



Teesside University

Tees Valley Hydrogen Innovation Project
Summative Assessment

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1. Project Context

1.1 Objectives

What was the project seeking to do?

by:

- Creating an innovative hydrogen demonstrator facility capable of producing hydrogen at different levels for different applications and providing a laboratory to research, development and test new low carbon hydrogen-efficient technologies in order to:
 - Develop new products and processes;
 - Overcome technical, product, process, commercial or regulatory challenges;
 - De-risk market entry or business growth.
- Supporting SMEs to enhance awareness and understanding of the hydrogen economy, exchange knowledge and best practice and provide coaching and mentoring to enable collaborative innovation to adapt existing products, processes and services to hydrogen solutions and/or develop new products, processes and services.

The project is funded under European Regional Development Fund (ERDF) Operational Priority Axis 4 'Supporting the shift towards a low carbon economy in all sectors, to deliver against the European Structural and Investment Funds 2014-2020 priority 4f 'promoting research and innovation in, and adoption of, low carbon technologies.'

The purpose of investment under this priority is to focus on supporting research and innovation (R&I) in low carbon technologies through the SMEs who develop and commercialise them; through developing technology centres of excellence and testing facilities; knowledge transfer between higher education institutions (HEIs); and innovation, demonstration, supply chain and commercialisation support for low carbon technology, products and processes.

Therefore, the principal objectives of the project are to create a pathway for stimulating innovation in, and the growth of, the hydrogen economy in the Tees Valley through the development of the physical research, development and innovation (RD&I) infrastructure and support to SMEs to stimulate innovation through awareness raising activity, technical support and collaboration. Collectively these objectives are intended to contribute to the greater commercialisation of products, services and processes; and the provision of support services to increase the proportion of innovation active SMEs and the number of businesses actively innovating to bring new low carbon technologies, products or processes to market.

Target beneficiaries for the project were therefore SMEs with the potential for growth through hydrogen and low carbon innovation.



1.2 Economic and Policy Context and Project Rationale

At the time the project was designed what specific market failures was the project seeking to address? Was there a strong rationale for the project?

Tees Valley has a strong low carbon sector and significant potential and is therefore well placed to drive innovation in a sector that has a key role to play in economic growth and environmental sustainability. The region has particular potential in the use of hydrogen within this context with the large volumes of waste produced by the extensive Tees Valley process industries having potential use as feeds for hydrogen generation; local geographical conditions well suited to hydrogen storage; and the development of strategic regional projects requiring hydrogen offering significant opportunities to be exploited.

Regional strategy highlights the potential importance of hydrogen to economic growth and innovation with the Tees Valley Investment Plan and the Tees Valley Strategic Economic Plan both identifying hydrogen technology and the developing hydrogen economy as a significant regional opportunity with supply chain opportunities for hydrogen across a range of uses, including:

- Refining crude oil;
- Ammonia synthesis;
- Transport;
- De-carbonisation of domestic heating.

Regional policymakers consequently recognise the specific potential for the Tees Valley area to develop large scale applications for hydrogen. In addition, the demand for hydrogen will increase as technological developments and policy shifts increase the shift to low carbon solutions. However, innovation and new technology requires investment and the costs for developing and testing are prohibitive, acting as a considerable constraint on innovation and the potential development of the hydrogen economy. In addition, SME engagement with key strategic drivers and opportunities is low with a lack of appropriate testing facilities.

There was therefore a strong rationale for the project as it would provide a unique testing facility in the region and associated support, thereby potentially placing the region and its SMEs in the forefront of technological innovation in the hydrogen economy and creating an economic and innovation “pull” to the region. Combining these facilities with the expertise of the university, provides facilities for RD&I activities with accompanying support acting as a catalyst for innovation and providing opportunities for innovation at all levels in the technology readiness scale. Combining capital and revenue elements therefore had the potential to increase commercialisation potential of innovations developed through the project.

As well as clear alignment with regional policy priorities the project has a strong strategic fit with national objectives outlined with the Industrial Strategy¹ and low carbon objectives.

¹ <https://www.gov.uk/government/topical-events/the-uks-industrial-strategy>

1.3 Project Design

Was it appropriately designed to achieve its objectives? Was the delivery model appropriate?

The project was appropriately designed to achieve its objectives with a delivery model designed specifically to deliver the above objectives. In particular the project delivered a programme of targeted support to SMEs, although the COVID-19 pandemic had a significant impact on its ability to deliver the project as originally designed, with access to the laboratory facilities at a crucial element of the project being severely restricted in the early stages, with SMEs unable to access the facilities funded by the project, impacting on a significant component of project design. This was, however, effectively addressed in the later stages of the programme.

One additional aspect that could have been considered would have been to support innovation through a challenge fund, to jump-start projects.

1.4 Realistic Targets

Were the targets set for the project realistic and achievable?

Original output targets for the project were based on the University's previous experience of delivering similar projects. However, achieving targets was challenging in the initial stages, specifically due the impact of COVID-19 and beneficiaries being unable to access the laboratory facility which is a key component of the support programme.

Despite the impact of this, the project is broadly on target.

1.5 Externalities and the Effect of Shifting Context

How did the context change as the project was delivered and did this exert any particular pressures on project delivery?

Bearing in mind any changes in context or weaknesses in the project design/logic model, can the project reasonably be expected to perform well against its targets?

The project encountered some externalities that impacted on project delivery. These largely relate to COVID-19 and the subsequent closure of the laboratory facilities that were funded under the capital element of this project. This has meant that the project has been unable to deliver the envisaged customer journey with the number of participants it expected at the earlier stages of the project.

Apart from the COVID-19 impact, one of the biggest challenges for the project related to staff turnover, with the current project manager being appointed during lockdown. This has led to staff restructuring and re-allocation of posts, which had some effect on delivery, extending the project life.

As shown in **Section 2**, the project achieved its expenditure and output targets by project closure despite the considerable challenges presented by COVID-19 and staffing issues mentioned above. This is reasonable since the project received a significant extension in terms of the delivery timescale.



2. Project Progress

2.1 Inputs and Outputs

Has the project delivered what it expected to in terms of spend and outputs? What factors explain this performance?

The project was originally scheduled to be funded and deliver through to May 2021, later extended to August, due to the time taken to create the project team. However, the project was granted a continuation request to extend the project continue with activities for a further 23 months, to enable delivery of a second phase of the project. **Figure 2.1** below provides a summary overview of the project expenditure outlined within the Full Application, and that agreed within the continuation request.

Figure 2.1: Project Inputs

<i>Funding</i>	Original Project		Agreed Variation		Variation	
	<i>Value</i>	<i>Contribution Rate</i>	<i>Value</i>	<i>Contribution Rate</i>	<i>Value</i>	<i>% variation</i>
ERDF - Revenue	£430,518	60%	£940,942	60%	£510,424	119%
Public match - Revenue	£287,016	40%	£627,303	40%	£340,287	119%
Total Revenue	£717,534	100%	£1,568,245	100%	£850,711	119%
ERDF - Capital	£91,944	60%	£112,300	60%	£20,356	22%
Public match - Capital	£61,296	40%	£74,868	40%	£13,572	22%
Total Capital	£153,240	100%	£187,169	100%	£33,928	22%
ERDF - Total	£522,462	60%	£1,053,242	60%	£530,780	102%
Public match - Total	£348,312	40%	£702,171	40%	£353,859	102%
Project Total	£870,774	100%	£1,755,414	100%	£884,639	102%

This shows that the project budget has increased significantly as a result of this extension with the project overall doubling in terms of resources with an increase in the revenue budget of 119%. The extension has approximately the same number of C1 outputs as first phase but these have to be delivered in a shorter timeframe.

Figure 2.2 below provides a summary overview of spend and outputs performance of the project to the end of Quarter 2 2023. It is provided in Table F.1 Standard Table Format: Spend and Output Performance, as required by ERDF Summative Assessment Guidance. Targets for the project have been achieved.

Figure 2.3: Spend and Output Performance

Indicators / Expenditure	Original Funding Agreement	Amount in most recent Funding Agreement Variation	Total achieved at time of evaluation	% of target	Projected to be achieved at Project Closure	% of target to be achieved at project closure
Expenditure						
ERDF Capital Expenditure	£153,240.00	£223,628.76	£217,894.57	97%	£223,628.76	100%
ERDF Revenue Expenditure	£717,534.00	£1,531,786.02	£1,406,472.13	92%	£1,531,786.02	100%
Indicators						
C1 Enterprises Receiving Support	20	44	39	89%	44	100%
C5 New Enterprise Receiving Support	2	5	6	120%	6	120%
C26 Enterprises cooperating with research institutions	3	6	3	50%	6	100%
C29 Enterprises Supported to Introduce New Products to Firm	3	8	5	63%	8	100%

3. Project Delivery and Management

3.1 Project Management and Governance

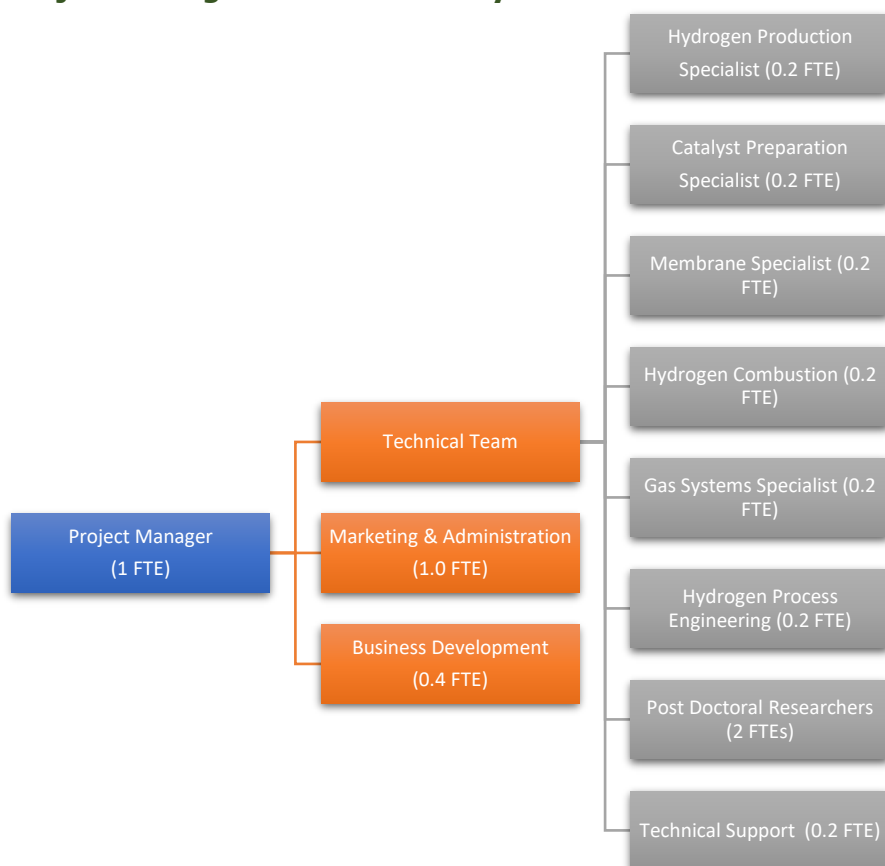
Was the project well managed? Were the right governance and management structures in place and did they operate in the way there were expected to?

Consultation with project staff and beneficiaries, and analysis of project data and documentation, suggested that the project has largely been managed well, with procedures in place to monitor overall performance and compliance structures and checks in place as part of the project management process.

The project has a strong project delivery team, with 5.8 full-time equivalent (FTE) staff, as outlined in **Figure 3.1** below. Over the last 2 months two of the academic team's hours were increased by 100 hours due to the heavy workload.

The project is embedded with the University's broader governance structures and support services within the School of Computing, Engineering and Digital Technologies, and participates in regular meetings with finance to monitor project progress and compliance, and in meetings covering the University's business support functions. It also engages with external professional services, with organisations such as the Centre for Process Industries and TWI.

Figure 3.1: Project Management and Delivery Structure Overview



3.2 Project Delivery

The project has delivered a range of activities to stimulate the hydrogen economy within the region and build the awareness, understanding and capabilities of SMEs to engage with this agenda and potentially take advantage of opportunities and drive innovation. This includes:

- Events and webinars;
- Expert support from Technical Team;
- Support to investigate process and product innovations such as its work with Micropore Technologies, a specialist particles and emulsion technology producer based at Wilton, Redcar, to develop a catalyst membrane required for a hydrogen catalytic membrane reactor (CMR);
- Access to University facilities and specialist equipment, such as the development and trialling of a hydrogen demonstrator unit using innovative production technology routes through adoption of catalytic membrane reactor assisted steam methane reforming.

Consultation with participants suggests that project delivery has largely proved effective, being valued by participants and responding to feedback. The sub-sections below consider some key elements of project delivery.

3.2.1 Delivery Standards

Has the project delivered its intended activities to a high standard? Could the delivery of the project have been improved in any way?

How are project activities perceived by stakeholders and beneficiaries? What are their perceptions of the quality of activities/delivery?

Extensive data has been gathered from project participants by the external evaluation team through surveys of 29 supported SMEs², undertaken in two waves in 2020 and 2023. This equates to 81% of all SMEs registered with the project (53) to the end of Quarter 2 2023. As a consequence, this provides a robust evidence base on which to assess the delivery standards, effectiveness and outcomes of support delivered by the project.

SMEs consulted by the evaluation team were asked to identify which types of support they accessed and their responses are summarised in **Figure 3.2**. This shows that:

- **Events and webinars were the most accessed type of support** with 89% of SMEs consulted attending at least one project event or webinar. This should be expected given that such support is often intended as a pathway for initially engaging SMEs in order to develop relationships which can then be used to engage them in more intensive support. The data suggests that the project has been successful in this with the majority accessing an event or webinar going on to receive expert support from Teesside University;
- **Accessing laboratory or specialist equipment available through the university was the least commonly accessed** type of support. This is unsurprising given that access to the University's laboratory and equipment was not initially possible due to COVID-19 risk assessments, and liaison with the University to

² Eight beneficiaries returned responses in both waves

make the necessary adaptations and consent to opening the laboratory to project participants was been a relatively lengthy process. However, this has been overcome with around half of participants accessing specialist equipment;

- The **majority of participants found any support they accessed to be useful or very useful to their business**; with only 13% of those accessing event/webinars, 10% accessing expert support; 19% investigating new processes and 15% using the laboratory finding the support as not useful to their business.

Figure 3.2: Participant perceptions of support accessed

Type of support accessed	Very useful	Useful	Not useful	Unhelpful	Total accessing support
Attended event/webinar	14 (61%)	6 (26%)	3 (13%)	0	23
Received expert support from TU	13 (65%)	5 (25%)	2 (10%)	0	20
Investigated new processes	8 (50%)	5 (31%)	3 (19%)	0	16
Used laboratory/special equipment	7 (54%)	3 (23%)	2 (15%)	1 (8%)	13

SMEs were also asked to rate the support they accessed from the project on a scale of 1 to 10 with 1 being very poor and 10 being excellent and the project scored an average rating of 7.8, with almost a half of the SMEs consulted giving the project a score of over 8. However, around 10% of respondents rated the project 5 out of 10 or under.

Supported SMEs also highlighted numerous benefits they had gained from their involvement with the TVHIP project with a number highlighting more than one different type of benefit and only two of the seventeen stating that their engagement had made no difference to their business. **Figure 3.3** shows that the majority of benefits are still feeding through at this stage. This largely reflects the developmental stage of the hydrogen economy in the region and beyond, something that is acknowledged by the project and is in fact an area which it wishes to raise awareness of.

Figure 3.3: Benefits gained through TVHIP support

Benefits gained	No. of Respondents
Made new contacts that have or could lead to new business opportunities	20
Identified a potential new or improved product or service	10
Learned more about market and innovation opportunities in hydrogen/low carbon	15
Developed or developing a new or improved product or service	12
Identified new markets	7
Grown my business	5
Made no difference	4



Specific comments made by SME leaders on the benefits the project has brought to their business include:

'See this as major opportunity to benefit my Business Strategy. Working with Uni(versity) Staff to supply other Uni(versities)'

'Company now planning new products for 2 years/10 years/long term future'

'Hoping to increase business profile - did meet a number of University Staff which may be useful in the future.'

'I have come up with a new company to support my Net Zero commitment'

'Our understanding of the range of sectors interested in hydrogen as an alternative fuel has grown'

'Developed new Education packages around Hydrogen Technologies when used in Fuel Cell Electric Vehicles'

'Was able to crystallise the need in the market for my services'

'Opportunity to make contact with existing players'

'All benefits are potential at this time. Major effects of virus holding up progress'

'See this as major opportunity to benefit my Business Strategy. Working with University Staff to supply other Universities'

'Hoping to increase business profile - did meet a number of University Staff which may be useful in the future'

'has increased my business profile which was our intention'

These comments further highlight the degree to which benefits largely relate to future opportunities rather than realised tangible benefits. However, **Figure 3.3** above shows that 12 businesses have been supported to develop or are developing new or improved products or services, while **Figure 3.2** showed that 18 of the businesses consulted have received expert advice from the University while 10 have been supported to investigate new processes.

A number of the SMEs consulted spoke highly of the Teesside University staff delivering the project, with examples including:

'I was very impressed with the TU staff we worked with'

'the staff were very good and professional'

'I am really impressed - they have provided over and above what I had expected'



However, a small minority of participants flagged some negative experiences with the project:

'Not been approached by Teesside University to become involved in the project since early seminars'

'direct involvement and support from the project has gone quiet, probably because of the loss of the Teesside University project manager'

'we have not been contacted for more than 12 months...'

This latter quote highlights the likely cause of a breakdown in communication for all three of the SMEs concerned. These comments all come from the early stage of the project, and have subsequently been picked up as the project has developed over the past 3 years. Early in the project there was some confusion over what support could be provided through the programme, with some cases nobly receiving 6 hours support. As the project progressed under new management, more selective activity ensured that businesses received the minimum of 12 hours support. This points to the importance of effective customer relationship management processes and warm handovers between staff, which help to ensure that all relationships between the project and SMEs are sustained beyond changes in key project personnel.

Despite these caveats, the evidence above demonstrates that participants generally valued the support provided by the project with the majority of feedback positive on every type of support made available.

3.2.2 Beneficiaries

Did the project engage with and select the right beneficiaries? Were the right procedures and criteria in place to ensure the project focused on the right beneficiaries?

Information provided within this sub-section is based on analysis of data provided to the evaluation team in March 2023. This data provides insight into the 53 of the businesses registering with the project.

A diverse range of SMEs were engaged by the project in terms of locality, sector and size. **Figure 3.4** shows the geographical distribution of SMEs that have registered for project support across the Tees Valley area.



Figure 3.4: Location of supported SMEs

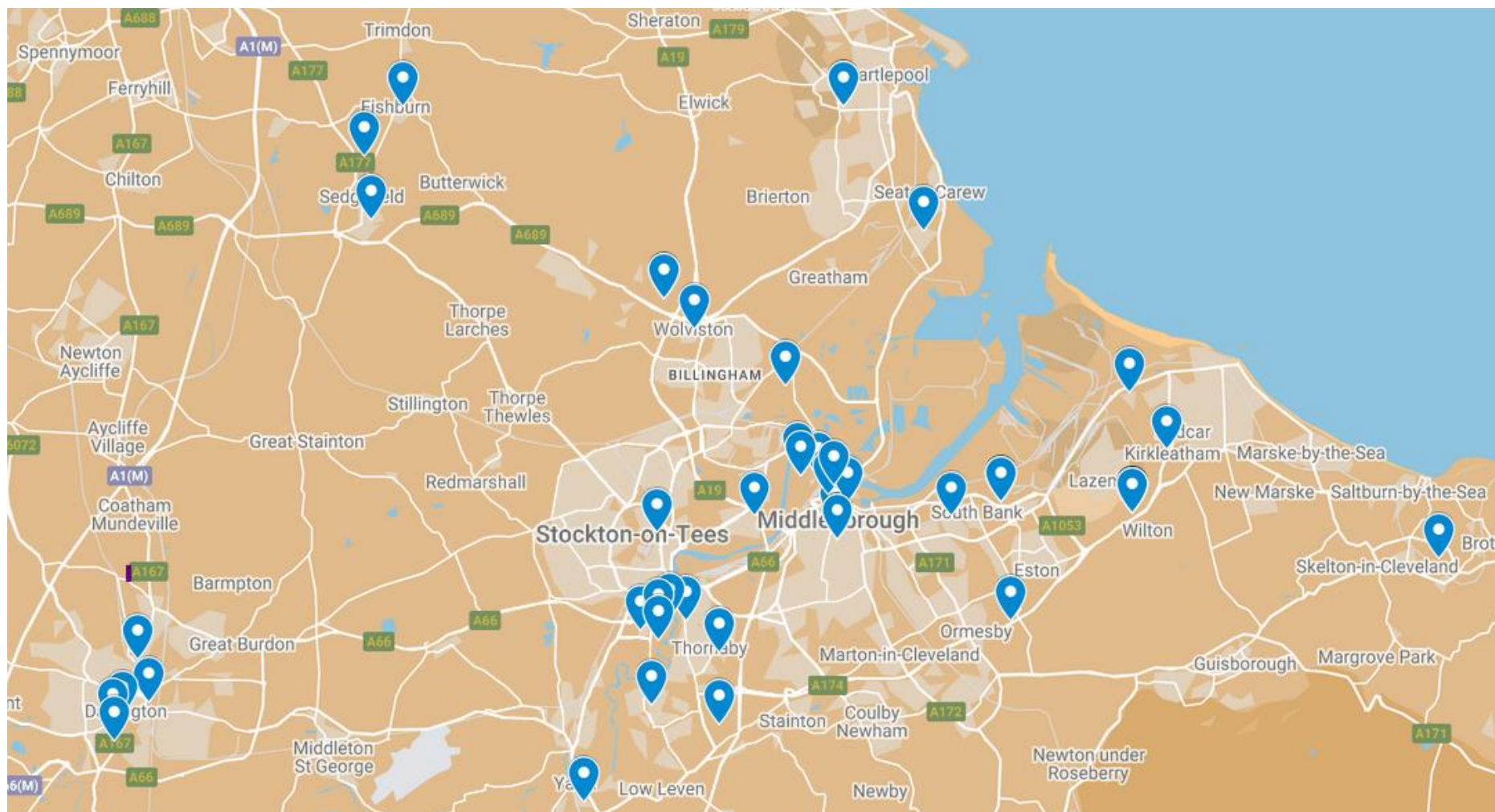


Figure 3.5 below shows the sectors of SMEs supported. This shows that manufacturing (23 SMEs) professional, scientific and technical activities (12 SMEs) are the most commonly represented sectors among the SMEs supported. The two education sector SMEs show that the project is successfully engaging businesses from a diverse range of sectors with one of these businesses being a provider of careers information, advice and guidance and the other providing training on low carbon technologies and industries.

Figure 3.5: Sector breakdown of SMEs supported

Sector	SMEs
Manufacturing	23
Professional, Scientific and Technical Activities	12
Information and Communication	3
Energy	8
Food	4
Education	2
Construction	1
Total	53

Consultation with supported SMEs showed that the project has successfully engaged businesses with the potential to participate and innovate within the hydrogen economy in a number of different ways from adapting their products and services to support businesses operating within the sector to the provision of training to support the development of the sector. The word cloud in **Figure 3.6** shows the words most used by these SMEs when asked to describe the nature of their business. This illustrates the prevalence of engineering and process industries within the businesses supported, regardless of their sector of operation.

Figure 3.6: Nature of supported SMEs business word cloud



SMEs consulted by the evaluation team were also asked to explain why they were interested in TVHIP, with a specific interest in hydrogen technologies the most commonly selected reason (see **Figure 3.7**).

Figure 3.7: Reasons for SME interest in TVHIP (questionnaire respondents)

Reason for interest	No. of SMEs
We have a specific interest in hydrogen technologies	19
We have a specific interest in the low carbon sector	10
We need expert support to develop new low carbon products/services	9
Our business works in the low carbon sector, and is looking to develop new technologies	9

The more detailed responses given by SMEs provide further insight into the diverse range of motivations for SMEs becoming involved with the project:

'we are interested in understanding more about the storage and distribution of Hydrogen - also production of green hydrogen'

'our main interest is around the possibility of pumping electrolyte into hydrogen processes'

'Hydrogen is a new world - wanted to get in at ground level...I write technical papers on insulating different types of plant'

'Seek an understanding of 'landscape' of hydrogen technology'

'Wish to be a supplier in what will be an expanding industry'

'we want to understand the opportunities for selling into the Hydrogen industry'

'Major diversification of company effort - batteries, hydrogen cells'

'We built a house using structural wood/components - heated by Hydrogen heating...and want to find out more'

'De-carbonisation of Marine Propulsion'

This suggests that enhancing awareness and understanding of the sector and opportunities within it were the principal motivations for business involvement.

Figure 3.8 shows the most recent annual turnover of supported businesses. This illustrates that the project has successfully targeted businesses of a range of different sizes (in terms of turnover). For example, a substantial proportion are small businesses with around a half (24 out of 53) having a turnover of £250,000 or less; although a similar number (22) have a turnover of £1m or more. Analysis of turnover at an individual firm level shows that a total of 14 businesses had been newly established and had no turnover to report. By contrast one

supported SME reported a turnover of £31m. This clearly demonstrates that the project has successfully engaged businesses at various stages of growth and development.

The £31m outliers result in a relatively high average turnover per supported business when compared to similar ERDF projects evaluated by the evaluation team with an average turnover of £2.3m (median £450,000). This shows that the project has done particularly well at attracting larger enterprises in terms of turnover, particularly when compared with other ERDF projects in the region.

Figure 3.8: Supported Businesses by Turnover

Turnover	SMEs
£0	14
Less than £5k	2
£5,001-£100k	5
£100-£250k	3
£250,001-£500k	4
£500,001-£1m	3
£1,000,001-£5m	14
£5,000,001-£10m	4
£10,000,001-£31m	2
Unknown	2
Total	53

The project has also engaged a good cross section of businesses in terms of business age, with 8 out of 22 operating for 5 years or less and 7 for 20 years or more; as shown in **Figure 3.9**.

Figure 3.9: Supported Businesses by business age

Age of business	No. of SMEs supported
Less than 1 year	1
1-2 years	4
3-5 years	7
6-9 years	3
10-14 years	6
15-19 years	1
20-29 years	5
30 years +	7
Total	34

Figure 3.10 shows the size of supported businesses in terms of full time equivalent (FTE) employees. This shows that almost half are micro-businesses with less than 10 employees (28 out of 53 businesses).

Figure 3.10: Supported Businesses by number of FTE employees

No. of FTEs	SMEs
0	2
1	9
2-9	17
10-25	10
26-49	8
50-99	6
Unknown	1
Total	53

Numerous methods were utilised to stimulate interest in, and raise awareness of, the project. **Figure 3.11** shows how businesses supported by the project that were consulted by the evaluation team initially became aware of TVHIP. This clearly shows that the most effective lead generation source has been Teesside University networks and relationships with this pathway accounting for 29 of the 40 respondents.

Figure 3.11: How supported SMEs became aware of the project

How did you hear about TVHIP?	No. of SMEs
Direct invite from TU	21
Direct invite from TVHIP	8
Social media	5
Word of mouth	5
Presentation	1
Total	40

These findings demonstrate that the project has adopted a proactive approach to engagement, utilising multiple touchpoints and providing numerous entry points for potential beneficiary SMEs to become aware of, and access the support available through the project.

In summary, the above data shows that the project has engaged with and selected the right beneficiaries, with appropriate procedures and criteria in place to ensure that it focussed on the right beneficiaries.

3.2.3 Horizontal Principles

To what extent have the horizontal principles been integrated into and shaped delivery?

The project had systems and processes in place to monitor both Gender Equality and Equal Opportunities and sustainability from a participant's perspective. For example, equality and diversity data was collected from each beneficiary added as part of the registration process last year and the project was delivered in accordance with the Public Sector Equality duty.

The project delivery and awareness raising process was designed to ensure that the project is accessible to all and prevent discrimination against any groups on any statutory grounds. Analysis of these processes has established no clear and specific barriers to participation for any potential eligible participants, with support available to enable those with additional support to access the project.



Sustainability is central to piloting new hydrogen technologies. While much of the existing production is 'grey', that is, created through steam reforming, with the excess CO₂ not captured, the innovation pilot takes place within the context of wider initiatives, not least with the development of Net Zero Teesside³

³ <https://www.netzeroteesside.co.uk/>

4. Project Outcomes and Impact

4.1 Outcomes and Impact Achievement

What progress has the project made towards achieving the outcomes and impact set out in its logic model?

To what extent are the changes in relevant impact and outcome indicators attributable to project activities?

The project logic model developed by Teesside University outlines the intended outcomes and impacts for the project. These are shown in **Figure 4.1**, below.

Figure 4.1: Target outcomes and impacts within the Project Logic Model

Intended outcome
A new and sustainable Hydrogen Economy Network
Higher levels of knowledge transfer and collaborative research across the Tees Valley
SMEs bringing new products to market and introducing new processes
SMEs achieving a net increase in employment and GVA
An increase in engagement with the low carbon economy
Intended Impact
The Hydrogen Economy and its supply chain grows and develops in the Tees Valley
The University's business network has capacity and capability built to service this new and growing sector
Current process and manufacturing companies adopt new technologies and products to take advantage of this market
An increase in the number of businesses within Tees Valley who are 'innovation active'.
A more competitive Tees Valley economy overall, and more competitive key sectors.

4.1.1 Project Outcomes

Network

Through its various SME engagement and support activities the project has started to contribute to the development a Hydrogen Economy Network in the region. However, such a network is in the early stages of development and will require further focussed developmental work to firmly establish it, widen engagement beyond project participants and transition to a self-sustaining model.

Knowledge transfer and collaboration

The project is helping to increase levels of knowledge transfer and collaborative research around the hydrogen agenda across the region, with all of the activities being delivered from events and workshops one to one support and specialist expertise; collectively helping to raise awareness and understanding and acting as a catalyst for innovation and collaborative research.

New products and services

Acting as a catalyst for innovation is one of the core functions or objectives of the project and as such it forms one of its four intended outcomes.



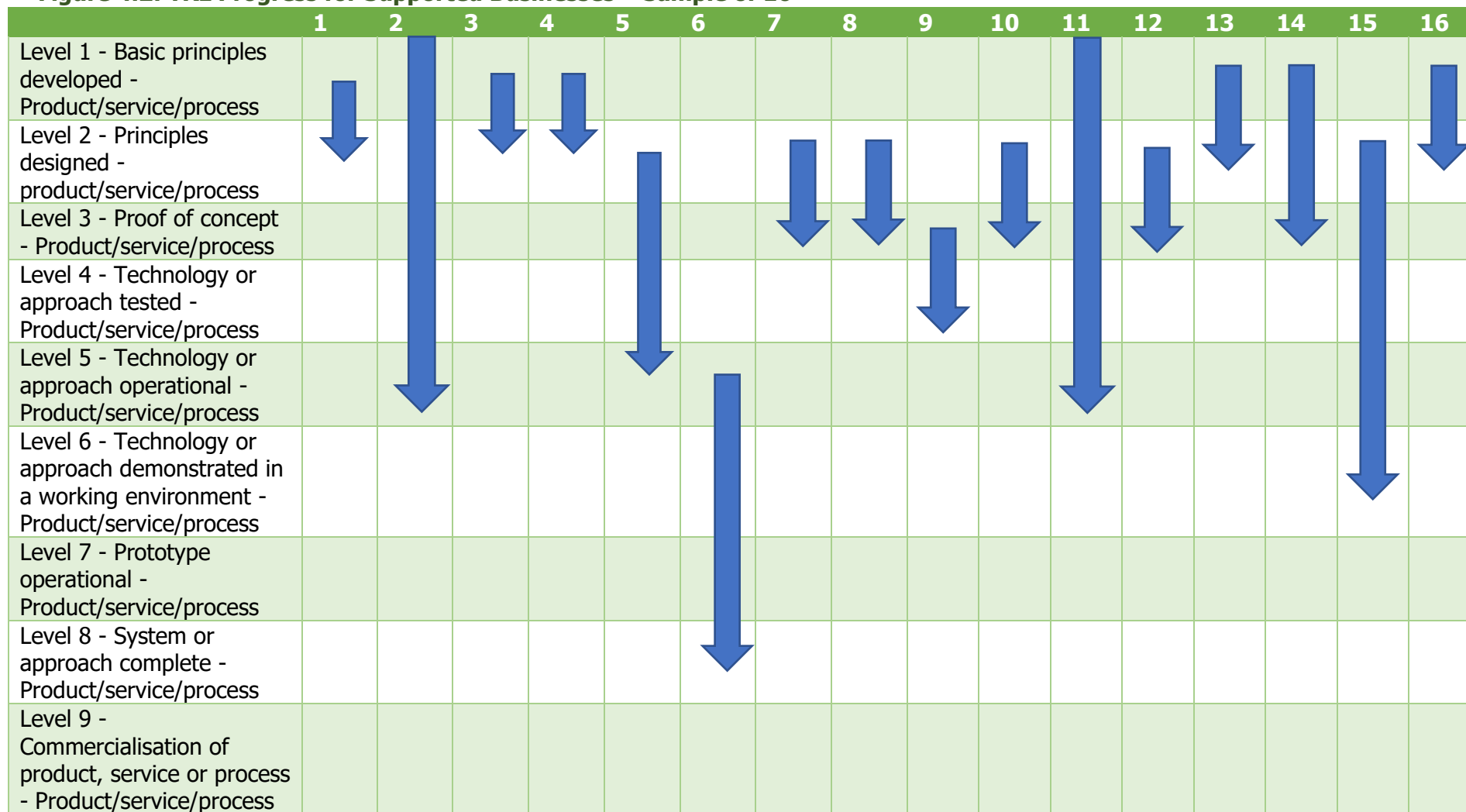
The Technology Readiness Level⁴ (TRL) scale enables an assessment of the progress of product and process innovation supported by TVHIP. Beneficiaries consulted by the evaluation team were asked to make an assessment of the progress of their innovation activity on the TRL scale. **Figure 4.2** below shows 16 beneficiaries' assessment of their position on the TRL scale before and after TVHIP support. Although it should be noted that not all of these shifts can be wholly attributed to the TVHIP project, this does demonstrate that supported businesses made good progress on developing or improving their technology, product, process or service innovations as a result of project support. This also demonstrates that the project supported businesses at various stages of their innovation project from helping to develop and design the basic principles of their innovation (1, 3 and 4) to helping to obtain proof of concept of their product, service or process innovation (7, 8, 10, 12 and 14) to helping an develop their system (6).

This clearly demonstrates that the project has successfully supported a number of businesses to progress their new product and service innovations through TRLs.

⁴ http://www.innovationseeds.eu/virtual_library/knowledge/tlr_scale.kl



Figure 4.2: TRL Progress for Supported Businesses – Sample of 16



Net increase in employment and GVA

While the project includes no ERDF output targets relating to employment increases, consultations with project beneficiaries shows that a number of supported SMEs expect to create additional jobs as a result of project support; while a number are expecting to increase their turnover. **Figure 4.3** shows that around half of consulted SMEs that expect to increase employment and to increase their turnover.

Figure 4.3: Forecast Employment and Turnover Shifts

	Yes
Over the next 3 years will you employ more people as a result of your involvement with TVHIP?	15
Over the next 3 years will your turnover increase as a result of your involvement with TVHIP?	15

Comments included:

'Targeting 5 to 10 staff'

'Possible 1 or 2 - could be more. Efforts strongly affected by Covid'

Those SMEs expecting employment or turnover increases were asked the degree to which these expected employment or turnover increases were as a result of the TVHIP project, with responses showing that:

- 4 claiming absolute additionality as projected increases would not have happened without TVHIP support;
- 11 reporting time additionality as projected increases would have happened without TVHIP support but would have taken longer;
- 2 reporting scale additionality, as projects were bigger due to TVHIP support;
- 7 reporting zero additionality as they would have happened without TVHIP support.

Section 4.2 quantifies this impact.

4.1.2 Project Impacts

Increased engagement

Consultation with beneficiaries shows that the majority of them were already engaged in the low carbon economy with 9 out of 22 having a specific interest in hydrogen technologies; 5 out of 22 already working in the low carbon sector and looking to develop new technologies and 3 looking for expert support to develop new low carbon products/services; while 5 had a specific interest in the low carbon sector and did not necessarily work in it. Consequently, the SMEs engaged by the project largely were already engaged in the low carbon economy, but the project is successfully helping to increase their level of participation.

'Hydrogen technology is new to us. Without the support our offer and information to schools and businesses we work with would be minimal. The support received has meant that the information I give out... is correct and full. It has also meant that we can talk to businesses in that sector in a more informed way and include them in our work.'



Sector and Supply Chain Growth

While progress against this target impact has been limited to date this report has demonstrated that the project has enabled a number of SMEs to develop links and potential business opportunities within the low carbon and hydrogen sectors as well as helping SMEs to develop products, services or processes for these sectors; with a number of supported SMEs expecting to generate new jobs and increased turnover within the hydrogen sector as a result of the project. Therefore, the project has clear potential to stimulate and support hydrogen sector growth within the Tees Valley.

Increased University Capacity and Capability

The University has developed its capacity and capabilities to support the growth of the hydrogen sector, with the laboratory facilities funded through the project and project delivery posts key to this. The project has also successfully engaged a number of businesses across the region to enhance their understanding, knowledge base, capacity and capabilities to take advantage of the opportunities presented by the sector.

'TU would like to see more initiatives working with SMEs - who are working with limited resources. They have helped us feed our management's curiosity!'

New Technology and Products Adoption

Figure 4.2 points to supported businesses taking forward a range of innovation activities in the sector, and the level of engagement shown in **Figure 3.3** show that around a half of participants have identified, and/or implementing new approaches.

Increase in Innovation Active SMEs

The project has supported at least 16 SMEs to innovate and begin to develop or take forward the development of new products or services in relation to the hydrogen economy. In addition, for the or the 11 participating companies where R&D spend is known (excluding one outlier), average spend is £69,505 (median £48,000).

'TVHIP and TU are excellent at promoting the Tees Valley innovation through existing larger industries and top of the range strategy in using small start-ups like me for their marketing'

More competitive economy and sectors

While there is limited evidence of the project achieving against this objective to date, in supporting the growth and development of a new sector of opportunity which has significant growth potential the project clearly has the potential to contribute to a more competitive economy and sectors.

4.1.3 Impact of COVID-19

Clearly COVID-19 had a significant impact with project delivery restricted at the earlier stage of the project. However, it is also important to recognise that COVID-19 and subsequent measures taken to suppress the pandemic had significant economic consequences, limiting business investment and opportunities for the project to generate economic impacts over the short term.

4.2 Economic, Social and Environmental Benefits

What are the gross and net additional economic, social and environmental benefits of the project (where relevant and applicable to project activities?)

Can these benefits be quantified and attributed to the project in a statistically robust way?

4.2.1 Economic Impact

This section of the report focuses on economic impacts arising from TVHIP. This measures increase in employment and gross value added (GVA) attributable to project participation, and takes into account the multiplier effects in the wider economy.

Additionality

The estimation of additionality has been taken from the survey of beneficiaries, where four firms attributed absolute additionality of economic gains to TVHIP, and eleven time, and two scale additionality, each of which has been interpreted as making 15% of reported gains additional. Using the reported future gains over the next three years suggests the following outcomes illustrated in **Figure 4.4**.

Figure 4.4: Employment and GVA gains over next three years attributable to support

	Employment (FTEs)	GVA ⁵
Absolute	14	£1,572,200
Time (15%)	9.5	£1,066,850
Scale (15%)	3	£336,900
Totals	26.5	£2,975,950

4.2.2 Leakage, Displacement, Substitution

There are three other factors to take into account in calculating net impact on product and labour markets:

- **Leakage:** the proportion of the gross impacts of the project that benefit areas or individuals outside of the intervention's target area (e.g. Tees Valley, England);
- **Displacement:** the extent to which an intervention results in economic growth for a beneficiary being offset by reductions in the activities of non-beneficiaries;
- **Substitution:** the behaviour of a beneficiary when one activity is substituted for another solely to take advantage of public sector support.

The calculations take into account the impact that the programme is intended to have in the Tees Valley area. These are considered in **Figure 4.5**, below.

Figure 4.5: Leakage, Displacement, Substitution

Consideration	Rationale	Tees Valley	England
Leakage	There is some leakage at Tees Valley level, with firms operating out of area	15%	10%
Displacement	There are no displacement effects, as the project provides a specialised service to firms based in the Tees Valley area	0	0
Substitution	There is no evidence of substitution effects	0	0

⁵ Using estimated GVA per FTE of £112,300 in net zero economy <https://eciu.net/media/press-releases/2023/report-uk-net-zero-economy-worth-more-than-70-billion>



Figure 4.6: Gross and Net Additional Impact over 3 years

		Impact Area 1:		Impact Area 2:	
		England		Tees Valley	
		Measure	Adjustment	Measure	Adjustment
Impact Indicator: Employment Unit = FTEs	Gross Impact	97		97	
	Deadweight / reference case	67.9	70%	67.9	70%
	Displacement / substitution	0	0	0	0
	Leakage	9.7	10%	14.5	15%
	Net Additional	34.9	Type II Multiplier 1.8	21	Type II Multiplier 1.44
Impact Indicator: GVA Unit = £ms	Gross Impact	10.9		10.9	
	Deadweight / reference case	7.6	70%	8.0	70%
	Displacement / substitution	0.0	0%	0.0	0%
	Leakage	1.1	10%	1.6	15%
	Net Additional	3.3	Type II Multiplier 1.5	1.6	Type II Multiplier 1.2

4.2.3 Social Impacts

Evidence suggests that there is some overlap of the technology into social provision, with one participant introducing the technology into housebuilding.

'We built a house using structural wood components - heated by Hydrogen heating.'

4.2.4 Environmental Impacts

The approaches being piloted have the intention of having a medium to long term effect on CO₂ emissions, and embedding green technologies within the local economy.

4.3 Strategic Contribution

To what extent has/will the project contribute to the achievement of ERDF programme results indicators?

What are the main sources of Strategic Added Value that the project has created?

Figure 4.8 provides a summary overview of the strategic added value generated by the project. This demonstrates that the activities delivered, and the outcomes and impacts achieved project has made a positive contribution towards the achievement of the ERDF Operational Programme and key results indicators as well as key regional priorities. As a consequence, much of the strategic added value achieved by the project relates to synergy and its strategic contribution.

Figure 4.8: Strategic Contribution

Strategic Theme	Contribution
ERDF Operational Programme	The project has contributed directly to activities under Priority Axis 4, specifically 4f – Research and innovation in low carbon, but also: 4a - Renewable energy; 4b – Energy efficiency; as well as business growth priorities.
ERDF Programme Results Indicators	Positive contribution to ERDF Programme Results Indicators. This includes contribution to Output Indicators set down in the EU regulation for ERDF that are common across the EU, including indicators C1, C5, C26 and C29; as well as P13, an Output Indicator that is programme specific to the ERDF operational Programme for England.
TV ESIF Strategy	The project directly contributes to the activities and objectives outlined under ERDF Priority Axis 4 within the TV ESIF Strategy, Low Carbon. It also makes a contribution to Axes 1 and 3, encouraging innovation and helping SMEs to enhance their competitiveness and increase their capacity and growth and development capabilities.
TV Strategic Economic Plan (SEP)	Direct contribution to the priority themes of Research, Development, Innovation and Energy and Business Growth, helping to address barriers to SME growth and provide them with the capability to expand, innovate, grow and access opportunities in key sectors.

The project has also delivered strategic added value as a catalyst for research and continued professional development (CPD) within Teesside University, with three post-doctoral researchers involved with the project. In addition, the lessons learned and knowledge gained through management and delivery of the project can make a contribution to future technical business support activity delivered by the team and the University.



The project has also achieved positive strategic added value for the University in relation to engagement, with new positive relationships forged with regional SMEs and previous relationships strengthened. The project has therefore acted as pathway for securing SME engagement with the project team and University developing ongoing working relationships with supported SMEs.

5. Value for Money

Analysis of the value for money that the project has provided and, where possible, benchmarks against other similar interventions

We have used data from the Regeneris Report⁶, which provides data on other ERDF-supported projects to benchmark projected TVHIP output performance at closure against outcome indicators, supplemented by data from another recent ERDF project summative assessment conducted by our team.

In the case of employment increase, it should be noted that the net additional jobs projected at the English level from investment to date over three years is 34.9, deriving a ERDF cost per job of **£30,179**, which is value for money. An additional consideration is that the jobs created are likely to be high value and contribute to the development of the skills base in the Tees Valley economy.

Figure 5.1: Value for Money on ERDF spend to date

ERDF Indicator	TVHIP	Other 2014-20 project	Regeneris ERDF Project Mean
(C1) Number of enterprises receiving support	£12,063	£25,291	£34,000
(C5) Number of new enterprises supported	£88,463	£230,151	£116,000
(C26) Number of enterprises co-operating with research institutions	£88,463	£47,948	£93,000
(C29) Number of enterprises supported to introduce new to the firm products	£66,348	£109,596	£94,000

Costs against outputs therefore represent value for money, and compare well to similar projects.

⁶ Regeneris (2013) England ERDF Programme 2014:20 Output Unit Costs and Definitions
<http://www.nwueu.ac.uk/NWUEU/PDFs/Regeneris%20Consulting%20-%20ERDF%20Output%20Note%20FINAL%20Version%2018%2012%2013.pdf>



6. Conclusions and Lessons Learned

Please provide a brief description of the strengths and weaknesses of the project. Please use quantitative data to illustrate your conclusions (e.g. of financials and outputs, of outcomes and impacts etc)

6.1 Project Strengths

The project provides a focus for SMEs to understand and adapt to hydrogen as an energy source and develop responses to this. It does this within a wider context of investment in low carbon and hydrogen technology in Tees Valley.

Key strengths that have enabled it to do so are summarised below.

- TVHIP has enabled a number of SMEs to develop links and potential business opportunities within the low carbon and hydrogen sectors as well as helping SMEs to develop products, services or processes for these sectors; with a number of supported SMEs expecting to generate new jobs and increased turnover within the hydrogen sector as a result of the project as well as supporting at least 8 SMEs to innovate and begin to develop or take forward the development of new products or services in relation to the hydrogen economy. This is evidenced through progression in TRL within these companies;
- The University has developed its capacity and capabilities to support the growth of the hydrogen sector, with the laboratory facilities funded through the project and project delivery posts central to this;
- Despite job creation not being one of the ERDF outcomes required, there is clear evidence at this stage of job creation at the and GVA growth being encouraged within participating businesses within the next 3 years, with the potential for c.35 new jobs and £3.3m GVA over this period;
- The skills within the TVHIP team enable the project to deliver support at a high level. Evidence collected from beneficiaries shows they largely valued support provided by the project.

Developing these existing strengths through the remainder of the funding for the project will mean that the project has the potential to make an important contribution to the development of hydrogen technologies in Tees Valley.

6.2 Weaknesses

As with any initiative, TVHIP has experienced its challenges and has had its weaknesses, which are summarised below.

- Changes in staffing over the project, with the appointment of a new project manager and restructuring of posts meaning that there was some loss of momentum in the initial period, which has been made up in later years;
- Delays in installing the hydrogen demonstrator unit meant that it was not operational before COVID-19 restrictions, again creating a time lag that had to be made up by extending the project;



- Record keeping has had gaps, with, for example, the baseline information on innovation activity within supported SMEs that is required for the ERDF Summative Assessment Data Monitoring Template form (number of product and process innovations in the last three financial years or annual R&DI spend in last complete financial year), only being introduced half way through the programme.

6.3 Lessons Learned for Teesside University

TU is highly experienced in the delivery of ERDF projects, and in the maintenance of records required.

Experience on this project also highlights the importance of a flexible approach to ensure that the project delivers activities of clear value to beneficiaries and reacts to externalities to ensure that delivery is entirely fit for purpose and adapts to a shifting delivery context or changes to beneficiary requirements (as evidenced through COVID-19). This also extends to fully understanding the timescales required to introduce new equipment, and the impact of staffing changes on project delivery.

6.4 Lessons for Other Stakeholders

6.4.1 Lessons for those designing and implementing similar interventions

Clearly the experience of delivering this project and the evaluation or summative assessment process itself have revealed number of potentially important lessons for organisations who are seeking to design and implement similar interventions, many of which directly relate to the strengths and weaknesses and subsequent lessons outlined in **Sections 6.1 to 6.3**, all of which are outlined above. This includes:

- The value of providing multiple engagement pathways to maximise the reach and accessibility of such a project and ensure it achieves its dual targets of business growth and RD&I;
- Embedding flexibility in delivery to accommodate unforeseen externalities, such as COVID-19;
- Tailoring support to the highly specific needs of SMEs engaging with new technologies;
- Aligning academic research interests to the practical needs of SMEs engaging with novel technologies.

6.4.2 Lessons for Policy Makers

Low carbon is a priority sector for Tees Valley Combined Authority, with significant investment being attracted to the area, including:

- Net Zero Teesside⁷;
- TVCA's ambition to be a hydrogen production hub, in which *'Tees Valley will be a global leader in clean energy, low carbon industry and hydrogen. The area will*

⁷<https://www.netzeroteesside.co.uk/>



European Union

European Regional
Development Fund



Teesside
University



achieve a net zero carbon industrial cluster by 2040, providing good jobs with long term prospects that local people can access.⁸

- BP's plans to create the UK's largest 'blue' hydrogen production facility - H2 Teesside⁹, targeting 1GW of hydrogen production by 2030.

While these major initiatives have the potential to make a significant contribution to the local economy, it will be essential to ensure that local SMEs are well positioned to benefit from these ambitions, and have a place within supply chains. Initiatives such as TVHIP will have an important role to play in ensuring that these linkages are developed and exploited.

⁸ <https://ukccsrc.ac.uk/wp-content/uploads/2020/07/Tees-Valley-16072020.pdf>

⁹ <https://www.thenorthernecho.co.uk/news/19169415.bp-announces-plans-uks-largest-blue-hydrogen-project-tees-valley/>