on university finances after the pandemic and uncertainty about the future of Sêr Cymru. This resulted in a number of researchers leaving and restrictions on any future recruitment.

It was also noted that a number of those who have stayed at their host institutions have done so in either lecturing or in combined lecturing and research roles. These have come under pressure to spend more time lecturing since the pandemic as universities have sought to increase student numbers as a means of growing income. In contrast, it was noted that some Vice Chancellors and heads of department do not see research “paying its way”, and therefore see it as less of a priority when finances are constrained. This has meant Sêr Cymru II fellows have had less time for research and some have become disaffected and are considering leaving their roles.

11.4.3. Quantity, quality and breadth of research

These impacts were assessed using counterfactual analysis (matching combined with DiD analysis). The key findings were as follows:

- Sêr Cymru II had a significant, positive additional impact on the number of research publications of the supported research fellows. The average number of publications per annum by Sêr Cymru II fellows increased by 1.27 between the pre-treatment and post-treatment periods. Of this, it is estimated that 1.19 was attributable to the Sêr Cymru II programme.
- There is some evidence the programme increased the breadth of subject areas covered by fellows’ research. The average annual number of subject areas in which fellows’ publications appeared increased by 2.55 between the pre-treatment and post-treatment periods, but declined slightly in the

control group. The DiD was estimated to be +2.76. However this finding requires some caution as the number of subject areas covered by Sêr Cymru II researchers was already increasing at a faster rate than the control group prior to the start of the programme, and therefore could be explained by other factors.

- There is mixed evidence about the impact of the programme on the quality of research by fellows. The programme had a significant, positive impact on the number of publications in journals ranked in the top 10% by CiteScore. While the number of articles in the top quartile for citations also increased by more than the control group, the difference was not statistically significant. Similarly, there was no significant difference in the change in the proportion of outputs in top journals or in the top quartile for citations.
- The impacts on the quantity and quality of research were greater for fellows than Research Chairs. The DiD is lower for a number of the outcome variables when Research Chairs are included in the treatment group (including the number of publications, the number of subject areas and the number of publications in top ranked journals). This is due to the average number of research outputs by Research Chairs declining between the pre-treatment and post-treatment periods included in the analysis. However it should be noted that the Research Chairs were already producing a large number of outputs prior to the start of the programme, and the added responsibilities associated with taking the role of Research Chair means a small drop-off in their rate of publication might have been expected. This analysis also only includes the publications in which Chairs are named authors and excludes the publications of their research teams.

11.5. Effectiveness of management, delivery and monitoring processes

It was widely recognised that the delivery team in Welsh Government made significant efforts and were flexible and responsive to the needs of grant recipients during the Covid pandemic. However the evaluation has identified a number of areas where the management and delivery of Sêr Cymru II could have been improved.

A recurring theme was that the robust and effective leadership and management in place at the start of the operation was not sustained after the pre-award phase. This was critically

influenced by the departure of the incumbent CSA and the original project manager, both of whom had played key roles in the design and early momentum of the operation.

Another important factor was the growing gap between the administrative requirements of the programme and the resources available within the delivery team, meaning resources were heavily weighted towards programme administration. This came at the cost of maximising the strategic impact of Sêr Cymru II and engaging with the scientific research that had been funded. There was limited follow-up to progress reports and fewer meetings with Rising Stars and Research Chairs after the early phases of the operation. This meant Welsh Government lacked a strategic overview of which awards were performing strongly and which were not, what further support was needed and how benefits could be maximised.

This also means opportunities were likely missed to celebrate the successes and achievements of Sêr Cymru II and raise the profile of Welsh science. This is particularly important given Wales' poor track record of securing research income from UKRI and research councils, and the UK government's commitment to increase spending on RD&I outside the South East.

Finally, it was noted that a number of early career researchers were not adequately supported by their host universities during their Sêr Cymru fellowship and this left many feeling isolated. In general, it appears those fellows who were integrated into existing research groups were better supported than those who were not. This suggests there are lessons for Welsh Government, as well as host universities, and that future rounds of Sêr Cymru will need to give greater consideration to how early career researchers will be integrated and supported.

11.6. Contributions to Cross Cutting Themes

Sêr Cymru II's main contribution to CCTs has been to the 'equal opportunities and gender mainstreaming' theme. The Recapturing Talent fellowships were designed specifically to help women restart their careers in academia after a period outside the workforce. The operation also took a number of steps to ensure applicants were not disadvantaged by their characteristics including sex, ethnic background, sexual orientation or socio-economic background. Although the operation did not meet its target for Recapturing Talent fellowships, the operation did meet its target for at least 40% of researchers to be female.

There are a small number of examples of where projects have contributed to the promotion of the Welsh language. This includes school outreach activities, speeches at events and

Welsh language awareness sessions. However this has generally only occurred where the fellow or a member of the research team was able to speak Welsh and was a strong advocate for promoting the language.

The main contributions to sustainability have been through the research funded by Sêr Cymru II. Around half of the awards have been related to the grand challenge area of low carbon, energy and the environment and are therefore contributing to this theme.

The operation has made only a limited contribution to tackling poverty and social exclusion. However this could be a longer term outcome if some of the research funded by Sêr Cymru II is commercialised and results in job creation in Wales. There are also a number of examples of where Sêr Cymru II funded researchers have undertaken volunteering and outreach activities which is relevant to this theme.

The potential to maximise and monitor contributions to CCTs was constrained by two factors:

- Limited capacity and high staff turnover in the Welsh Government delivery team, which meant the role of CCTs Champion changed hands multiple times and was vacant for a long period.
- The expectations around CCTs not being made clear to grant recipients from the outset and providing no feedback to the information in the quarterly progress reports.

The evaluation finds that Sêr Cymru II is contributing to most of the seven goals of the Wellbeing of Future Generations Act, with the only exception being a 'Wales of Cohesive Communities' as this is less relevant to this operation. In many cases, this alignment is due to the nature of the funded research which includes research in new medicines, carbon reduction and climate change adaptation, and in areas aligned with growing markets and economic drivers such as semi-conductors. These offer the potential to contribute to a more 'resilient Wales' a more 'healthy Wales' and a more 'prosperous Wales', although it may take some time for these benefits to emerge.

11.7. Recommendations

11.7.1. Rationale and design of future rounds of Sêr Cymru

1. Welsh Government should continue to support and deliver the Sêr Cymru programme. As noted above there is still clear evidence of need for Sêr Cymru in order to build research capacity and funding at Wales' HEIs.

However, given that future rounds are likely to have substantially less funding available, this will need to be more strategic and selective than Sêr Cymru II. This should also set specific targets which more closely reflect the outcomes and impacts which are achievable.

2. The future of Sêr Cymru should be guided by a clear, long-term vision and strategy. The stop-start nature of Sêr Cymru has created significant uncertainty for Wales's HEIs. This has made it difficult for the Research Chairs and their groups to plan for the future and build on their successes. An urgent priority is therefore for Welsh Government to work with the universities to establish an agreed vision for Sêr Cymru and its long-term priorities for the next ten years.
3. Focus investments on internationally excellent research which builds on Wales' strengths and addresses national priorities. Future rounds of Sêr Cymru will need to avoid spreading resources too thinly. To maximise impact this should be focused on a small number of investments where there is a compelling strategic and economic opportunity, linked to Wales' national priorities, the existing strengths of universities and the distinctive assets, strengths and opportunities for Wales as a country (e.g. its natural assets which lends itself renewable energy investment or its most high performing industry clusters such as semiconductors).
4. Ensure that industry is engaged in determining priorities. Linked to the above, it is essential that Welsh Government engages with industry and offers industry stakeholders a chance to influence priorities for investment. This had been missing from Sêr Cymru II which was focused mainly on scientific excellence and funded some research which was less relevant to the needs of industry.
5. Provide more flexibility and structure funding in a way that allows universities to leverage other funding. Sêr Cymru II offered a lot of flexibility in how funding could be used by universities to build capacity. This should continue in future rounds, whether that is the recruitment of outstanding researchers or investments in infrastructure. However, there is also an opportunity to offer more flexibility, including funding for PhD studentships which was not permitted for ERDF funded investments. It is also important that future funding is structured in such a way that it allows universities to

leverage other funding opportunities. For example, Sêr Cymru funding could be used as leverage to secure new programmes such as Centres for Doctoral Training (CDTs) which offer another route to recruiting more PhD students to Wales. Structuring funding in such a way would allow Wales' HEIs to gain a competitive advantage for securing these programmes.

6. Outcomes and progress should be rigorously scrutinised. Given the funding constraints and the need to focus on a small number of high impact investments it is essential that the progress and outcomes are closely monitored. Welsh Government and universities could agree a number of milestones and outcome indicators for each investment and monitor progress against these. If it is found that projects are not delivering the Welsh Government should not be afraid to terminate projects early.
7. Welsh Government will need to work with universities and heads of department to ensure research groups are protected. There are concerns that some of the gains made by the research groups supported through Sêr Cymru II will be lost. It is clear that funding constraints have already led to the loss of a number of researchers recruited through the operation, even in those groups which have secured a large amount of new research income, due to wider financial constraints in these organisation and pressure to focus on teaching.

Consultees pointed to the importance of Pro Vice Chancellors and heads of department who have the control over these research teams. Their priorities are not always aligned with those of Welsh Government meaning there is no guarantee that they will protect research groups or build on their successes. It is therefore important that the policies and priorities of Welsh Government and universities are harmonised as far as possible (recognising the financial pressures facing universities and the effect this has on research), and to work with Pro Vice Chancellors and heads of department to ensure they provide an environment for these research groups to flourish.

11.7.2. Leadership, management and delivery

1. Welsh Government needs to forge close relationships with universities and be a powerful voice for Welsh science. The long-term vision and strategy referred to above needs to secure the buy-in of Wales' HEIs to gain as much

leverage as possible and to identify areas where universities can collaborate around shared national priorities. Given the commitment of the UK government to increase RD&I investment outside the South East of England, it is essential that Welsh Government is prepared to advocate forcefully within government circles on behalf of Welsh science and to set out a compelling narrative about its achievements and what its universities can offer. A key part of this should be celebrating the achievements of Sêr Cymru II and raising the profile of its 'stars'.

2. Ensure there is sufficient capacity and scientific expertise overseeing delivery. It is clear that the effective management and delivery processes in place at the start of the operation was not sustained after the pre-award phase, and that there was a lack of scientific expertise and capacity to manage and monitor the operation effectively. It is essential that this is addressed on future rounds of Sêr Cymru and that scientific rigour is applied in the post-award phase as well as the pre-award phase. Welsh Government should consider using a panel of scientific experts to monitor the progress of projects once in delivery as well as in the pre-award phase. Alternatively, both the award and monitoring process could be subcontracted to a trusted external organisation with established, robust processes for awarding research funding and monitoring progress.
3. Ensure early career researchers are supported and integrated into existing research teams. If future investments involve the recruitment of new researchers, the selection process should give far greater consideration to how they will be supported and integrated in to existing or new research teams, and ensure they are being supported by their host institutions on an ongoing basis.
4. Streamline reporting and claims processes. The reports should be streamlined in line with research council norms and the claims process should be simplified to reduce the administrative burden and resource requirements for universities, grant recipients and Welsh Government.
5. Develop more robust systems for monitoring retention of staff. The monitoring data on the number of retained researchers appears to be inaccurate and it has been difficult to establish how many of the research staff recruited by Research Chairs have been retained in research roles. If

growing the number of research staff is an objective of future programmes,
this should be addressed.

12. Annex A – Counterfactual Impact Analysis

This appendix presents the findings of the counterfactual impact analysis undertaken as part of the evaluation of Sêr Cymru II. This focuses on the impact of the programme on the quantity and quality of research undertaken by Sêr Cymru II participants with a control group of similar researchers who did not participate.

The analysis has only been undertaken for the original Sêr Cymru II awards (including Research Chairs, Rising Stars, Recapturing Talent, Precision Medicine Fellowships and Research Fellowships). It has not been applied to assess the impact of SCII+ awards. This is for a number of reasons, but mainly due to the fact that these started and finished later than the original awards. There has therefore been less time for these awards to generate outcomes.

12.1. Methodology

Counterfactual impact evaluation (CIE) is a method used to assess the effect of an intervention or programme by comparing observed outcomes with what would have happened in the absence of intervention. It involves estimating the difference between the actual outcomes of those who participated in the intervention and a counterfactual group (those who did not participate but are similar in all other respects). This approach helps to determine the causal impact of the intervention by accounting for potential confounding variables.

The inception evaluation for Sêr Cymru II considered how CIE could be applied to estimate the impact of the programme on the quality and quantity of research. The method used here is broadly consistent with the approach recommended by the inception evaluation. This combines two statistical techniques; matching and difference-in-difference (DiD) analysis:

- Matching is a technique used to create a comparable control group for a group who have received some form of support or intervention (the treatment group) using data on their observable characteristics. It aims to balance these characteristics so they are as similar as possible to the treatment group.
- DiD is a method used to estimate the causal effect of a treatment, policy or intervention by comparing changes in an outcome variable over time between a treatment group and a control group. The key assumption is

that, in the absence of the treatment, the two groups would follow parallel trends over time.

Combining these techniques can improve the robustness of control group analysis. By introducing a time element through DiD, it provides a way of controlling for unobservable differences between treatment and control groups that cannot be addressed through matching alone. Introducing time is useful because if there are some unobservable factors that are time invariant, then any change in performance over time cannot be due to these if they do not change with time.

12.1.1. Methodology for matching

The matching was undertaken by analysts at Elsevier. This used a matching algorithm designed for an evaluation of Canadian Excellence Research Chairs, which was re-purposed for this study. For each given Fellow or Research Chair, the algorithm identified and ranked potential matches in Elsevier's database by sequentially applying the following criteria, and then retaining the top match for each Fellow or Chair:

- Exact match on gender (with gender predictions based on first and last name provided by the NamSor software)
- Similarity of career stage, operationalised as:
 - year of first publication of match is ∓ 2 years within year of first publication of Fellow or Chair
 - year of last publication of match is ∓ 2 years within year of last publication of Fellow or Chair
- Similarity of institution/country national context of affiliation: ideally at a Welsh institution; or, failing this, at a roughly similar institution (same size and resources, such as number of students, number of research FTEs, grant volume) within the UK (excluding London-based institutions, as well as University of Oxford and University of Cambridge, given important differences in either regional socio-economic context or resources in comparison to Welsh universities).
- Exact match on the main domain of research (domains as defined in the Science-Metrix classification)

- Similarity (cosine) of vectors of the distribution of prior journal publications across the 174 Science-Metrix classification subfields
- Similarity of prior output volume over the 2011-2016 period
- Similarity of prior citation impact over the 2011-2016 period
- Chair or Fellow and potential matches have not published extensively together as co-authors

Out of a pool of 46 Fellows (non-Chairs), 37 could be successfully identified and matched. The seven Research Chairs covered by the study could all be linked to Scopus author identifiers. However, the algorithm had to be modified, with some criteria relaxed to produce matches.

The matching algorithm can be considered a bibliometric data processing strategy, subject to the same limitations as the Scopus database^[footnote53] from which it is derived. Notably, Scopus coverage, by design, is not fully comprehensive and leaves out journals that do not meet criteria set out and applied by the independent Scopus Content Selection and Advisory Board. Notably, it is known that Scopus and other bibliographic databases' coverage is biased towards English-language content published in North America, the Netherlands, or the UK.

Additionally, there are small margins of error associated with data processing operations performed by Scopus, such as association of publications to certain affiliations or author identifiers. Given the very small number of researchers included in this analysis (n = 43 or 44), use of the Scopus author identifier to identify relevant publications is likely to be associated with non-negligible margins of errors. Use of the NamSor software to predict gender of authors is also associated with a margin of error. NamSor is particularly error-prone in predictions based on names and surnames of Chinese, Korean, Thai or Vietnamese origin.

12.2. Methodology for DiD analysis

All data for the DiD analysis was extracted from Scival. This is an online tool developed by Elsevier for undertaking bibliometric analysis, containing a wide range of outcome variables. The analysis in this case focused on the following

[53] This is Elsevier's main database containing detailed bibliographic information on researchers, publications and citations

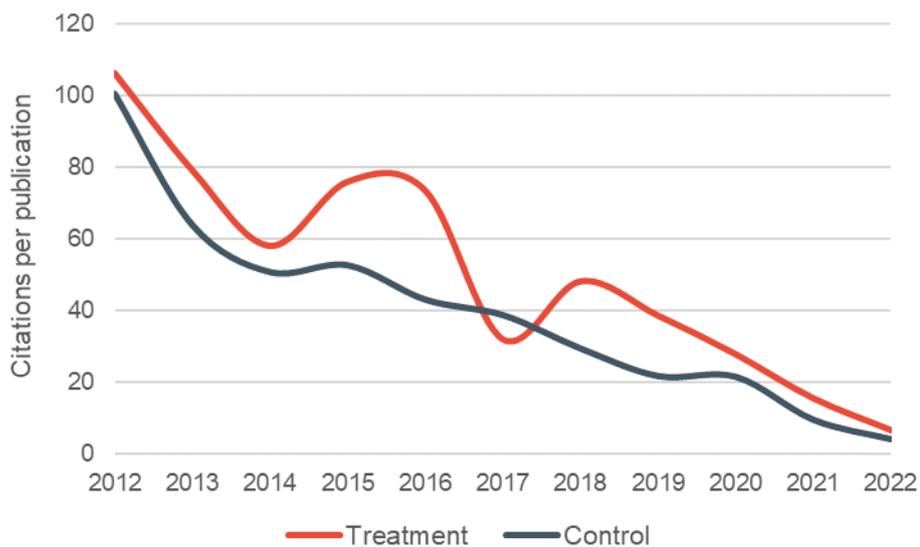
outcome variables for researchers which cover both indicators of research volume and quality:

- Number of research articles published per researcher per year
- The number of subject areas in which a researcher's publications have appeared^[footnote54]
- Number of publications in journals which are ranked in the top 10% of journals by CiteScore
- Percentage of publications in journals ranked in the top 10% by CiteScore
- Number of publications that are in the top quartile for citations in a given year.
- Percentage of publications in the top quartile for citations.

The first outcome variable is a measure of the quantity of research, the second is a measure of the breadth of subjects covered, and the last four variables are all measures of the quality of research. The evaluation did also consider the number of citations per publication as a measure of quality, however this was considered to be less suitable for DiD analysis at this point in the evaluation because of the time lags involved for publications to receive citations. This means the number of citations for researchers tends to decrease over time (since earlier publications have had more time to attract citations) as shown in Figure 12.1.

Figure 12.1: Citations per publication for Ser Cymru Researchers and Control Group, 2012 to 2022 (excluding Research Chairs)

[54] Elsevier allocates all articles to one of 27 main categories and 334 sub-categories. This analysis focuses on sub-categories. Publications can be allocated to more than one category if the subject of an article covers multiple categories.



Source: Elsevier processed by Hatch

The DiD analysis compares change in these variables over two time periods relating to the commencement of the Ser Cymru Programme in 2016:

- Pre-treatment: the average over the period 2012 to 2015^[footnote55]
- Post-treatment: the average over the period 2016 to 2022.

The DiD is estimated by first calculating the difference between the pre-treatment annual average and the post treatment average for each group (the control group and the treatment group). This is the first difference. Then calculating the difference between these two figures (the second difference):

DiD = (post treatment average of treatment group – pre-treatment average of treatment group) – (post treatment average of control group – pre-treatment average of control group)

If the DiD is positive it indicates that the treatment had a positive effect on the outcome compared to the control. If this difference is statistically significant (e.g. at the 1%, 5% or 10% level), this means it is unlikely to have occurred by random chance alone. This increases the statistical confidence that the treatment had an additional positive effect (i.e. there was an additional impact which can be attributed to Sêr Cymru II) which would not have been achieved in the absence of the programme.

[55] It should be noted that the DiD analysis used a slightly different pre-treatment period to the matching algorithm (2011 to 2016). However this is unlikely to make a difference to the findings.

12.2.1. Research Chairs vs Early and Mid Career Researchers

The results of the analysis below are presented for two treatment groups; one which excludes Research Chairs and one which includes them. The reasons for this are as follows:

- Research Chairs are all highly experienced professors, and therefore have different characteristics to other Sêr Cymru II fellows, the majority of whom are in the earlier stages of their career. This means they naturally have a different publication rate which could skew the findings.
- Although the number of research publications and citations is an important success measure for all Sêr Cymru II participants, it is arguably more aligned with the objectives for non-chair fellowships which were focused on attracting stellar researchers and supporting them to develop their research capabilities. The main goal of Research Chairs was to build new research teams and attract new research funding for their host universities which could reduce the rate of publications in the short to medium term. The number of publications and citations was therefore a secondary measure of success.

The approach to matching was also different for Research Chairs than other fellowships. Due to the small sample of Research Chairs (seven), these were matched on a one-to-many basis rather than one-to-one which was the preferred approach for the research fellows. This provided more observations for the control group, which reduces the risk of random variation which can occur with small sample sizes.

Research Chairs were matched using the same criteria as the Sêr Cymru II fellows. However, it was more difficult to find matches in the case of Research Chairs due to their distinctive profiles. Therefore the matching applied a series of steps in which some of the criteria were relaxed, resulting in a larger pool of potential matches. These steps were as follows^[footnote56]:

- Step 1: all criteria described in paragraph 1.6 enforced

[56] In each case the matching pool was restricted to researchers at UK institutions. The analysis did also identify matches in other countries, however it was felt that UK researchers were a better match as they have been subject to the same policy and funding environment.

- Step 2: relaxing the seniority constraint to +/- five years, with all other criteria enforced.
- Step 3: relaxing seniority criteria and the disciplinary vector, with all other criteria enforced.

The results of this matching analysis are shown in Table 12.1. It shows that two of the Chairs yielded a large number of matches but it was particularly difficult to find multiple matches for three others using steps 1 and 2 due to their unique profiles (or even a single match in the case of one Chair). While it was possible to find additional matches in step 3, the gains in robustness from increasing the size of the control group might be counteracted by the lower similarity of those matches with the Research Chairs. For this reason, the results below are presented for two control groups for Research Chairs:

- Control group 1: this uses the matches identified in steps 1 and 2. The one Chair with no matches is removed from the treatment group for the analysis involving this research group.
- Control group 2: using the matches from steps 1-3. The analysis includes all Chairs.

Where multiple matches were identified, the modelling used the average outcomes for each Chair's matches to ensure the analysis was not skewed by those with a large number of matches.

Table 12.1: Numbers of matches for each Chair when applying different criteria

	Step 1 matches	Step 2 matches	Step 3 matches
Chair 1	5	13	91
Chair 2			4
Chair 3	3	6	103
Chair 4	1	2	5
Chair 5	1		13
Chair 6	3	1	11
Chair 7		1	13

Source: Elsevier. Note: the figures in the table indicate the number of 'new' matches for each step so are not cumulative. The table includes seven Chairs

even though there were only six awards because one of the awards at Cardiff University was for two Chairs.

12.2.2. Other factors affecting additionality

The analysis here focuses on the performance of individuals that participated in Sêr Cymru II. However the aim of the programme was to boost the research capacity of Wales's HEIs. The additionality of Sêr Cymru II on outcome variables at institution level could be affected by a number of factors:

- Substitution effects. These could arise if universities switch funding to support a Research Chair rather than other research groups, which could result in a decline in publications by other researchers.
- Displacement. This could occur if the research of other researchers is not published due to limited capacity of these publications.
- Wider effects. Other researchers who are not in research groups funded by Sêr Cymru II could still benefit from a more active and stimulating research environment focused on particular topics.

The evaluation does not have enough information to make quantitative adjustments for these effects. Therefore these are not captured in the results below. However the consultations with university stakeholders included questions about substitution effects and none were reported by consultees, which suggests these effects would be limited.

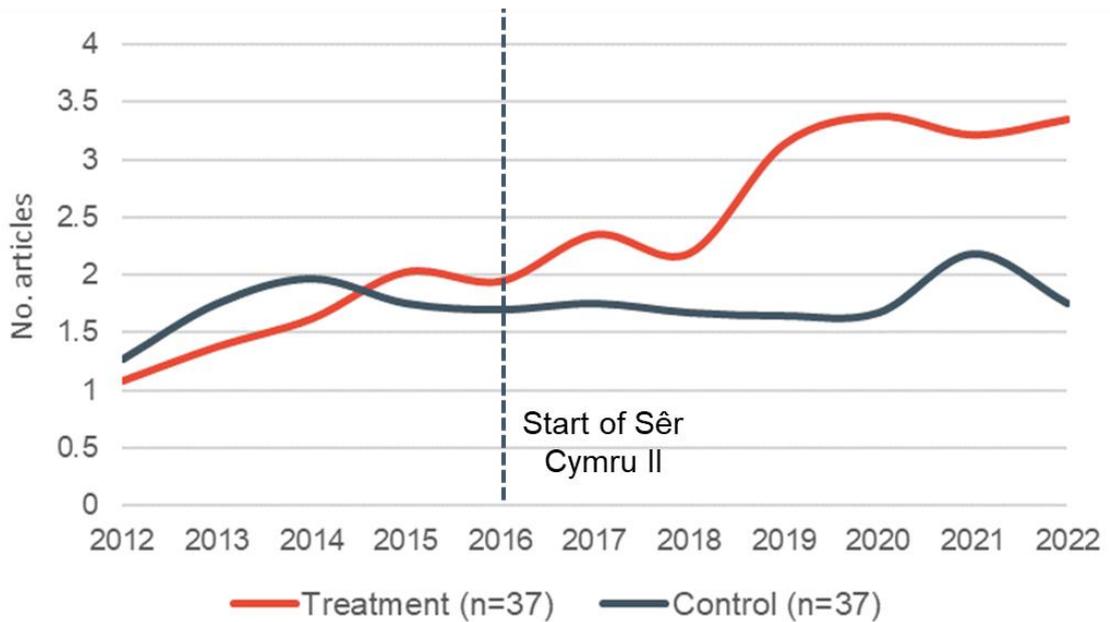
12.3. Results

12.3.1. Average number of publications

Figure 12.2 shows the change in the average annual number of publications for Sêr Cymru II fellows (excluding Chairs) and the control group. It shows that fellows and their matches, on average, were on a similar trajectory in the period 2012-2015. This increases our confidence that the control group had similar characteristics to fellows and would have followed a similar trend in the absence of Sêr Cymru II.

The chart shows the average number of publications increased for Sêr Cymru II fellows after the start of the programme at a higher rate than the control group and has remained at a consistently higher level since 2016.

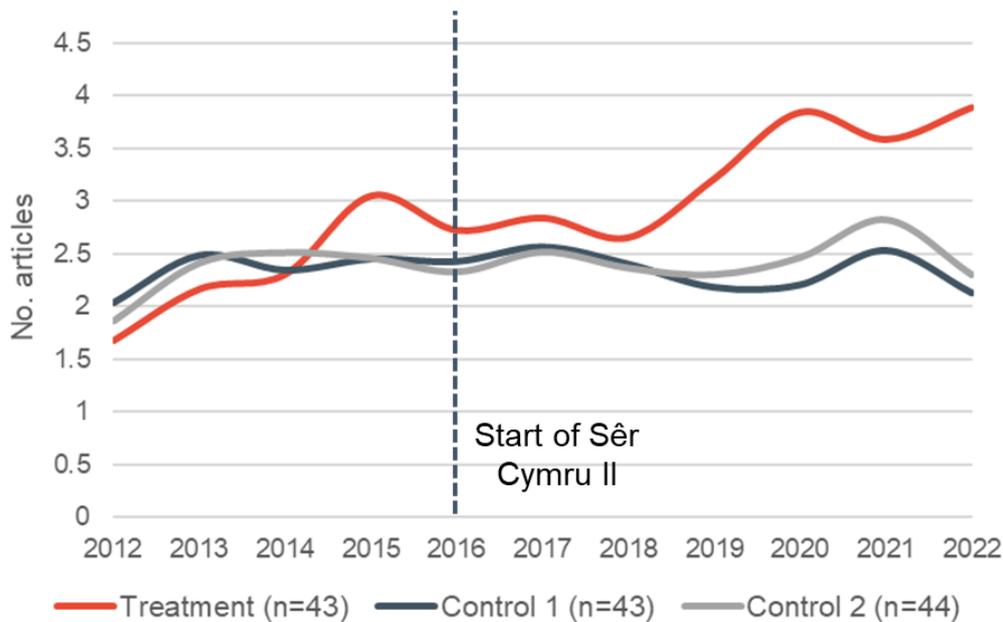
Figure 12.2: Average number of publications per researcher, 2012-2022 (excluding Research Chairs)



Source: Hatch analysis of Elsevier data

Figure 12.3 repeats the analysis including Research Chairs in the treatment group and the two control groups. This shows the inclusion of Research Chairs has a large effect on the average annual number of articles, reflecting the fact that a number of the Chairs were already quite prolific in terms of research outputs. This also shows the pre-treatment trend for the treatment group is quite different to the control groups, indicating Research Chairs have characteristics which are not fully reflected in the control group. This illustrates the difficulty of finding comparable matches for Research Chairs, particularly given the small sample size.

Figure 12.3: Average number of publications per researcher, 2012-2022 (including Research Chairs)



Source: Hatch analysis of Elsevier. Note: Control 1 includes the matches from steps 1-2. Control 2 includes the matches from steps 1-3. Only one treatment group is shown in the chart (the one which removes the Research Chair with no matches in steps 1-2). Adding this Research Chair makes only a small difference. This has not been shown to avoid overcomplicating the chart.

Table 12.2 provides quantitative estimates of the additionality of Sêr Cymru II on the number of research publications per researcher using DiD analysis. This shows:

- When Research Chairs are excluded from the analysis, the average number of research publications per annum by Sêr Cymru II fellows increased by 1.27 between the pre-treatment and post-treatment period compared to only 0.08 for the control group. The additional effect of the programme (given by the DiD) is therefore estimated to be 1.19 publications per annum (1.27-0.08). The difference between the treatment and control group is statistically significant at the 1% level.
- When Research Chairs are included and compared with control group 1 (identified using steps 1-2), the DiD is reduced to 0.93 publications per annum. The difference is significant at the 5% level.
- When Research Chairs are included and compared with the control group 2 (identified using steps 1-3), the DiD is reduced to 0.69 publications per annum. Although this suggests Sêr Cymru II had a positive effect, the

difference between the treatment and control groups is not statistically significant.

Table 12.2: Difference in difference analysis for average annual number of research publications per researcher

	Excl chairs (n=37)	Incl chairs, Control 1 (n=43)	Incl chairs, Control 2 (n=44)
Change in treatment group	1.27	0.95	0.82
Change in control group	0.08	0.02	0.13
DiD	1.19***	0.93**	0.69

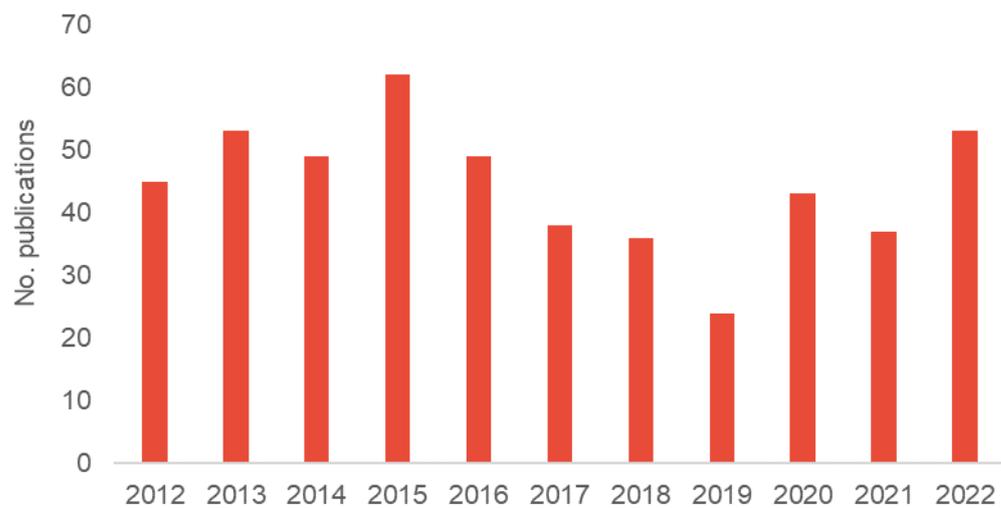
Source: Hatch analysis of Elsevier data. Significance levels are 1% (***), 5% (**) and 10% (*).

This suggests that Sêr Cymru II had a significant positive impact on the number of research publications of participants, but the impact was greater for early and mid-career researchers than the more experienced Research Chairs. Closer analysis shows that the average number of publications by Research Chairs actually declined after the start of Sêr Cymru II (see Figure 12.4). There may be a number of reasons for this:

- Research Chairs were already producing a large number of research publications prior to the start of Sêr Cymru II (between 7 and 9 articles per annum between 2012 and 2015 compared to only 1 to 2 articles for other fellows). They were therefore starting from a higher base and there may be a limit to how many additional publications they could contribute to, given their resource constraints.
- Taking on the role of Sêr Cymru II Chair could have resulted in a drop-off in their research outputs for a period due to an initial induction period when research productivity could be reduced and the greater responsibility and work involved in building a new research group.

It is also important to note that this analysis only captures the outputs in which the Research Chairs were named authors. There are likely to have been other publications by members of their research group where they are not named authors but which might not have occurred in the absence of the Chair establishing the research group. For example, the Sêr Sam research group lists a large number of publications on its website, but the Chair is not named as an author in around 40% of these.

Figure 12.4: Number of publications by Research Chairs, 2012-2022

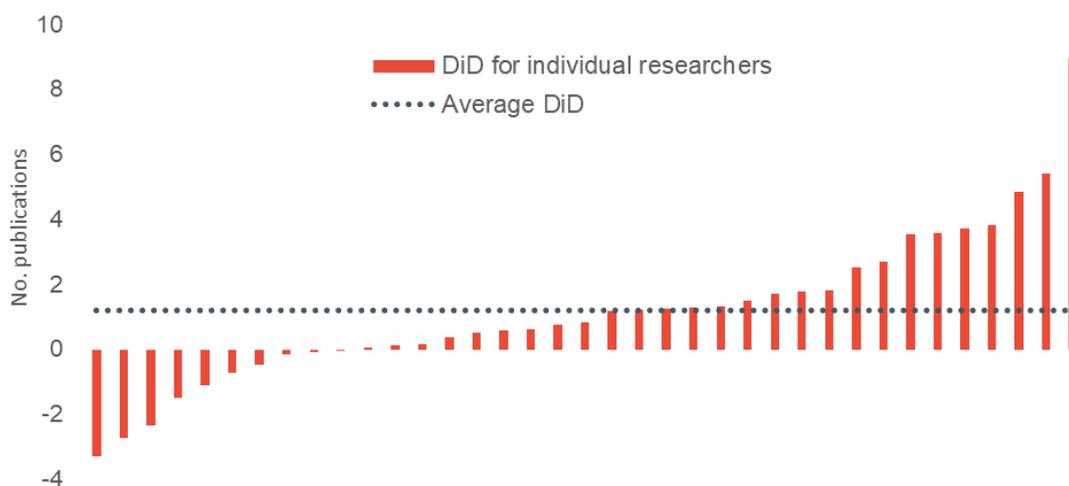


Source: Elsevier, processed by Hatch

Figure 12.5 shows there is significant variance in the DiD for this outcome variable. It shows that the positive DiD for research publications is influenced by a small number of high performing researchers and one in particular who, on average, increased their annual average research outputs by nine more than their match in the control group. Removing this outlier reduces the average DiD from 1.19 to 0.96 but still results in a positive, statistically significant difference with the control group^[footnote57].

[57] At 5% level

Figure 12.5: Distribution of DiD for average annual publications by researcher (excluding Research Chairs)



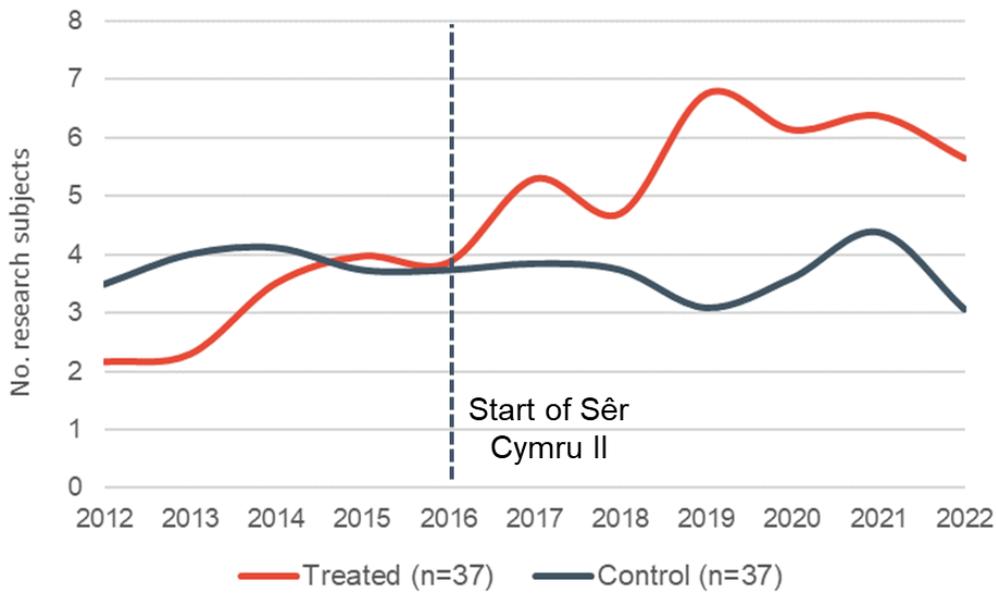
Source: Hatch analysis of Elsevier

12.4. Number of subject areas in which researchers' publications have appeared

Figure 12.6 shows the breadth of subject areas covered by Sêr Cymru II fellows' research publications was similar prior to the start of the programme, although the pre-treatment trend was different. This may indicate there may be other factors affecting the performance of researchers which are not captured in this analysis.

Following the start of Sêr Cymru II, the gap between fellows and the control group has widened, suggesting the programme has had a positive effect on the breadth of subjects covered by fellows' research. This may indicate there has been more inter-disciplinary working by fellows. It could also reflect the fact that all fellows moved to a new institution which may have encouraged them to develop new relationships with colleagues who have different specialisms.

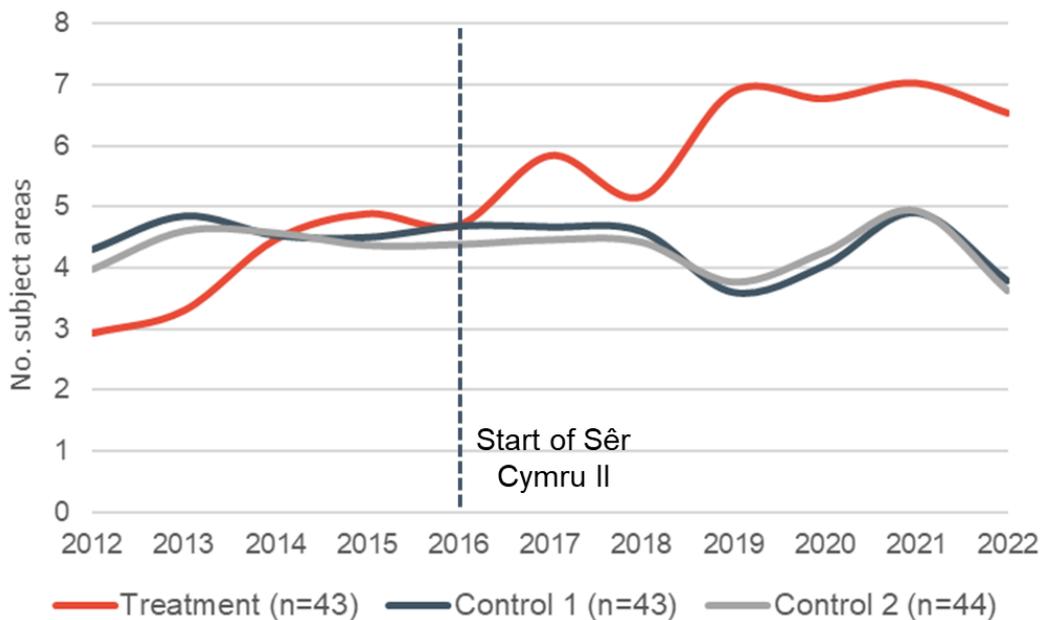
Figure 12.6: Average number of subject areas in which articles have appeared, 2012-2022 (excluding Research Chairs)



Source: Hatch analysis of Elsevier data

Adding Research Chairs into the analysis shows a broadly similar trend. The breadth of subject areas covered by Sêr Cymru II participants was similar to control groups at the start of the programme period but the gap widened over time. However the difference in the pre-treatment trend suggests there may be other factors other than Sêr Cymru II which explain the relative performance.

Figure 12.7: Average number of subject areas in which articles have appeared, 2012-2022 (including Research Chairs)



Source: Hatch analysis of Elsevier data. Note: Control 1 includes the matches identified in steps 1-2. Control 2 includes the matches identified using steps 1-3.

Table 12.3 shows the average number of subject areas in which Sêr Cymru II research publications have appeared increased by a larger amount than control groups in all of the models. In each case the difference was statistically significant at 1% level. This suggests Sêr Cymru II had a significant impact on the breadth of research.

However this finding requires some caution as the number of subject areas covered by Sêr Cymru II researchers was already increasing at a faster rate than the control group prior to the start of the programme, and therefore could be explained by other factors.

Table 12.3: Difference in difference analysis for average number of subject areas covered by research

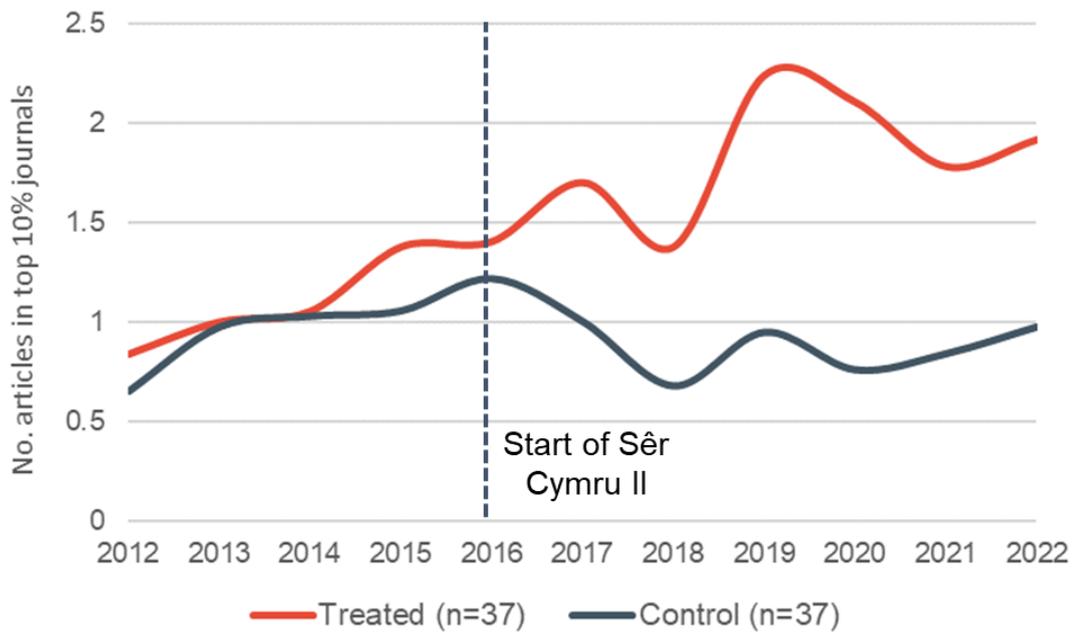
	Excl chairs (n=37)	Incl chairs, Control 1 (n=43)	Incl chairs, Control 2 (n=44)
Change in treatment group	2.55	2.23	1.91
Change in control group	-0.20	-0.22	-0.12
DiD	2.76***	2.45***	2.03***

Source: Hatch analysis of Elsevier data. Significance levels are 1% (***), 5% (**) and 10% (*).

12.4.1. Number of research articles published in journals ranked in the top 10% by CiteScore

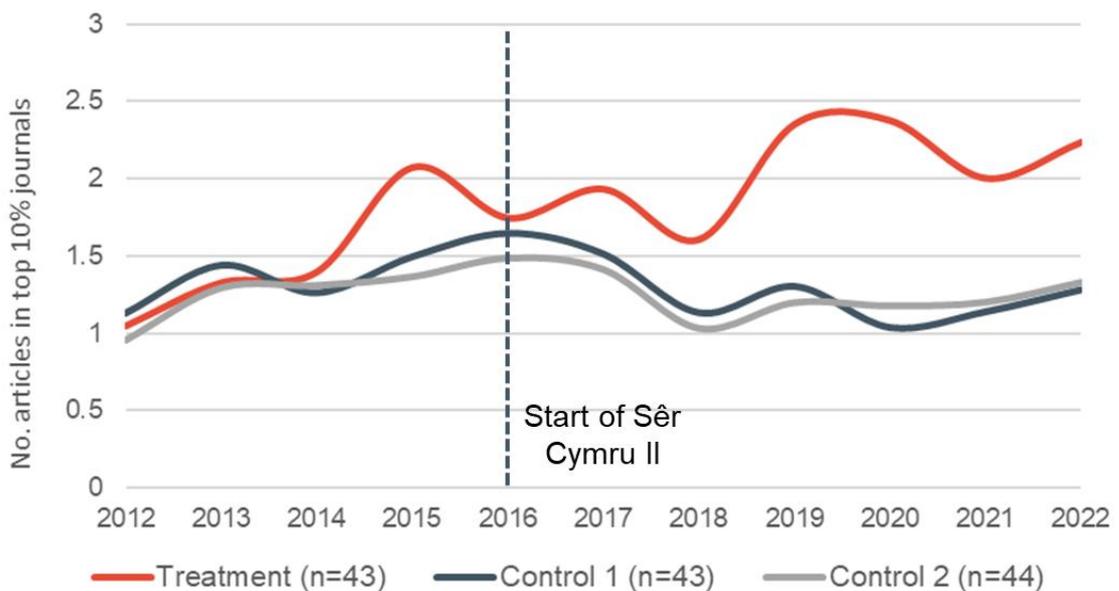
Figure 12.8 shows Sêr Cymru II fellows (excluding Chairs) were producing a similar number of articles in top ranked journals to control group researchers prior to the start of the programme, and that the pre-treatment trend in the two groups was broadly similar. Following the start of the programme, fellows have consistently outperformed the control group. This is also the case when Research Chairs are included (see Figure 12.9).

Figure 12.8: Average number of articles published in top 10% journals, 2012-2022 (excluding Research Chairs)



Source: Hatch analysis of Elsevier data

Figure 12.9: Average number of articles published in top 10% journals, 2012-2022 (including Research Chairs)



Source: Hatch analysis of Elsevier data. Note: Control 1 includes the matches identified in steps 1-2. Control 2 includes the matches identified using steps 1-3.

The DiD analysis shows a positive effect in each of the models, ranging from 0.48 to 0.73 (see Table 12.4). Again, the results suggest the difference between control and treatment groups is larger and more significant when Research Chairs are

excluded from the analysis, indicating the main *additional* benefits of the programme were for early and mid-career researchers.

Table 12.4: Difference in difference analysis for average number of articles in top 10% journals

	Excl chairs (n=37)	Incl chairs, Control 1 (n=43)	Incl chairs, Control 2 (n=44)
Change in treatment group	0.72	0.57	0.51
Change in control group	-0.01	-0.02	0.03
DiD	0.73***	0.59**	0.48*

Source: Hatch analysis of Elsevier data. Significance levels are 1% (***), 5% (**) and 10% (*).

12.4.2. Percentage of research articles published in journals ranked in the top 10% by CiteScore

Table 12.5 focuses on the change in the *percentage* of research articles in top journals. This shows very similar results for each of the models regardless of whether Research Chairs are included or excluded from the analysis. Although each of the models suggests the percentage of articles in top journals increased more for Sêr Cymru II participants than control group researchers, the difference is not found to be statistically significant.

This suggests that the additional effects of Sêr Cymru on the number of articles in top journals (shown above) is due to the fact that fellows are producing a larger number of articles in general. However there is not clear statistical evidence that it has affected the proportion of articles which are in top ranking journals.

Table 12.5: Difference in difference analysis for percentage of articles in top 10% journals

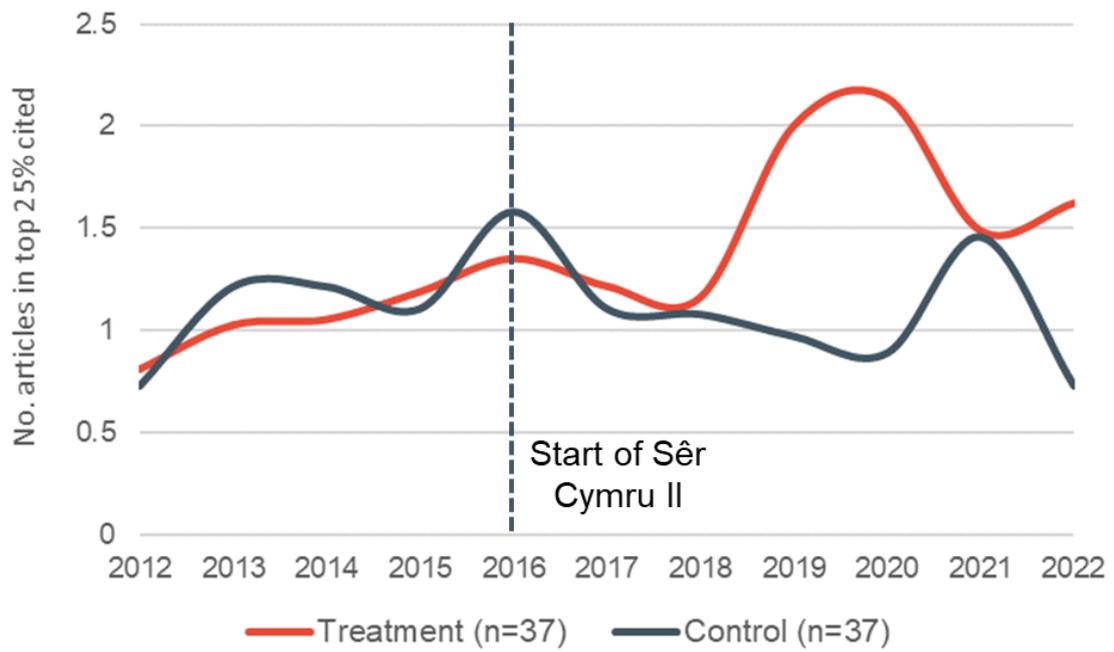
	Excl chairs (n=37)	Incl chairs, Control 1 (n=43)	Incl chairs, Control 2 (n=44)
Change in treatment group	0.02	0.02	0.02
Change in control group	-0.03	-0.04	-0.03
DiD	0.05	0.06	0.05

Source: Hatch analysis of Elsevier data. Significance levels are 1% (***), 5% (**) and 10% (*).

12.4.3. Number of research articles in the top 25% cited

Figure 12.10 shows the treatment and control groups had a similar pre-treatment trend for the number of research articles in the top quartile for citations, indicating a good match. Post-treatment performance has been highly variable from year to year, but overall the chart shows the treatment group out-performed the control group.

Figure 12.10: Average number of articles in top quartile for citations, 2012-2022 (excluding Research Chairs)

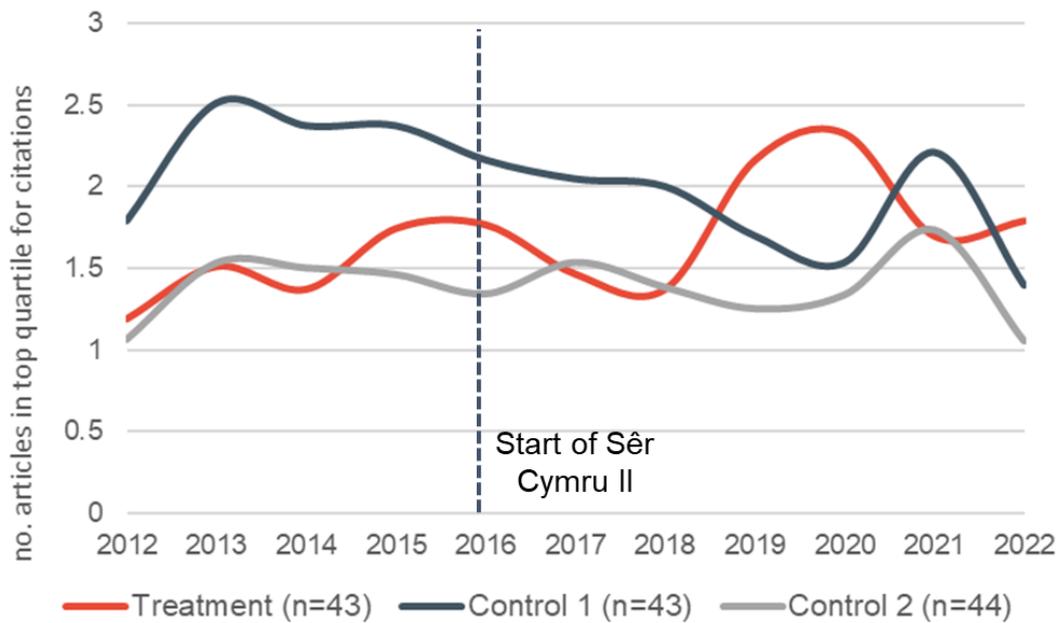


Source: Hatch analysis of Elsevier data

Including Research Chairs in the analysis generates highly variable results, as shown in

Figure 12.11. The pre-treatment trend for both control groups is different to the treatment group, particularly control group 1 which also starts from a much higher base. This suggests there are other factors which have influenced performance which are not captured in this analysis.

Figure 12.11: Average number of articles in top quartile for citations, 2012-2022 (including Research Chairs)



Source: Hatch analysis of Elsevier data. Note: Control 1 includes the matches identified in steps 1-2. Control 2 includes the matches identified using steps 1-3.

The DiD analysis in Table 12.6 shows the average number of articles in the top quartile for citations increased by a larger amount for the treatment group than the control group for all models. However the difference was only statistically significant for one of the models; the one which includes Research Chairs and compares performance against control group 1. As shown above, this is the control group which had a very different pre-treatment trend to the treatment group and also started from a higher base. It is therefore unlikely to provide a robust counterfactual for the treatment group.

Therefore, on this evidence, it is not possible to conclude that Sêr Cymru II had a significant additional effect on the number of publications in the top quartile for citations.

Table 12.6: Difference in difference analysis for articles in top quartile for citations, 2012-2022

	Excl chairs (n=37)	Incl chairs, Control 1 (n=43)	Incl chairs, Control 2 (n=44)
Change in treatment group	0.55	0.35	0.30
Change in control group	-0.02	-0.37	-0.01
DiD	0.57	0.72**	0.31

Source: Hatch analysis of Elsevier data. Significance levels are 1% (***), 5% (**) and 10% (*).

12.4.4. Percentage of research articles in the top 25% cited

Table 12.7 focuses on the change in the percentage of articles in the top quartile for citations. This shows that the change in this outcome variable between the pre-treatment and post-treatment periods is -7 percentage points for all treatment groups and control groups, meaning the DiD is zero in each case.

There is therefore no evidence that Sêr Cymru II has had a significant positive effect on the proportion of articles which are highly cited.

Table 12.7: Difference in difference analysis for percentage of articles in top quartile for citations, 2012-2022

	Excl chairs (n=37)	Incl chairs, Control 1 (n=43)	Incl chairs, Control 2 (n=44)
Change in treatment group	-0.07	-0.07	-0.07
Change in control group	-0.07	-0.07	-0.07
DiD	0.00	0.00	0.00

Source: Hatch analysis of Elsevier data. Significance levels are 1% (***), 5% (**) and 10% (*).

12.5. Summary

The key findings of this analysis are as follows:

- Sêr Cymru II had a significant, positive additional impact on the number of research publications of the supported research fellows. The average number of publications per annum by Sêr Cymru II fellows increased by 1.27 between the pre-treatment and post-treatment periods. Of this, it is estimated that 1.19 was attributable to the Sêr Cymru II programme.
- There is some evidence the programme increased the breadth of subject areas covered by fellows' research. The average annual number of subject areas in which fellows' publications appeared increased by 2.55 between the pre-treatment and post-treatment periods, but declined slightly in the control group. The DiD was estimated to be +2.76. However this finding requires some caution as the number of subject areas covered by Sêr Cymru II researchers was already increasing at a faster rate than the control group prior to the start of the programme, and therefore could be explained by other factors.
- There is mixed evidence about the impact of the programme on the quality of research by fellows. The programme had a significant, positive impact

on the number of publications in journals ranked in the top 10% by CiteScore. While the number of articles in the top quartile for citations also increased by more than the control group, the difference was not statistically significant. Similarly, there was no significant difference in the change in the proportion of outputs in top journals or in the top quartile for citations.

- The impacts on the quantity and quality of research were greater for fellows than Research Chairs. The DiD is lower for a number of the outcome variables when Research Chairs are included in the treatment group (including the number of publications, the number of subject areas and the number of publications in top ranked journals). This is due to the average number of research outputs by Research Chairs declining between the pre-treatment and post-treatment periods included in the analysis. However it should be noted that the Research Chairs were already producing a large number of outputs prior to the start of the programme, and the added responsibilities associated with taking the role of Research Chair means a small drop-off in their rate of publication might have been expected. This analysis also only includes the publications in which Chairs are named authors and excludes the publications of their research teams.