The Provision of External Evaluation Services to the STEM Cymru 2 Project

Draft final report presented to **Engineering Education Scheme Wales** by **Arad Research**

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Glossary

APD	Awards and Presentation Days
CAD	Computer Aided Design
CCT	Cross Cutting Themes
CNC	Computer Numerical Control
CPD	Continuing Professional Development
EESW	Engineering Education Scheme Wales
ESF	European Social Fund
FLL	First Lego League
FSM	Free School Meals
HEI	Higher Education Institution
ITE	Institute of Engineering and Technology
i2E	Introduction to Engineering
MAT	More Able and Talented
NSA	National Science Academy
SLT	Senior Leadership Team
SRO	Senior Responsible Officer
STEM	Science, Technology, Engineering and Mathematics
ULN	Unique Learning Number
WBQ	Welsh Baccalaureate Qualification
WEFO	Welsh European Funding Office
WW&V	West Wales and the Valleys

1 Introduction

In September 2022, Arad Research was commissioned by Engineering Education Scheme in Wales (EESW), to evaluate STEM Cymru 2, a European Social Fund (ESF) funded project aimed at 11–19-year-olds in West Wales and the Valleys (WW&V) region to encourage participation in engineering activities and improve STEM skills. The project was initially funded between 2015-18. After 2018, EESW received further funding from the European Social Fund (ESF) through Welsh Government (Welsh European Funding Office) to run the project for a further three-year period to 2021 and this was subsequently extended to June 2023.

This evaluation reviews the activities and outcomes of STEM Cymru 2 from 2015 to 2023 and builds on the previous interim evaluation undertaken by Arad in 2018.

1.1 Objectives of the STEM Cymru 2 Programme

The STEM Cymru 2 Operation is designed to address ESF Priority Axis 3: Youth Employment and Attainment, with a focus on Specific Objective 3: To increase the take-up of and attainment levels in STEM subjects amongst 11–19-year-olds.

The project offers young people (particularly girls) the opportunity to participate in technological & engineering activities in order to contextualise & improve skills in Science, Technology, Engineering and Maths (STEM). By doing so the project aims to raise aspiration and attainment levels in STEM subjects and increase the number of students progressing to study these subjects in further education (FE) and higher education (HE) and / or pursue a career in a STEM related industry.

The key objectives of STEM Cymru 2, as defined in the project's 2017 business plan are to:

- Deliver activities for young people, which encourage the use and development of literacy, numeracy and scientific principles, in exciting and motivating contexts, with a view to raising standards of attainment.
- Link young people with industry, FE & HE institutions through team activities that will deliver measurable, time-based outputs.
- Demonstrate the importance of gaining STEM qualifications through engagement with STEM role models.
- Organise specific female only events which focus on gender equality awareness by challenging gender stereotypical perceptions over an extended period.
- Provide contextualised situations to enhance Essential Skills.
- Equip young people with employability skills that will allow them to be flexible and adaptable in the labour market, to gain sustainable employment and to support economic growth in Wales.
- Produce materials to embed issues related to sustainability into activities.

1.2 Activities supported under STEM Cymru 2

To achieve the aims outlined above STEM Cymru 2 delivers activities via five main strands summarised below in Table 1.

Table 1: Summary of the five activity strands supported by STEM Cymru 2

Strand	Overview
EESW Sixth Form Project	Sixth form and college students work with employers on a practical project (Sept -March). Participating teams present their projects at EESW Awards & Presentation Days (APD) in north and south Wales.
Headstart Cymru	Year 12 students spend two or three residential days at a university engaged in activities to help them consider STEM focused careers.
Girls into STEM	Females in years 8 and 9 are encouraged to consider engineering careers via visits to industry and universities, practical activities are also included.
F1 in Schools Challenge	This is an established national project. Students' computer aided designs are manufactured into model racing cars. Teams compete against each other in relation to design and car performance in races and presentations at regional finals.
Introduction to Engineering (i2E)	Years 8 to 10 experience practical engineering-based activities, delivered in schools or company/university settings. This strand also includes the First Lego League Challenge.

During the delivery period of the project, target outputs for the project have been amended and agreed with WEFO based on an agreed extension to the Project – see table 2 below. The project's achievements against these output targets are outlined in section 3.1.

Table 2: Initial and reprofiled outputs targets 2018 - 2023

Output or result indicators	Initial target values to June 2018	Approved values to June 2021	Re-profiled values to June 2023
Participants	4,990	10,111	13,453
Participants completing training	2,330	3,700	4,240
Participants continuing to study STEM	460	838	926

Source: EESW monitoring records

1.3 Objectives of the evaluation

The objectives of the evaluation are as follows:

- Whether the aims and objectives of the Project outlined in the 2017 Business Plan (as well as any amendments agreed during re-profile with WEFO) have been met
- How efficiently were the outputs and results achieved in relation to the Business Plan and WEFO Targets
- How effective are the outputs and results achieved in relation to female participation.
- Whether the Monitoring and Evaluation Plan was successfully implemented by the STEM Cymru 2
- The efficiency and effectiveness of the STEM Cymru 2, including its management and administration systems.
- Whether the Cross-Cutting Themes have been successfully integrated into delivery
- Collaboration with and views of key stakeholders of STEM Cymru 2
- Other outcomes associated with delivery of STEM Cymru 2 which may be relevant
- Value for money and suitability of investment
- What changes has STEM Cymru 2 activities made to provision of services that impact on strategic fit
- How STEM Cymru 2 has dealt with necessary changes to the delivery model and risks identified during its lifetime
- Any delivery against the Cross-Cutting Themes, including performance against case level indicators
- Recommendations to the beneficiary
- Identify any need for continued intervention, delivery or investment of funds.
- The impact of COVID-19 on the delivery and outcomes of the operation.

1.4 Report structure

This report presents findings relating to STEM Cymru 2's activities and achievements between 2015 and 2023. It begins with an overview of the methodology used to gather and review the evidence upon which the evaluation findings are based. It then goes on to present the Project's progress against output targets and the impact that the COVID-19 pandemic had on the Project's ability to deliver activities. The report then goes on to review the achievements gained by each individual delivery strand and the management and delivery processes in place to support them. Finally, the report reviews the extent to which the Project has addressed the required cross cutting themes and considers what might have happened if the Project didn't exist.

Conclusions drawn focus on the impacts achieved, the added value and value for money generated, the monitoring and management challenges faced, and potential future funding options for STEM Cymru 2.

2 Evaluation methodology and approach

A mixed-methods approach was adopted for the evaluation. This combined a review of monitoring data, progression reports and participant feedback gathered by EESW with primary data gathered by Arad during visits to schools, universities, and industry sites where STEM Cymru 2 activities were being delivered. These visits provided the opportunity to observe how activities were delivered and to gather feedback from participating students, teaching practitioners, employers and higher education representatives. The fieldwork also included interviews with members of the delivery team in EESW. The qualitative data gathered from the fieldwork was coded and analysed and the main findings are presented in chapter 3.

Table 3 provides a breakdown of the visits undertaken for each strand of the STEM Cymru 2 project. More school and on-site industry site visits were planned, however, some of these were cancelled or postponed, due to staff shortages within EESW, and therefore lack of capacity to deliver activities, as well as staff absences within individual schools and therefore lack of capacity to coordinate activities or visits. Any shortfall in the number of events attended by Arad were replaced by additional interviews with participating employers.

An invitation to participate in an interview was distributed to all employers who had participated in STEM Cymru 2 activities. Those who accepted the invite were interviewed. The 11 employers interviewed included three who Arad had intended to interview during the site visits that were cancelled, and eight other employers who had participated in or facilitated other STEM Cymru 2 activities.

Table 3: Consultations informing the evaluation

Strand	Activities	Number of EESW events attended by research team
EESW Sixth Form Project	Launch events Workshops and Awards and Presentation Days	**1** Launch **2** workshop events* **2** APDs
Headstart Cymru	3-day residential courses (4)	**2** (one day during each course)
Girls into STEM	Industry visits IT workshops	**2** events / site visits
F1 in Schools Challenge	Finals	**1** Finals **1** school visit
i2E	Workshops	**2** class delivery sessions **1** Lego League Challenge event (linked to i2E)
***Follow up employer interviews**		**11**

practical workshop activities and competitions to delivered by EESW.

* One was a workshop held at a university campus in December 2022 to allow EESW Sixth Form Project participants to further develop their ideas with the support of the participating engineering. The other was a day long school event where i2E sessions were delivered.

3 STEM Cymru 2 achievements

The findings presented in this section outline the most recent evaluation evidence gathered between September 2022 and May 2023. It examines progress against target outputs and the impact of the 5 strands of the project on participating students, colleges, universities and employers. Where relevant, the findings compare and contrast those contained in the previous evaluation report, produced by Arad in 2018.

3.1 Progress against output targets

To monitor progress against output targets, EESW periodically report indicators of achievement data to WEFO. Table 2 in the previous section contains STEM Cymru 2's initial and reprofiled participation against targets between 2015 and 2023. A summary of the final monitoring data (June 2023[1]) collected by EESW is presented in Table 4. **Overall participation targets for both male and female were exceeded by 16 per cent** - **15% ahead of profile target for total male participants and 17% ahead for female participants.**

The number of participants recorded across the five strands is based on the number of completed consent forms and other monitoring forms that schools return to EESW. In cases where activities are delivered in schools, but the relevant forms are not completed or returned, the participating pupils cannot be included in the participant record. In addition, 115 participants who did complete and return the forms chose not to give their gender (or selected Other or Non-binary). These participants could not therefore be recorded against male / female participation achievement targets. Key data fields were missing from the forms returned by a further 10 participants and therefore could not be recorded against EC reporting lines. Therefore, although the participation figures presented in Table 4 record an over-achievement against targets, they also under record the actual number of pupils who participated in STEM Cymru 2 supported activities.

Participants **completing training and / or continuing to study STEM also exceeded the 8-year target set**. The number of female participants completing training exceeded the profile 9%, and the number of female participants continuing to study STEM exceeded the target set by 14%. The number of make participants completing training and continuing to study STEM were in line with the reprofiled targets set.

[1] Awaiting updated data for June

Table 4: Targets and achievements up to March 2023

Indicator	Target July 2015 to June 2018 (3 years)	Target to June 2021 (6 years)	Target to June 2023 (8 years)	Achievement to June 2023	Variance against the 8 year target
Actual Participants – male	2,160	4407	6287	7,227	+15%
Actual Participants – female	2,830	5704	7166	8,392	+17%
Total Participants (male and female)	4,990	10,111	13,453	15,619	+16%
Actual Completing training – male	1,359	2,274	2,443	2,461	+1%
Actual Completing training - female	971	1,426	1,797	1,957	+9%
Actual to study STEM – male	346	586	641	643	0%
Actual Continue to study STEM - female	114	252	285	326	+14%

Source: EESW monitoring data.

Overall, the number of females participating in STEM Cymru 2 activities during the duration of the project is higher than the number of males. This indicates that the project has achieved its aim of effectively engaging with female participants and ensuring equality of opportunity, a cross-cutting theme and key goal of the Wellbeing of Future Generations Act (see section 3.5.1. for further details). The relatively high level of female participation largely reflects the success of the Girls into STEM activity strand in which over 2,500 female students participated up until March 2023 – see Table 5.

However, the number of females who participate in some of the other activity strands remains lower than the number of males. For example, only 30% of the EESW Sixth Form Project participants and 39% of F1 Schools Challenge participants were female. These relatively low proportions of female participants are not a reflection on the STEM Cymru 2 project. Instead, they outline the continued need for activities that focus on positive actions to challenge gender stereotypes in order increase the pipeline of females engaged in the study of STEM subjects and pursuing STEM-based careers.

Table 5: Participation figures by EESW activity strand, up to March 2023

Activity Strand (Initial Engagement)	Young people 11-19 years of age	
	Male	Female
EESW 6th Form	1405	588
F1 in Schools	922	580
Headstart Cymru	171	66
I2E	4,665	4,647
Girls into STEM/STEM Awareness	64	2,511
Total Achievement to June 2023	7,227	8,392
Number that can be recoded against ESF reporting criteria	**7,223**	**8,386**
Delivery Profile target to June 2023	6,287	7,166
Variance to Date (%)	+15%	+17%

Source: EESW monitoring data.

3.2 Impact of Covid-19 on output targets

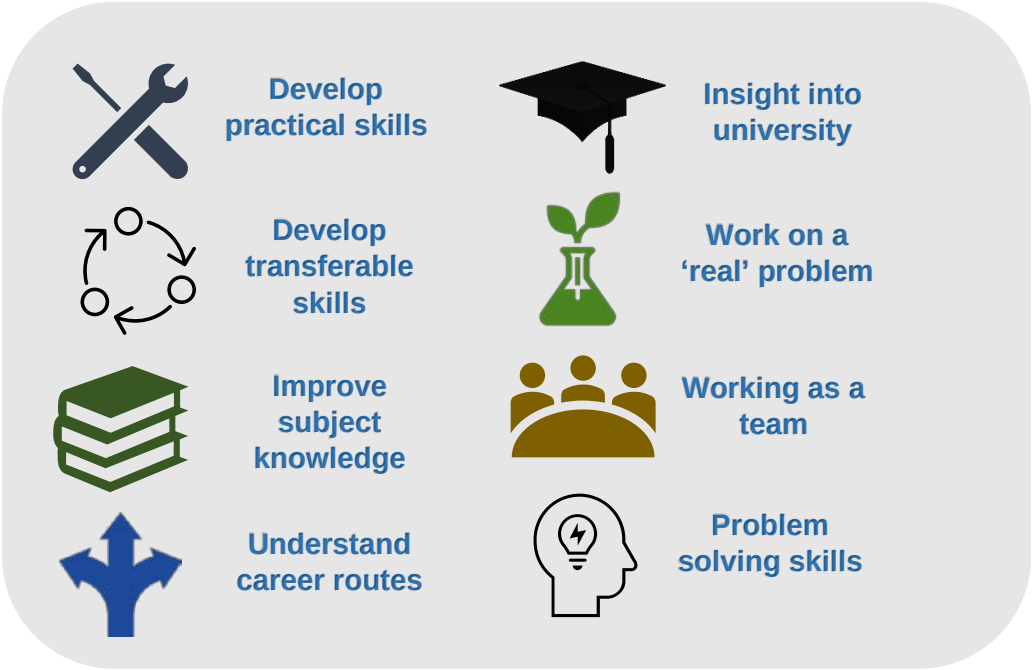
The COVID-19 pandemic created further challenges to achieving participation targets, particularly during 2020 and 2021, when recorded participation in STEM Cymru 2 fell to 124 individuals compared to almost 1,400 during the previous year. The pandemic also created challenges around recruiting and retaining staff – see section 4.3. The evaluation findings indicate however, that during 2022/23, participation in activities increased significantly again, which helped ensure that overall participation targets were achieved and exceeded.

However, for reasons noted above increasing participation during the last year of the Project does not allow sufficient time to record whether participants during 2022/23 go on to study STEM subjects in the following year.

3.3 Summary of achievements gained across activity strands.

The following sections outline some of the achievements delivered by each of the five activity strands. The findings are based on feedback gathered by Arad during site visits and events attended, from participating pupils, school practitioners and, where relevant, employers. Students, teachers and industry representatives all identified a number of key benefits for students taking part across the five activity strands. Some of these key achievements align with the findings from the 2018 report and are illustrated over the page.

Figure 1: Summary of key achievements across five activity strands



3.3.1 The Sixth Form Challenge Project

Views from students

Students reported various motivations for taking part in the sixth form project. Most students felt that the project would look good on their CV and university application. Several students also highlighted that it was an opportunity to learn new skills and gain real experience of working in industry. Some students reported that the experience aligned with the subjects they aimed to do in university and so gave them an insight into what studying these subjects would be like. Others did not know what they wanted to do at university yet but felt this project would help to focus what career path they go down – whether this would be in STEM-based careers or not.

All students spoken to as part of Arad visits said that they had enjoyed taking part in the project. For some participants it was 'good to get out of school and do something different', others mentioned that it was a unique experience, and many had especially enjoyed the final awards and presentation days.

"It's free and I enjoy it. I'd like to get into product design and see if it's a viable option as a career. Do things on a bigger scale than in school. Our teachers spoke very highly of it, which encouraged me to come". ***Project participant***

For many students the projects related to something in their locality, for example a task set for one school was to develop an active travel route/network through the community to encourage more walking and cycling. Students felt that this was an advantage as it helped to contextualise the project and gave them something they could relate to, and ultimately see the benefit of at the end.

Some students also enjoyed the practical element of the project and that the projects were 'real-life' challenges. The 'real' context of STEM Cymru 2 activities was noted as an important success factor in the 2018 evaluation report, and it was recommended that this be maintained in future delivery. This feedback therefore demonstrates that EESW have continued to deliver on this, with students feeding back that they felt it had given them an opportunity to gain an understanding of what it would be like to work in these fields or to study them at university. One group of students reported that the 'hands-on nature' of the project meant it was more accessible for them and they could work hard and produce something successful.

"It has been a great experience, it much more practical than theory, there are end goals."

"It's real-world situation."

Project participants

Feedback gathered from students suggests that a key achievement of the sixth form project is the opportunities it gives students to learn and develop new skills. Some of these skills included:

- **Problem solving skills** – students liked using their skills to come up with different solutions to the challenges set.
- **Team working skills** – many students fed back that this was a key outcome of their experience, some also commented that they do not get such team working opportunities in school normally.

- **Communication skills** – students felt this had given them the opportunity to practise their communication skills with their peers, teachers, industry representatives and at the awards and presentations event.
- **Improved subject knowledge** – some had learnt new design skills or had gained deeper subject knowledge.
- **Presentation skills** – this was particularly evident at the final awards and presentation events where students had to present their project to industry representatives.
- **Team leadership skills** - most projects assigned different roles to members of the team including team leader roles. Those spoken to in these roles had enjoyed this element of it.

Figure 2: Developing new skills – quotes from participants

These key benefits recognised by students aligns with those outcomes identified by participants who took part in the 2017-2018 Sixth Form project, in particular the communication, team building and problem-solving skills which were said to be important transferrable soft skills.

During the workshop visits Arad observed how engaged students were with the tasks and witnessed the students, teachers, university technicians and support staff, and industry representatives actively working together to come up with solutions to the challenges they were set. Students working successfully together was also evident in observations during the final awards and presentation days. Students appeared enthusiastic and confident about their projects, some teams were actively encouraging passers-by to come and see what they had created for their projects and enjoyed speaking to different people.

Another key achievement as part of this is the successful relationships students have built up as part of the project. Several students commented on new friendships within the teams

that had been created through the projects. Many students also felt that an important and unique part of the project was the links built with industry representatives. Students felt this was a good opportunity to learn how to work with these individuals, and to learn more about the industry from those who are directly in the field. Some students gave examples of how they have gone to these representatives to ask for career advice.

"We have been working really well as a team, working side by side, it's like a new friend group now as well."

"The levels of communication between the engineers and us are good, we have independence, we work on things for planning and delivery together."

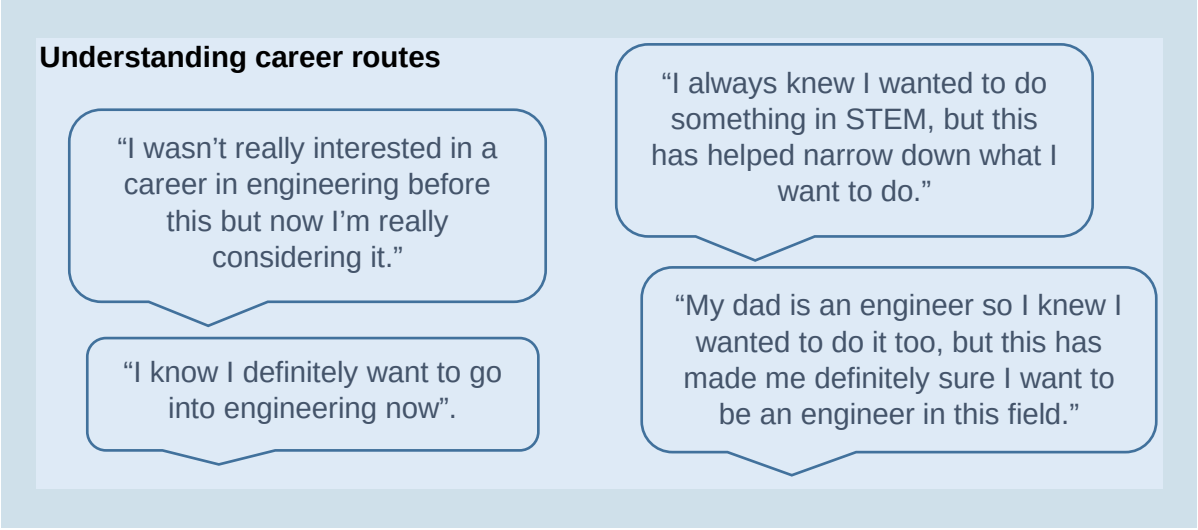
Project participants

Several students also reported that they enjoyed the competitive element of the project, within schools if they had multiple teams or across all schools involved in the project. Students also commented on how it was a unique opportunity to meet up with and interact with students from other schools.

"The competition with the other teams is good, you are all trying to come up with a good final idea." **Project participant**

Many students spoken to said that taking part in the Sixth Form Project had helped them with their future subject and career choices, as outlined in the quotes below.

Figure 3: Understanding career routes – quotes from participants



Some students who did not want to go into STEM subjects or who were not yet sure what they wanted to do still commented on the benefits of taking part in the project and felt that they had learnt transferable skills that they could take into any future career. Many also noted that the experience will look good on their CV's and university applications.

"Even if I don't go into engineering, I think I've learnt a lot of skills like communication and working in a team that will help me in the future." ***Project participant***

At the final awards and presentation events EESW organised stalls for employers and organisations to provide information about career routes students could take. Some students spoken to at the events felt that this was useful and had appreciated the opportunity to speak to different organisations and find out more about STEM-based career paths.

A key aim of the STEM Cymru 2 project is to raise awareness of STEM subjects and careers and to encourage take up of STEM. Although it is difficult to determine with certainty how many students go on to study STEM subjects and pursue careers down this route, these findings suggest that students who take part in the sixth form project are gaining increased knowledge of subjects and career routes in STEM which many felt would help them in the future.

As was also suggested in the 2018 report, activities directed at those in sixth form are predominantly aimed at students who are already studying STEM related subjects at AS and A Level and so it could be determined that the sixth form project activities are supporting study choices that have already been made by students.

However, the 2018 evaluation also concluded that '*even though some activities are directed towards those who already study and have an interest in STEM subjects, they do add value in relation to nurturing further enthusiasm and awareness of STEM subjects and improved access to the preferred university courses of participants.'* Feedback gathered during the more recent round of interviews in 2022 - 23, also indicates that the Sixth form project strongly influences the future study direction and career paths of the students involved and equips students with the knowledge and experience to create clearer routes for some participating students.

Views from teachers/schools

Feedback gathered from teachers in participating schools was generally positive. Similar to the feedback by students, teachers also felt that the opportunity to learn new skills was a key outcome of the project for students. This included developing their communication skills, team working skills, problem solving skills, presentation skills and increasing their confidence. One teacher commented that it is about the '*whole experience, making friends, team building and improving the soft skills of students.'* Another teacher described the team working as especially '*invaluable as it reflects the way workplaces work'*, which they considered good experience for students. Some mentioned that these skills specifically enhance the employability of students as well as developing life skills which is important for their futures.

Figure 4: Teacher example of benefits

One teacher reported that some of the students in their group were *'initially quite shy'* but that this project has *'allowed them to come out of their shell'*. At the final awards and presentation event the teacher had asked some of the students to go to some of the career's stalls to try and get a free item on offer, some students were nervous at first but they ended up talking confidently to the organisation at the stall and came back happy. The teacher highlighted that '*this project is about breaking down barriers and encouraging young people to go out of their comfort zone'* and praised the event for offering this unique experience for students.

One teacher described how the students had really taken ownership of the project, they have been leading in conversations, developing new vocabulary and terminology and were being independent with their decision making. Several also spoke of how 'rewarding' it was to see students come up with such innovative and creative ideas, highlighting the importance of the alignment of these activities to the new curriculum of developing independent and creative learners.

Figure 5: Quotes from teachers from participating schools

Several teachers highlighted the importance the project has in helping to get more girls into STEM and considered that that the project helps with addressing stereotypes. Many of the project teams which engaged with the project had an even split of girls and boys and teachers felt this was important to give girls the opportunity to understand what career options there are for them and that they had equal opportunities to progress. Female participation is explored more in section 3.5.1.

Teachers also valued the opportunity students had gained through the project to visit some of the sites of their respective partner companies and to use facilities they would not have had access to otherwise. Several teachers commented on the importance of the project in opening up links and communication with organisations outside of the school and some noted the sustainability of these links, a point emphasised by some employers.
Many teachers recognised how the sixth form projects have helped students with their future career decisions. One teacher also commented on how the project has helped with the marketing of the schools for its sixth form.

"The awards associated with the project have also helped raise the profile of the school and potential participation in the EESW project is used in marketing by the school for its sixth form." **School response from EESW survey**

There were also several examples given from schools who recalled previous students who took part in the project who went on to study STEM subjects and pursue careers in STEM. One of the teachers commented that the project is '*a massive influence on their decision*

making'. One teacher had taken part in the sixth form project every year for the past 15 years and recalled how often the school hears of students who have taken part going down the STEM route, with one student who took part now working as an engineering lecturer at a university. The teacher also commented that for those who do not go down the STEM career path, the project still has an influence over their future careers as it gives them important skills and experiences.

"It has opened their eyes to new ideas and to courses and employment opportunities they didn't know existed, for example renewables. They are using this experience for their personal statements and interviews." **Teacher from participating school**

Overall teachers were also satisfied with the overall management and delivery of the Sixth Form project and the organisation and communication from EESW. This is explored in more detail in section 3.3.

Views from industry representatives

Arad gathered feedback from some organisations who had been partnered with the schools and had set the project challenge. One university partner felt that this was a 'good opportunity' for students to get a taste of what it would be like to study these subjects at university and gain an understanding of what developing these skills can do in real life contexts. They also reported that it gives the university a chance to see what prospective students are like, identify any gaps in knowledge and what further workshops or events are needed for students. They felt that therefore the project benefits both the students and the university.

"The scheme is brilliant. Even if students don't go into STEM it provides transferable skills such as report writing, communication etc. I'm really glad to have been involved as a student and now as a professional." **Partner organisation**

Other partner organisations also considered that one of the main benefits of the project is that is gives students '*real experience of what it is like to be in the industry*' and helps to guide students with their decision making for future subject choices and career paths. For organisational representatives the project provides them with a unique opportunity to network with schools and young people and to promote careers in STEM. One organisation commented that they have subsequently experienced students who have taken part in the project applying to them for placements at their organisation.

"This gives us a platform into the consciousness of students when embarking on an engineering career." **Partner organisation**

Figure 6: Example of good practise – partner organisation

Example of good practice

One organisation set their students a task to design a VR training tool to use in the company - one of their main motivations to take part in the project was to recruit more women into the industry. From the outset the organisation was 'very impressed' by the students and were '*amazed at how capable they were*'. They felt that the team worked well together and that the female student who led most of the activities did a good job - "*I think she is going to be a CEO of a company in future*". The group came up with innovative and original ideas that the company would not have thought of themselves. They ended up doing what the company saw as '*probably be two years' worth of work in six months'* and came up with a tool that the company is going to use moving forward.

"Students were impressive; they completely ran with the project. Their enthusiasm was amazing".

"I would take any of the students on tomorrow as higher level apprentices. They were just amazing. The whole thing was great – it was the right company with the right team with the right project".

During the final awards and presentation events Arad also gathered feedback from industry representatives who had stalls at the event. Those who were there to promote their organisations felt that this was a good opportunity to demonstrate to students the different career paths they could go down and allows organisations to speak to a wide range of students. One organisation now had students looking at applying to do apprenticeships as a result of speaking to them at the event. A university representative also reported that it '*helps with recruitment and allows a unique opportunity to see what students are doing*.' This demonstrates further positive outcomes of the project for employers and organisations that extend beyond the benefits to students and schools.

Figure 7: Summary of key achievements of Sixth Form Project

Summary of key achievements of Sixth Form Project

Feedback from student participants, teachers from schools participating and industry representatives involved in the project suggests that the sixth form project is successful in:

- Developing important skills in students, including soft and transferrable skills;
- Producing engaging and relevant projects;
- Giving students experience of 'being in a real working environment';
- Increasing awareness of STEM subjects and career paths;
- Encouragement and enthusing participants to study STEM subjects in university;
- Providing a platform for organisations to promote STEM careers;
- Creating links between students, schools and organisations.

3.3.2 Introduction to Engineering (i2E)

Views from students

Feedback from students was gathered by Arad at a First Lego League Challenge event. Students outlined that they had been enjoying the event and the challenges set for them. They felt it was a good opportunity to develop new skills and learn more about coding and building robots. Some students highlighted that they had especially enjoyed learning how to work in a group and being '*able to immerse themselves into the project'*. Another student felt that this had made them think about pursuing a career in engineering and technology in the future.

Figure 8: Quotes from participating students

"Really enjoyed the day- especially working on coding and building robots, not usually something we do in school, so it's been fun to learn".

"Course has helped to develop new skills that will be important for university and later in life, like learning how to do research and then cite and reference for the presentation".

"Happy to learn new skills, especially with the presentation. I have learnt how to speak up and be louder when talking in front of people".

"It was helpful because I wasn't on the outside looking in, I was fully invested and immersed into it".

Participating students

During other i2E sessions attended by Arad, students reported that sessions had been enjoyable and "*better than being in normal lessons*". One student found the Microbit coding sessions especially useful as she wanted to create her own website. Another student said that "*these are the types of lessons I've been dreaming of. I've loved it so much and want to do it again*".

Views from teachers

Teachers involved with the First Lego League Challenge events were very positive overall about their experiences and those of their students. Teachers felt that this had given students the opportunity to develop and show off different skill sets, for example some were more interested in the practical side, whereas others were more interested in the innovation and research side. They also felt that it builds a lot of confidence in the students that take part and the competition of it brings 'a fun element' to the challenge.

Some mentioned that the accessibility was beneficial, with one commenting, "*being open to all schools and pupils means that anyone has the ability to take part.*"' Most schools had selected students to take part who were in certain clubs in the school (for example coding and computer clubs). Some commented on how it gives students the opportunity to explore different careers and subjects and gives them a taste of what this could look like in reality. One teacher mentioned that it has not only spiked the interest of those directly involved in the project, but other students have also taken an interest in it, "*it reaches further than just the pupils involved*".

"We're not from an affluent area, lots of kids haven't been to a museum before, so coming to this day was a real eye-opener for a lot of the kids. They came in and was like "Miss, look at where we are!"" **Teacher from participating school**

"This opportunity from STEM Cymru opens so many doors that aren't usually available for us, the kids are never this enthusiastic in school". **Teacher from participating school**

One teacher reported that he had been involved in these events when he was a student and felt that it had a 'massive impact' on his career, encouraging him into the STEM field and becoming a maths teacher. He felt that it gave him a real insight into what can be done through STEM and what it can be like to work in the field. Another teacher gave several anecdotal examples of past students who had taken part in the First Lego League Challenge events and have gone into successful careers in STEM.

Teachers also provided positive feedback during other i2E sessions attended by Arad, such as the Microbit and wind turbine sessions. Teachers felt that these sessions were very engaging and gave students the opportunity to do something hands-on and different to their

normal lessons. It was also felt to be accessible for students of all abilities, providing a *'good opportunity for different groups of students to work together'*.

One teacher commented that the accessibility of these sessions is particularly important for those who are seen to be less academic, it builds up their confidence and "*makes them believe that they can do this in their future*". Teachers also commented that the sessions fit in with the new curriculum which was considered as a further benefit to the school. It was also suggested that some of the students who partake in these activities often go on to study STEM at GCSE, As and A level. One teacher also commented that as a result of these sessions some students had approached him to say they wanted to be engineers or coders in the future. It was felt that the exposure to these career paths was very important at an early stage and a further benefit of the i2E sessions.

"It exposes kids to the subject and careers they could get into from a young age and this makes a difference to them in their future decisions as they may not get this experience as much in normal subjects. Kids may know what engineers are but things like this shows them the different types of engineers and what their job is like." **Teacher from participating school**

I2E activities are aimed at students in Years 8 to 10, a time where students make important subject choices which can influence their future career. A key aim of these activities is therefore to influence these decisions and promote STEM subjects. Although it cannot be determined how strongly the i2E activities influence these choices in participating students, it can be seen from feedback by students and teachers that the activities increase knowledge of the opportunities and career paths available and anecdotal evidence suggests that some participating students have a desire to pursue STEM subjects after participating in these activities.

"Our intake of students for DT GCSE and Engineering has increased greatly especially girls. This is due to engaging them early on in yr8 and 9, offering numerous activities on site and day trips to locations provided by EESW STEM. We as teachers enjoy the aspect of making external contacts too so that will benefit us in future activities or assistance with pupil work and subject expertise." **School response from EESW survey**

Views from industry representatives

During the First Lego League Challenge event Arad gathered feedback from two industry representatives who were judging the presentations of the students. These representatives provided positive feedback about their involvement in the event and expressed satisfaction to see the young people getting *'involved and enthused'* by the projects and to see their creativity in action. The motivations of these industry representatives to get involved was to give back to the industry as well as trying to get more females into STEM, and they felt that projects such as these do a good job of achieving this aim.

"I feel really positive about the future generations coming in through the industry". **Industry representative**

Figure 9: Summary of key achievements of i2E activities

Summary of key achievements of i2E activities

Feedback from student participants, teachers from schools participating and industry representatives involved in i2E suggests that the activities are successful in:

- Providing enjoyable activities for students;
- Developing new skills such as coding and team working;
- Providing 'hands-on' practical experience;
- Increasing awareness of STEM subjects and career paths
- Increasing awareness of STEM subjects and career paths in younger students;
- Encouragement and enthusing participants to study STEM subjects in later school years.

3.3.3 F1 in School Challenge

Views from students

Feedback gathered from students by Arad at the final F1 events was very positive. All students had enjoyed taking part in the project and in the final event day. Some had especially enjoyed setting up their stall and racing against other schools on the final event day. Students generally felt that they had gained good experience and it gave them the opportunity to do something new and different. For example, one student said they have never worked in a team before. The following key new skills were identified by students as an outcome of taking part in the F1 challenge:

- Team working skills
- Communication skills
- CAD and design skills

Similar to i2E the F1 challenge is delivered to students at an important age before students have to make subject choices at GCSE, AS and A Level. Many students commented that the project had helped them with future career decisions. For some, a career in motorsport engineering seems more open. Others felt that it had helped them to decide they want to pursue a STEM related career, with one student saying they had no interest in engineering before this project but now wants to pursue a career in this field. Several students

mentioned that they were unsure what career they wanted but that the project had helped them to develop skills that would be useful in any career path they choose.

One female student took part in the project to improve her communication and social skills. She reported that the project has been a great opportunity for her to improve on her public speaking which she is hoping will help her in 'a future career in activism'. One female student felt that the lack of females in the industry makes them want to pursue a career in engineering even more, *"there needs to be more girls represented in engineering."*

Students reported that a further key benefit to taking part in the project was to develop links with companies. One team were able to interview representatives from Mercedes, which they found very insightful. Many teams also had sponsors for their projects, they received a variety of support from the sponsors such as money, t-shirts and posters, as well as help with setting up displays and graphics and other advice and guidance. Students found it useful to work with those in the industry and many felt they had built up good relationships with sponsors and partners.

Views from teachers/schools

All teachers who gave feedback were positive about the F1 challenge. Teachers reported that students had enjoyed the project and that the schools were happy to be involved in such a '*unique opportunity'*. Teachers also identified new skills learnt by students, such as communication, teamwork and design. Teachers also considered that the final event day was a good opportunity to interact with other schools and teachers. Some also mentioned that it was beneficial that the event was combined with the sixth form project as it meant schools had a chance to see what else EESW offers and for students to see what other types of projects they could get involved in as they progress through school.

"It gives them even more exposure into the engineering pathway – being able to see all of the different paths they could go down." **Teacher from participating school**

Some teachers also commented that a number of students who take part in the project go down similar subject and career routes. One school has a high rate of students signing up to engineering from their school and feels that these types of projects help with this.

"I definitely see pupils who have been involved in the F1 go on to study engineering or other STEM subjects." **Teacher from participating school**

Views of industry representatives

One organisation involved in the F1 challenge felt that the students were very enthusiastic and "amazing". They commented that one school they worked with had no teacher attached to the project and so the students did their project without the support of a teacher. However, they did a good job and the organisation had a positive experience working with the students.

"It's a dream to work with these types of kids." **Organisation representative**

This organisation also felt that the company also gains benefits from taking part in the project, for example they exhibited at the F1 challenge in Swansea Arena which they felt was good publicity for the company and they also used the opportunity to promote apprenticeships to students.

Figure 10: Summary of key achievements of F1 project

Summary of key achievements of F1 project

Feedback from student participants, teachers from schools participating and industry representatives involved in the project suggests that the F1 project is successful in:

- Developing important skills in students, including team working, communication and design skills;
- Providing a 'unique' experience for students;
- Producing engaging and relevant projects;
- Giving students experience of 'being in a real working environment';
- Increasing awareness of STEM subjects and career paths;
- Encouragement and enthusing participants to study STEM subjects in later school years;
- Providing a platform for organisations to promote STEM careers;
- Creating links between students, schools and organisations.

3.3.4 Headstart Cymru

Views from students

At sessions attended by Arad, students were very positive about their experience taking part in the Headstart Cymru scheme. Students enjoyed the 'hands on' element of the activities, meaning they could get practical experience. Several students specifically mentioned the 'bias in engineering' talk as being very interesting and not what they had expected.

Most students also felt that they were learning new skills or being able to put existing skills into practice as part of the experience. Some reported that the project had also helped to contextualise the subjects. Students also liked the social element, they were able to meet and speak to different people and form new friendships with students from different areas. A few students were also positive about the social activities such as beach volleyball. Some students said that the event had exceeded their expectations and did not think they would enjoy it as much as they have.

"This has given me an eye into what university will be like and an opportunity to see different things". **Student participant**

Figure 11: Key benefits identified by students

Key benefits identified by students:

- Enjoyment
- Practical experience
- Learning new skills
- Contextualises subjects
- Social aspect – making new friends and meeting different people
- Fun social activities
- 'Real' experience of university life
- Helped with future decision making (career routes, university, subject choices)
- Helping to address gender stereotyping

As with the sixth form project, Headstart Cymru is aimed at students who may already be pursuing or have an interest in STEM subjects so it is difficult to determine the strength of influence it has on subject and career choices. However, evidence suggests that it helps participating students with choices for future study and gives them more insight into different career paths. As such, when asked if the experience had influenced any future decisions, students either said that they already knew their future plans but this has cemented it for them, or that they did not previously know, but it has given them '*more options to think about'*.

A couple of students reported that it has inspired them to go to university. Some students said that they now have more options of what subjects to take and will have more of a decision to make because they enjoyed different subjects that they did not expect to like so much.

Some also felt that the experience has helped them to rule out some subjects that they like less than others. Students were also positive about gaining "real-life" experience of what to expect when going to university in terms of university life, as well as gaining experience of the subjects. A couple of students from both of the sessions attended by Arad said they were now thinking of applying to Swansea University or University of South Wales when they had not considered these institutions before.

Feedback was also gathered as to whether the sessions had challenged any stereotypes for students. Both male and female students commented on how positive it was to see so many females taking part in the event, as well as females working at the university. One female student commented that she was the only girl in her physics class in school, so it was nice to be amongst other females and "*I don't feel out of place here*".

Views from university representatives

Representatives from Swansea University and University of South Wales who provided feedback during Arad visits felt that Headstart Cymru provides students with a useful insight into university life and a taste of different subject choices. They considered it also provides an opportunity for the universities to attract students to their university and promote subjects and careers in STEM. It gives them a chance to “show off the discipline”.

“It is hugely important to raise awareness of these degrees and subjects as there can be a lot of misconceptions about what biomed is and involves. These practical sessions show an accurate reflection of what it will be like to study and get a real perspective of the subject.”
University Professor

One head of department felt that there is a big gap in the industry, commenting, *“there are lots of jobs and opportunities but not enough applicants to fill them.”* They felt that these events are important as they need more students to be able to fill future jobs in an important industry.

Not only does Headstart Cymru benefit Year 12 pupils, but it also gives student ambassadors at the universities the opportunity to volunteer and help out at the sessions. Student ambassadors wanted to take part to be able to share their experience and give back to the university and to younger students. All of the student ambassadors interviewed by Arad reported they would have taken part in Headstart Cymru if they had the opportunity as a Year 12 student.

Figure 12: Summary of key achievements of Headstart Cymru

Summary of key achievements of Headstart Cymru

Feedback from student participants, teachers from schools participating and university representatives involved suggests that the Headstart Cymru project is successful in:

- Developing important skills in students;
- Providing a 'unique' experience for students;
- Increasing subject knowledge of students;
- Giving students 'real' university experience;
- Providing social opportunities for students to interact with each other;
- Increasing awareness of STEM subjects and career paths;
- Helps to address some gender stereotyping;
- Providing volunteer opportunities for student ambassadors;
- Encouragement and enthusing participants to study STEM subjects in universities;
- Providing universities the opportunities to promote themselves and subject choices;
- Creating links between students, schools and universities.

3.3.5 Girls into STEM

Views from students

Students who gave feedback at Girls into STEM events all found the sessions enjoyable. Some especially enjoyed the sessions with set tasks such as the lip balm making sessions. Of the ten pupils spoken to at one event, eight said that they wanted to pursue a career in STEM after attending the session.

Views from teachers

Teachers felt that these sessions gave students the opportunity to learn new skills that they would not have in school, for example during a pharmaceutical lecture students had the chance to develop skills in a lab setting, learning how to measure and weigh different materials, and developing the confidence to mix chemicals. Teachers also found the sessions engaging and relevant to students, for example one session involved creating their own cosmetics which students could enjoy and relate to.

"*The Girls into STEM days have been useful to engage pupils with potential career pathways in a fun way*." **School response from EESW survey**

Views from industry representatives

Industry representatives who provided feedback highlighted the importance of the Girls into STEM events in order to diversify an industry which is typically male-dominated. They felt that these events provide unique opportunities to promote careers to females and to show female role models already in the industry, allowing students to be able to speak to these role models and learn more about working in the industry as a female. As has been demonstrated through other event strands, it also provides organisations with the opportunities to promote their organisation and attract future apprentices or employees.

"What these events offer is something unique, and there isn't anything similar out there which could replace it." **Employer**

"[STEM activities] *Engages young people in considering a career in manufacturing. Gives a realistic view of the challenges. Also our graduate engineers get to engage with / share their knowledge with young people. By sending female engineers and engineers from other ethnic groups we can promote diversity and give role models for other young people. Making STEM and manufacturing a career choice for all."* **Stakeholder response from EESW survey**

Figure 13: Summary of key achievements of Girls into STEM

Summary of key achievements of Girls into STEM

Feedback from student participants, teachers from schools participating and industry representatives involved suggests that the Girls into STEM activities are successful in:

- Providing enjoyable and relevant activities for female students;
- Developing important skills in students, including lab skills;
- Increasing subject knowledge of students;
- Increasing awareness of STEM subjects and career paths;
- Promoting female role models in STEM;
- Encouragement and enthusing participants to study STEM subjects in later school years;
- Providing organisations the opportunities to promote themselves and subject choices;
- Helps to address some gender stereotyping.

3.3.6 Counterfactual

As part of the EESW stakeholder survey, participating schools were asked if EESW were not successful in gaining funding to continue with STEM Cymru 2, would the school be willing to pay to participate in activity strands they have engaged with to date. 14 out of 40 respondents said they would not, or rather they could not because their school budget was insufficient to pay to engage in these activities. Only 3 school respondents said they would be able to pay and would continue to participate in activities at their current level; a further 5 said 'yes,' they would be able to pay but they would have to reduce their level of engagement with the Programme.

The remaining 18 respondents answered 'maybe' to this question. Further comments suggest that the main issue for schools to continue if funding was not available would be the inability to fund this type of project themselves due to already pressured budgets and increasing costs.

"Our School already has a significant budget deficit. It is a commitment for the school to pay for cover and transport, they would not be in a position to allocate any further funds."
School response from EESW survey

Schools were asked what impact the potential loss of EESW STEM Cymru 2 activities would have on their school/pupils. Schools expressed concerns about the lack of careers support and information that would be available to students if these activities were no longer delivered. This in their view would ultimately lead to a lack of uptake of STEM subjects at GCSE, A Level and Further Education and therefore a decrease in those taking up STEM related careers.

*"It would not be possible to promote STEM in the same way without additional funding [*to deliver STEM Cymru 2]*. STEM subjects are innovative and forever changing, schools need additional funding and support to keep up and provide new equipment/opportunities for pupils."* **School response from EESW survey**

Some also commented on the potential loss of innovative and engaging activities for students, and a lack of opportunities for students to develop new skills, increase their subject knowledge and gain experience to add to their CV's and university applications if the STEM Cymru activities were no longer available.

"It will make their learning more 1 dimensional and the sixth form project helps our group to get into university or apprenticeships" **School response from EESW survey**

There were also concerns from some that schools would lose the opportunity to create links with industry. Stakeholders from organisations who responded to this survey also raised concerns about diminishing links between schools and industry if EESW activities were not available.

"One of our learners got an apprenticeship with Aston Martin after doing the [Sixth Form] *project. They would lose all of this, and EESW's help to link us up with local industry."*
School response from EESW survey

Other stakeholders also expressed concerns that if the STEM Cymru 2 project were to discontinue the loss of engagement and outreach employers would have with students

would result in fewer students taking up STEM careers. This concern was also expressed by some organisations who participated in interviews with Arad.

"The skills, knowledge, relationships that EESW has developed are irreplaceable. It would significantly reduce are interaction as industry we would not have the time to organise or manage programmes as effectively as EESW. This would impact the pipeline of students considering engineering and careers in our industry."

"EESW project was one of the reasons I got into engineering myself, so losing the scheme will have an impact on encouraging the next generation of the engineers but also losing the connection between schools and industry."

Stakeholder responses from EESW survey

4 Management and delivery

This section assesses the effectiveness of the management and delivery of the STEM Cymru 2 Project by EESW. It examines EESW's role in engaging with schools, colleges and employers; staffing; and delivering cost savings, value for money and added value for the Project.

4.1 Engaging with schools, colleges and employers

Since 2015, the ESF funded STEM Cymru 2 project has delivered activities to over 14,000 young people in West Wales and the Valleys. Achieving this reflects the ability of the project delivery team to effectively promote the project to schools, higher education institutions and employers and to then engage with them to deliver activities across the five work streams. All representatives from participating schools, universities and employers, noted during interviews that in their view the project activities have been delivered effectively, efficiently and to a high standard.

Schools and employers in particular welcomed the way in which the EESW management and delivery team organised and coordinated all of the activities and events. This is highlighted as an integral element of EESW support for teachers and organisations who want to engage in projects that promote STEM and career and work-related activities but are often limited to doing so because of the time and resources required to organise and deliver it themselves.

"Time tabling, planning and implementing the above would have been impossible without the EESW". **Response from EESW schools survey**

Evaluation evidence gathered during 2022–23 confirms that EESW has maintained good engagement with schools, colleges, universities, and employers, which was highlighted as a key success of the project during the previous evaluation round in 2018. EESW's link with organisations and institutions is nonetheless often reliant on contacts they have established with key individuals employed within them and maintaining these links in cases where these individuals move on to employment elsewhere remains a challenge. Despite these challenges, the Project team has maintained good partnerships with most of the educational institutions and employers involved, while also establishing new links with employers and schools.

As well as establishing direct links, with employers and teaching institutions, the STEM Cymru 2 project team has also facilitated and strengthened links between these organisations. This was considered a particular benefit amongst many employers and teaching institutions interviewed. Many employers noted that they had previously struggled to engage effectively with schools, particularly secondary schools, even within their localities. One of the main reasons identified for this was the challenge these schools faced in releasing students (particular those in year 10 and above) from their lessons to participate.

"We do other things to raise awareness of what we do including visits to schools (mainly primary) to deliver presentations. We also try to engage with secondary schools to deliver similar sessions but with more focus on engineering and careers in engineering – however it's often difficult to get secondary schools to offer sufficient time and release pupils to attend these sessions." **Employer**

Some employers also noted that even when they engaged directly with schools, outside of the support offered by EESW, they were not necessarily engaging with students who had an interest in STEM subjects. These employers noted that a key benefit of the Sixth Form project was that not only did it provide an opportunity to engage with local schools to promote their organisation and the potential career opportunities they had to offer, but also enabled their engineers to work with students who were genuinely interested and enthusiastic about the task that they'd been set.

"The students and teachers [who were engaged in the Sixth Form Project] were very enthusiastic, so this made it much easier for the engineers to work with them. This enthusiasm also gave all of us within [name of company] who were involved in the project a real morale boost." ***Employer***

A couple of employers noted that although they considered activities such as the EESW Sixth Form project and Girls into STEM to be very well organised and delivered to a high standard, they did not always know what impact their involvement in the project was having on the participating students. These employers noted that they would welcome further feedback on whether students and teachers enjoyed and valued the site visits and / or support they had received and whether anything could be improved. These employers also noted that they would also like to hear more about the progression of individual students following their engagement with them.

4.1.1 Organising Awards and Presentation Events

EESW's successful engagement with a range of organisations is also evident in the number of companies that sponsor awards at the annual Awards and Presentation events. Two events (one in North Wales and one in South Wales) are held each year to showcase the Sixth Form projects completed by participating schools and colleges and to present the best projects with awards in recognition of their achievement. During 2023 the event was also combined with the final of the F1 Challenge in Schools.

All those consulted who had been involved in these events agreed that they were very well organised and delivered. Participating students were very enthused by the opportunity to be involved in the event and employers supporting individual projects and organisations judging projects at the events were impressed by the high standard of the event itself and the quality of work produced by participating teams.

4.2 Challenges for recording outputs

Recording the number of participants who complete training and continue to study STEM subjects has been a challenge for some time and this was highlighted in the 2018 evaluation. The main challenge is that if an individual takes part in more than one activity delivered by STEM Cymru 2, only the first activity engaged with can be recorded as having

completed training. For example, a pupil participating in an i2e session who later participates in an F1 in schools challenge and / or the Sixth Form project can only be recorded as one participant who has completed one element of training.

The challenge noted above in section 3.1 relating to a lack of returned consent forms also results in a net under-recording of participants who complete the training i.e., only participants who complete training who also return a consent form can be recorded.

A further challenge is recording whether or not students who participated in the EESW Sixth Form project go on to study STEM subjects in further or higher education. There is no systematic way of recording the destination of students once they leave school or sixth form college and therefore tracking whether or not they continue to study a STEM subject at university.

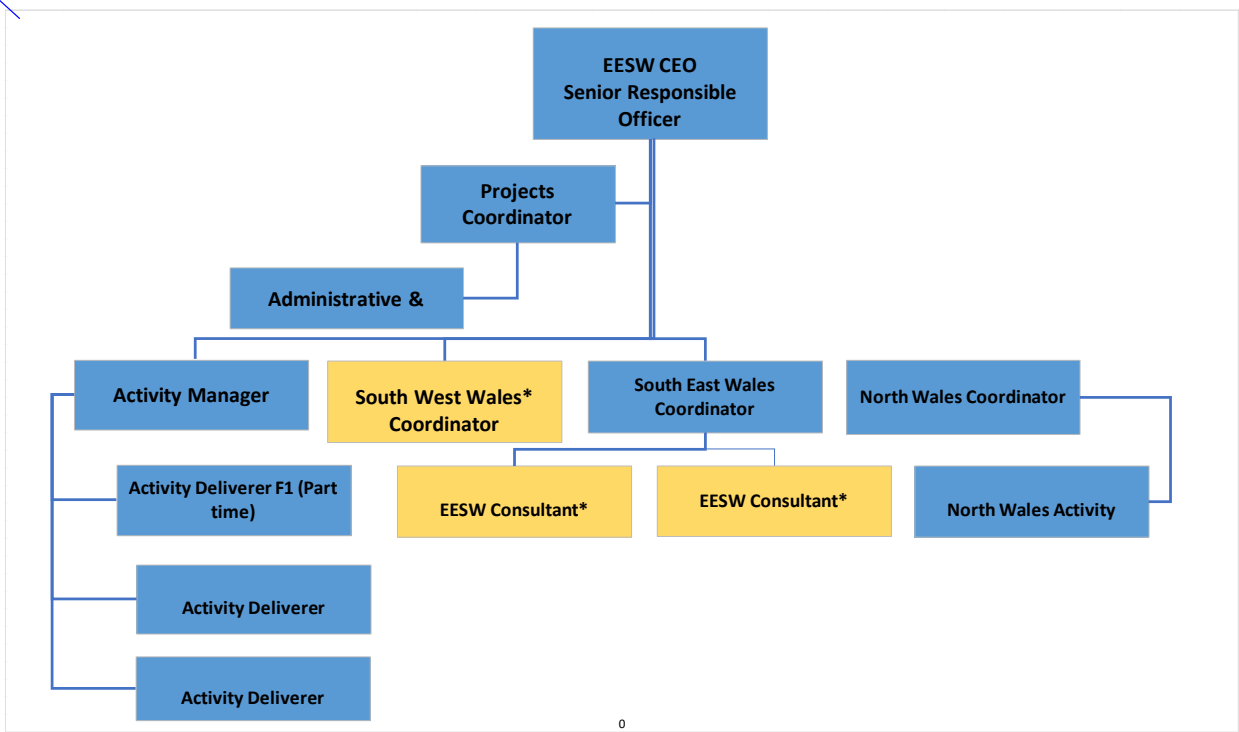
The 2018 evaluation report outlined that a system was, at the time, in the process of being introduced to gather destination data, of year 13 leavers who have taken part in STEM Cymru 2 activities, directly from Senior Management Teams (SMT) across participating schools and colleges. This is now in place, however, to record the destination of these participants, EESW is reliant on schools tracking the progression of their students and reporting this back to them. These records are not always returned and even those that are do not always contain all the information required. There is also a time delay factor. For example, it is not yet known whether the current 2022 / 23 cohort of participants will go on to study STEM subjects from September 2023 onwards.

It should be noted however, that challenges associated with under recording participation outputs achieved have been previously noted and reprofiled targets have taken these challenges into consideration. Figure 2 in the Annex outlines output original targets for completing training and continuing to study STEM have been reprofiled downwards during the course of the Project – partly to reflect the monitoring challenges noted above.

4.3 Staffing

The delivery of the STEM Cymru 2 project is led by a Senior Responsible Officer (SRO), who is responsible for the day-to-day management and delivery of project activity strands. The SRO is supported by 10 members of staff including a Projects Coordinator, an Administrative and Marketing Assistant, an Activity Manager, Regional Coordinators and Activity Deliverers. The delivery team also includes three self-employed consultants – see Figure 2 below. The SRO is also supported by the provision of evaluation, monitoring, and financial control and accounting services.

Figure 14: EESW STEM Cymru 2 Staffing structure



*Most team members are salaried staff – team members in yellow are self employed consultants.

The staffing structure outlined in figure 2 above, includes posts that have been occupied by a core team of individuals who have remained part of the management and delivery team since 2015. Other posts within the team structure have however, seen a relatively high turnover of staff in recent years. This turnover of staff often occurs in the months leading up to the end of STEM Cymru 2 funding award periods, when it is uncertain whether future funding will be secured and therefore whether the Project, and the jobs supported by it, will continue. This uncertainty often prompts some individuals to leave their posts early to secure employment elsewhere.

It is often difficult to recruit new staff to fill these vacant positions in the short term as EESW cannot offer any new recruits longer term employment contracts until new funding sources have been secured. As a result, some roles within this staffing structure have at times remained vacant for months before new recruits have been appointed to fill them, which in turn impacts on the Project's ability to deliver all planned activities during these periods.

During 2022 / 23 uncertainty regarding future funding and therefore continued delivery of STEM Cymru 2 activities was further heightened in the knowledge that the Project could no longer be supported by ESF funding beyond June 2023. As a result, some staff members left their posts and the delivery of some STEM Cymru 2 activities planned during the first quarter of 2023 had to be cancelled due to staff shortages.

Staff shortages, and therefore additional work pressures placed on other team members within EESW to deliver planned activities, has also resulted in less focus being placed on gathering data from schools to evidence whether students completed training and / or

continued to study STEM following their participation in activities. This partly explains the underachievement relating to these targets recorded to date – see table 4 in section 3.1.

An increase in the number of schools and young people taking up STEM Cymru activities during 2022 also placed additional pressures on the administrative tasks required to record participant numbers. A temporary administrative support post was created during this period to try and deal with the backlog of paperwork that had accumulated.

However, despite the staff shortages and administration challenges experienced at times, STEM Cymru 2, as noted above, has overachieved on its output targets, and based on feedback received by students, teaching institutions and employers, has continued to deliver activities to a high standard throughout. The ability of the Project to do this appears to be largely down to the ability and willingness of other team members within EESW to work flexibly to continue to deliver activities despite these staff shortages.

4.4 Cost savings and underspend

EESW spend projections included a budget of £13,000 to cover what was anticipated to be redundancy costs for staff at the end of the funding period. However, as several staff members had already left before the end of the funding period, this cost was not incurred.

The restrictions imposed because of the COVID 19 pandemic, required the Project to deliver some activities virtually via online platforms. This included the 2020–21 Awards and Presentation Event where participating teams sent in videos to showcase their projects and presented their findings during live online interactions with assessors.

Other STEM Cymru 2 activities were also delivered online during the pandemic including the Girls into STEM workstream. Although delivering activities online could not fully replicate the experience of a large event or onsite visits, they did enable the project to widen the breadth of participation and reduced the need to take students out of school. Delivering Girls into STEM activities online also enabled more participating girls to engage with female role models working in STEM related occupations – a key benefit of this workstream (see section 3.5.1). For this reason, some of these activities continued to be delivered online after the pandemic restrictions were lifted.

Organising events online required similar levels of organisation and coordination as face-to-face events. However, hosting virtual activities, did reduce delivery costs, particularly the cost of hiring a venue to host the awards and presentation event.

Hosting some activities online, having staff posts vacant for extended periods of time and not requiring the redundancy pay budget funded for, has resulted in a series of cost savings. As such, the STEM Cymru 2 project has recorded a net underspend of almost £300,000, which equates to almost 7% of the planned budget – see Table 6 below.

Table 6: STEM Cymru 2 income and expenditure summary (forecast to June 2023)

			Total forecast to June 2023	Budget	Difference
Actual	Private	EESW	227,371	222,979	-4,392
In Kind	Private	Various Private	21,477	13,495	-7,982
Actual	Private	Various Private	284,800	288,400	3,600
In Kind	Public	Various Public	272,799	320,618	47,819
Total (£)			806,447	845,492	39,045
Total ESF Grant (£)			3,215,011	3,456,577	
Total funds available / spent (£)			4,021,458	4,321,069	**299,611 (underspend)**
ESF % of total budget			79.95%	79.99%	

4.4.1 Securing match funding

ESF funding provided to deliver STEM Cymru 2 activities is match funded by direct and in-kind funding provided by EESW as well as various private and publicly funded bodies. Direct funding contribution comes from industry sponsors and in-kind contributions are offered in the form of hours of work provided by teaching practitioners and industry representatives to support the project activities.

Recording in-kind contributions is reliant on teaching practitioners and industry representatives supplying EESW with information outlining the hours they have contributed and details of their salary. This information has not always been available, and as a result, forecast in-kind contributions recorded from public sector contributors, largely teaching professionals, is lower than the budget initially set out.

4.5 Delivering value for money

The 2018 evaluation report outlined that assessing value for money achieved by the STEM Cymru 2 project in terms of wider or indirect economic benefits to participating employers and HEIs was not possible due to impact time lags and a lack of data that would have allowed us to isolate and quantify impacts on an individual participant and stakeholder level. The same is also true now, in 2023.

STEM Cymru 2 has supported over 15,000 participants from schools and colleges across Wales (see Table 5) with an overall budget of just over £4million. This equates to a delivery cost of £267 per STEM Cymru 2 participant: £214 of direct ESF funding per participant. These are lower than the per head cost figures reported in the 2018 evaluation report, reflecting the cost savings and subsequent underspend noted in the previous section. In addition, as noted elsewhere in this report students taking part in two or more STEM Cymru

2 activities can only be counted as one participant. This, coupled with the fact that participation amongst young people is under recorded at times due to incomplete consent forms, indicates that the actual number of young people who have participated in STEM Cymru 2 activities is higher than the 15,000 noted above. It therefore follows that the actual delivery cost per head is lower than the values reported above.

4.5.1 Direct and in-kind contributions

Participating employers are asked to provide a direct financial contribution to support the STEM Cymru 2 programme. University teaching and technical staff as well as school teaching staff contribute to the programme by offering their time to support the delivery activities at no additional charge. The time contributed by these individuals is usually paid for by the organisations they represent. The value of this time (based on the hours contributed and the salary of the individual involved) is recorded as an in-kind contribution.

Direct and in-kind contributions provided by participating employers, HEIs and schools can be considered as a proxy indicator of the value stakeholders place on the activities delivered by STEM Cymru 2. Forecasted actual and in-kind support provided by organisations outside of EESW equates to £580,000 – see Table 6.

This is a significant contribution, however the in-kind figures reported here are likely to under record the actual in-kind support provided. This is because some teaching professionals fail to return all the required information relating to the time they have contributed to activities and therefore these unreported hours cannot be counted. In addition, some industry organisations who offer the time of their engineers to support the Sixth Form project activities, do not provide any of this information as they do not want to disclose sensitive information relating to individual salary levels. This again results in under reporting of in-kind contributions.

4.5.2 Added value

One means by which added value can be considered is the extent to which the Project, as a whole, can be considered greater the sum of its parts. The 2018 evaluation report outlined that, in many cases, the individual activity strands of STEM Cymru 2 project were delivered in isolation of each other and that there was not always any obvious connection between the delivery, awareness of, and participation in, various activity strands of the project when delivered within individual school and college settings. This was because the Project's engagement with individual schools and colleges was often based on contact established with one individual within that institution who may have had a particular interest in just one of the Project activity strands.

The conclusion drawn from at the time was that this placed limitations on the potential reach and awareness of the Project within participating schools and colleges. This in turn limited opportunities for students to progress from, for example, Girls into STEM to the Sixth

Form Project, and therefore limited the extent to which the Project could be considered greater than the sum of its parts.

The way EESW engages with schools and colleges in 2022 – 23 remains the same as it was in 2017-18, and therefore the limitations noted above remain in place. However, given that students taking up activities across multiple activity strands can only be recorded once as a participant, there is little incentive, in relation to performance against output targets, for the Project to encourage progression from one STEM Cymru 2 activity strand to another. This is something that should be taken into consideration in any future rounds of the Project.

STEM Cymru 2 has however, demonstrated how it can contribute to supporting schools and students to progress their participation in other STEM related activities that are associated with, but do not form part of the Project's core activities. An example of this is the way in which some of the i2E activities were delivered to support teams within schools to participate in the FIRST Lego League (FLL) Challenge competition and events. Schools participating in the FLL were required to design, build, and programme Lego robots. These schools then went to FLL regional events where they competed with other schools and presented their robot designs and wider projects to a panel of judges.

School teams in West Wales and the Valleys who wished to compete in the FLL were offered i2E sessions, delivered through STEM Cymru 2, that focused on designing and programming Lego robots. EESW also hosted the regional competition finals in north and southeast and southwest Wales. Winners from these regional competitions had the opportunity to progress to the UK and Ireland national competition, which offered them further opportunities to develop their STEM skills and interest.

The STEM Cymru 2 activities not only benefit participating students by supporting their STEM skills, but they also benefit participating schools, HEIs and employers more broadly. Findings from the most recent evaluation fieldwork (in 2022-23) confirm those previously reported in 2018, i.e. that the Project activities help schools to showcase and promote STEM subjects and activities to other students and the wider community outside of the school.

Evidence gathered during fieldwork indicates that the Girls into STEM and Sixth Form Project also create and strengthen links between schools and industry, (see sections 3.2.1. and 3.2.5.). These links benefit schools in their ability to introduce students to experiences relating the world of work and benefit employers in their ability to promote STEM related career opportunities to potential future employees. Higher Education Institutions also reported that they benefit from promoting engineering and other STEM related courses to students and offering them a taste of what studying STEM subjects at university is about.

"We get a chance to plant the seed into minds of the future generation of talent - so we have a lot to gain out of the events and partnerships that EESW enables" – **Employer** (EESW stakeholder survey respondent)

Many examples of the added value generated by STEM Cymru 2 activities have been outlined as part of the evaluation fieldwork evidence gathered. Examples included in section 5 also outline how the activities and outcomes supported by them contribute to wider Welsh Government policies and priorities including Tackling Poverty and the Wellbeing of Future Generations Act, as well as the Cross-Cutting Themes that are integral to ESF funded projects. These examples of added value serve as further examples as to how the STEM Cymru 2 has demonstrated good value for money.

4.6 Section conclusions

Overall, STEM Cymru 2 has been well managed through the lifespan of the project, despite some staffing challenges. Activities across all the main activity strands have been delivered effectively and to a high standard. EESW's effective role has been highlighted by project partners such as universities and employers who particularly valued the project coordination, which saved them time and resources. New links between industry and education institutions have helped support young people gain an appreciation of potential career opportunities and, in some cases, greater industry-higher education cooperation.

Challenges with staff retention and recruitment at times during the project were largely successfully addressed through flexible working from EESW staff. Some overall underspend has been recorded due to some staffing posts remaining vacant for periods of time and cost savings gained from delivering some activities online during the pandemic, and in some cases beyond that. EESW successfully attracted match funding in terms of in-kind contributions offered in the form of staff time paid for by other institutions and organisations. The project has also attracted match funding through direct contributions provided by organisations sponsoring the Sixth Form project activities and sponsors of the Awards and Presentation Events, delivering additional added value.

5 Integrating cross-cutting themes

There are three CCTs integrated into the Wales European Structural and Investment Fund Programmes 2014-2020- **Equal Opportunities, Sustainable Development and Tackling Poverty**. The STEM Cymru 2 original Business Plan states that, “projects are required to incorporate actions to address the Cross Cutting Themes (CCTs) which are considered essential for the achievement of a well-balanced, sustainable, and innovative economy. The design and delivery of STEM Cymru 2 activities have therefore integrated the CCTs from the outset and delivered a range of positive outcomes for learners with the support of employers.

5.1.1 Equal opportunities and Gender Mainstreaming

An important emphasis of the STEM Cymru 2 Project is addressing gender stereotypes and breaking down perceived barriers for females considering studying STEM subjects and/or pursuing a STEM focused career. The female-only **Girls into STEM** strand provides sessions raising awareness of the potential for females to succeed in the field of STEM. Female role models engage with participants in their roles as engineers, graduates supporting workshops at higher education institutions, leading visits to employer organisations, and at national competition and award events delivered by EESW.

Supporting equal opportunities is at the heart of STEM Cymru’s rationale and goals and programme activity strands such as Girls Into STEM, which was especially designed to encourage female pupils to consider STEM pathways and to make Engineering and Technology easily accessible, interesting and relevant to them and enhance their understanding of the subject. As outlined in section 3.1, female participation targets for the overall STEM Cymru 2 programme have been exceeded and this is contributing to meeting the first of the CCT goals.

Schools reported that programmes such as Girls into STEM, Headstart Cymru and the Sixth Form Challenge have given them a platform to encourage female learners to take part in activities. Teachers commented on the positive female role models provided for learners that ‘motivates the girls to do well and understand that STEM careers are for them too’ and the enthusiasm shown by all deliverers to support female progression into STEM careers.

Teachers highlighted the positive impact of these activities in addressing stereotypes for all learners and showing the progression routes available from schools into university and beyond into STEM careers. Sixth formers interviewed as part of these projects praised their inclusivity and their focus on the potential of female careers in STEM while younger female learners felt that they could do things just as well as the boys in their class, with one commenting on building a wind turbine, *“girls can do this sort of things too, we could be better.”*

“We are really focusing on getting girls involved in STEM in the school through these activities, there is no point HE trying to balance their intake if there aren’t girls engaged in

STEM at GSCE and A level. We have a 'celebrating women in science' campaign in school." **Secondary School Teacher**

"We want to encourage more women to choose STEM subjects. Usually, when we work with schools, the girls always say they want to study law or medicine, but never engineering, even if they are good at it. However, since doing the STEM activities we have seen a lot more girls interested in engineering / STEM." **Employer**

Supporting equal opportunities has been a key element for employers participating in the programme too. Several employers reported that that the programme links to their own corporate strategies to encourage more women to work in engineering or the wider STEM sector. Employers have also used female staff in senior positions, female technicians, and apprentices to lead some of their activities to provide role models for female pupils and show examples of the potential career entry points and progression paths on offer.

A further element of supporting equal opportunities is the delivery of the activity strands in both Welsh and English, which allows for access to activities in the language of choice for learners and contributes to the Welsh Government's Cymraeg 2050 Strategy. Where applicable, Welsh speaking staff are allocated to groups during EESW launch events and during workshops. The APD and F1 in Schools Challenge events are bilingual and Welsh speaking assessors are allocated accordingly to schools to ensure that students have the opportunity to participate in Welsh.

Headstart Cymru events are attended by both English and Welsh speaking students, and as a result it is not possible to deliver the entire event in Welsh. Nevertheless, EESW staff members attending these events are bilingual and can engage with learners in both languages if opportunities arise.

Girls into STEM events are generally delivered by external companies, however when EESW deliver elements of these activities they are delivered in Welsh for Welsh medium schools. 12 of the 79 i2E workshops were delivered through the medium of Welsh. Welsh speaking students, particularly those from Welsh medium schools, valued being able to access the STEM Cymru 2 activities through the medium of Welsh. Some students also complete the CREST Award and use their EESW project to contribute to their Welsh Baccalaureate work and therefore if students are from a Welsh medium school, it is important that this work is linguistically consistent[2].

A few challenges were reported by EESW with regards to recruiting suitably qualified Welsh speaking staff. The offer of activities delivered in either Welsh or English has not therefore always been possible, although this was not raised as a concern by any of those consulted during the evaluation fieldwork.

[2] EESW has recently worked closely with the British Science Association (BSA) who run CREST Awards to ensure that the forms are available to STEM Cymru 2 participants in Welsh, as they previously were not.

5.1.2 Sustainable development

Sustainable development is the second of the CCTs and, again, this has been integral to the design and delivery of programme activities. All elements of STEM Cymru 2 place an emphasis on the importance of engineering as a means to address environmental challenges, with the resulting products and processes developed supporting sustainability. All launch events for the Sixth Form projects include presentations on sustainable development and it is a key focus of practical activities delivered during i2E sessions, for example, powering a calculator using solar power, building a vinegar battery cell and constructing a wind turbine.

Observations of these sessions by the research team have indicated a strong level of engagement from students e.g. relating to the potential for alternative energy production and supply and developing new technology-based solutions to environmental challenges. For example, as a result of the focus on sustainability, some students go on to submit independent investigations as part of their Welsh Baccalaureate Qualification (WBQ) with a sustainable development focus, and presentations students were tasked with delivering during the First Lego League Challenge competition, which is part of the i2E strand, also reflected a sustainability focus.

For younger learners the focus of building wind turbines during i2E sessions provides an introduction to green forms of energy and this was commented on by some learners during the sessions, with one noting, *"it's good, I like building things, it makes me think about new technologies and how they can work."*

For the sixth form pupils engaged in the Challenge and Headstart Cymru projects there was a strong focus on developing new environmentally friendly solutions to challenges in industry or their communities, for example developing a new walking route to a school. Teachers and university employees also commented on the relevance of the sustainable development theme with regards to engaging young people and linking to future careers in sustainable development through STEM.

"The main theme of the exercise is to find environmentally friendly solutions to business challenges so it's about timescales, logistics, being creative and problem solving. It allows for active engagement of learners and for them to undertake independent learning and group discussions." **University technician**

"*It is great to see the pupils come up with new and innovative ideas. It is also really beneficial that it is a real problem in their local area."* **Teacher**

For some employers, sustainability is a driver of corporate goals and therefore many of the tasks set for the pupils on projects such as the Challenge encompassed this approach. Activities were often based around enhancing sustainability and employers encouraged an innovative approach to developing solutions - for example, with one employer, 2 teams created off-grid extensions while another looked at how much electricity was being used on-site in the production processes and whether savings could be made.

Employers highlighted that these projects required skills such as statistics, excel, data analysis and maths. Several employers also reported that they were undertaking sustainable projects in partnerships with local universities e.g. green hydrogen, which could provide further opportunities for progression in future.

"The students were set the challenge of considering ways to extract heat from the large transformers we have and use it to heat the office building. Therefore, the project ticked the sustainability box – but also the ideas that the 6th formers came up with were good and could be used in practice by our company at some point in the future." **Employer**

"The students do fun things but there's a serious side too, they're learning about new techniques for decarbonisation, and sustainable values. It's something for them to get their teeth into. They are split into proper research and work groups, there is lots of communication. It's encouraging them to keep doing STEM and enhancing the talent pool available for employers like us. The students also have a site visit, it's linked to real life and real jobs." **Employer**

5.1.3 Tackling poverty and social exclusion

With regards to the third cross-cutting theme, tackling poverty, the ethos of the programme has been to target some of the activities at under-represented groups and communities, promoting potential careers paths through STEM. As outlined in previous sections the programme has delivered to a range of schools in WW&V areas to support disadvantaged learners' engagement with STEM. A further example is the collaboration with the Ospreys Tackle project, which has contributed to support disaffected learners who have become disconnected with school and missed out on other STEM activities. STEM Cymru 2 supports this project by delivering i2E sessions and other opportunities to students from low socio-economic groups, or black and minority ethnic communities.

Some schools reported involving FSM pupils in activities such as Girls into STEM and this can potentially raise aspirations and offer the opportunity for disadvantaged students to develop better skills. The collaboration promoted by EESW between schools, local employers, and universities can also create employment and progression opportunities within disadvantaged communities, offering the potential for greater access to apprenticeships and progression routes into quality jobs for school leavers and graduates.

"*The programme has really engaged with some of the more deprived areas in north Wales, schools don't have huge budgets here, so the cost-free nature of the programme is hugely appreciated. It's given a lot of learners a unique opportunity to do something different and to consider progression routes such as apprenticeships."* **STEM Cymru 2 coordinator**

"Our incentive in taking part in the Girls into STEM and the Sixth Form Project is also to enable us to reach to more pupils from disadvantaged areas. EESW enables us to broaden our reach into these schools, which would be more difficult otherwise." **Employer**

The table below demonstrates overall profile details of participants from under-represented groups or learners in disadvantaged areas who took part across all five activity strands. Population data breakdown for those aged 11-19 in Wales was not available for comparison across all profile characteristics. Therefore, it is not possible to conclude how representative

student participation currently is in STEM Cymru 2 activities however it does indicate some positive outcomes in terms of access to the Project for these groups.

Table 7 7: Participant profile breakdown for all STEM Cymru 2 activities

Characteristic	Participants overall	Percent %
BAME Participants	687	4.5%
Participants with a disability	393	2.6%
Single adult households	2370	15.6%
No working adult households	938	6.2%
Migrant status (EU or non EU)	442	2.9%

5.1.4 Project against case (project) related indicators for the CCTs

Case (project) related indicators were developed by EESW, with the support of WEFO, to monitor progress against the CCTs during the 2018-23 funding period. A summary of progress is outlined below, based on quantitative and qualitative data provided from EESW as part of case level reporting to WEFO.

With regards to **positive action measure – women**, as reported in previous sections, female participation for the operation is currently at 53.7% of total participants and EESW monitoring data indicates that 269 female participants have gone on to study STEM following the STEM Cymru 2 intervention. All the operation's activity is aimed at young people aged between 11-19 to improve attainment and take-up of STEM subjects, thereby meeting **positive action measure - young people**.

A further positive action measure is **mentoring / advocacy activity**. STEM Cymru 2 activity strands have included elements which provide engagement opportunities across several academic years, and therefore participants who engage for a second time have the potential to act as mentors for other participants. The F1 activity includes various levels of entry, and First Lego League Challenge teams often consist of participants of various ages, so that older students can share previous learning with others and act as role models across both strands. A similar measure is **peer support activity** and all of the STEM Cymru 2's activities have involved teamwork elements to deliver on this.

To meet positive action measure **developing an Eco-code** Stem Cymru 2 has put in place one for its staff which details how the programme activity strands should raise awareness of environmental and sustainability issues with participants. Participant projects have often featured environmental factors, particularly the i2E and EESW Project strands with sustainability and environmental protection part of the annual awards. To support the final measure, **developing / engaging CCT champions**, EESW appointed a senior staff member as 'CCT champion' to promote the themes with STEM Cymru 2 participants.

5.1.5 Contribution of STEM Cymru 2 to the Wellbeing of Future Generations Act

Sustainable development is not only a CCT but is also a key driver for Welsh Government policies. The design and delivery of STEM Cymru 2 activities provide clear context and activities to support sustainable development and contribute to a number of the well-being goals of *The Well-being of Future Generations (Wales) Act 2015*. The key goals that STEM Cymru 2 are most closely aligned with are a **prosperous Wales, a resilient Wales** and a **more equal Wales**.[3]

With regards to support a **prosperous Wales** STEM Cymru 2 activities contribute through the subject matter of many activities, which place a focus on efficient use of resources and developing solutions to environmental challenges, thereby acting on climate change. Activities also support the goal of progression to decent work through the provision of new knowledge, skills and aspirations for learners, and directing them to potential progression routes into STEM-based apprenticeships, further and higher education courses and quality jobs.

There are similar environmental goals for **the resilient Wales** goals under the Wellbeing Act, which highlights the capacity to adapt to change (for example, climate change) and supporting ecological, along with social and economic resilience. Again STEM Cymru 2 contributes to this in terms of focus on climate change and supporting adaptation and resilience in some activities such as developing wind turbines in i2E and creating sustainable solutions to industry challenges in the Sixth Form Challenge.

Regarding the Wellbeing Act's goal for a **more equal Wales**, STEM Cymru 2 supports a range of activities that enable young people to fulfil their potential no matter what their background or circumstances (including their socio-economic background and circumstances). Part of the focus for the activities have been on providing equality of opportunity in terms of access to STEM engagement through specific targeting of female learners e.g. the Girls into STEM activities and the targeting of all learners from less prosperous areas of Wales (linked the ESF funding guidelines).

5.1.6 Section conclusions

The design and delivery of STEM Cymru 2 activities have integrated the CCTs from the outset and delivered a range of positive outcomes for learners. Projects such as Girls into STEM, Headstart Cymru and the Sixth Form Challenge have given a platform to encourage female learners to take part in activities and provided positive female role models who have contributed to the successful focus on inclusivity and addressing stereotypes. Supporting equal opportunities has been a key focus for participating employers too, linking to their corporate and recruitment strategies.

[3] Well-being of Future Generations (Wales) Act 2015: the essentials | GOV.WALES

The programme has integrated sustainable development into activities for learners of all ages and this has had a positive impact in terms of their engagement with STEM. This has included activities aimed at addressing environmental challenges through new technological approaches. For some employers, sustainability is a driver of corporate goals and their partnerships with local universities, which has provided further opportunities to link to future careers progression paths in sustainable development involving STEM.

STEM Cymru 2 activities have addressed Tackling Poverty through targeting under-represented groups and communities, for examples schools in WW&V areas. These opportunities have supported disadvantaged learners' engagement with STEM, contributing to raising aspirations, new skills and greater access to apprenticeships and progression routes. The programme has also supported wider Welsh Government goals through its alignment with elements of the Wellbeing of Future Generations Act, particularly the drive for a more equal, prosperous and resilient Wales.

6 Conclusions and recommendations

6.1 Achieving output targets

The STEM Cymru 2 project has successfully met and, in many cases, overachieved on its output targets relating to participation amongst males and females across all five activity strands. Participation amongst females across the eight years of the Project is over 53% confirming its contribution to positive actions to supporting equality of opportunity and encouraging more girls into STEM.

The Girls into STEM activity strand significantly contributed to this achievement, however, the number of females who participate in some other work stands remains lower than the number of males. This indicates the continued need for activities that focus on supporting females to engage in STEM subjects and progress into further study (A level and further and higher education) and STEM-based careers.

Recommendation for Welsh Government and other funding bodies

Welsh Government and other funding bodies should support further actions to challenge gender stereotypes and increase the pipeline of females engaged in the study of STEM subjects and subsequent STEM-based careers.

Monitoring data indicates that the Project fell slightly short of its target number of participants completing training and continuing to study STEM. This shortfall to some extent reflects limitations in the data gathering and monitoring processes that have been in place to record these outcomes.

The 2018 evaluation report recommended that the Welsh Government should introduce methods of tracking and monitoring the progression of students with regards to attainment in STEM subjects and their progression routes. The Learning Records Service (LRS) is now in operation across schools and colleges and this could be utilised further to tack student progression routes. Further utilisation of systems such as LRS as well as considering other methods by which the progression of students could be recorded would be beneficial for any future delivery of projects such as STEM Cymru 2.

Recommendation for Welsh Government and other funding bodies

Actions may be required to further utilise the Learning Records Service to ensure that it serves as the tool required to track the progression routes of students into higher education and / or apprenticeships and therefore monitor the extent to STEM Cymru 2 participants continue to study STEM subjects and / or gain employment in STEM industries.

6.2 Achievements of STEM Cymru 2

STEM Cymru 2 has generated a range of short and longer-term impacts through its eight-year funding period. The short-term impacts include the practical and softer, transferable skills gained by participants. Providing insights into the world of work within STEM-based industries has raised the knowledge, awareness, and enthusiasm of participants towards future career opportunities in these areas. Activities such as Headstart Cymru and the Sixth Form Project have also helped participants to make informed decisions about their higher education plans.

The activities delivered through STEM Cymru 2, particularly Girls into STEM have broken down gender stereotypes associated with STEM and engineering. The inclusion of female role models within these activities has had a particularly positive impact on encouraging girls to consider engineering as a possible future study and career option.

For schools, the main short-term impacts have been the opportunity the Project has offered their students to participate in STEM related activities that would not otherwise be available. Participating in STEM Cymru 2 has enabled schools to promote and showcase their STEM activities within their respective schools as well as the wider community. Participation has also enabled many schools to develop stronger links with local industry employers. Schools noted that they felt that STEM Cymru 2 had a positive impact on the number of students continuing to study STEM subjects at AS and A level – however, it is difficult to quantify the extent to which this can be attributed directly to the Project.

The immediate impact that the Project has on participating employers is the opportunity it offers them to engage with schools, a process often reported by them as a challenge. Gaining access to these students offers these employers an opportunity to raise awareness of career opportunities available within their business, including apprenticeships and progression routes based around the study of STEM. The assumed longer-term impact for employers is that more young people will be attracted into STEM-related careers, thus increasing the overall diversity of the talent pool from which they can employ future recruits.

6.3 Delivering added value and value for money

During the eight years between 2015 and 2023, the STEM Cymru 2 project has overachieved on its participation output targets and continued to deliver activities that participants and wider stakeholders consider to be of high quality. However, although the Project has achieved its output aims, it also records a net underspend against its delivery budget. Much of the underspend recorded reflects staff posts that remained vacant for considerable periods of time.

Smaller cost savings have also been gained by delivering some activities online. Online delivery was a practice initially introduced to enable schools and young people to continue to participate in STEM Cymru 2 activities despite the Covid-19 restrictions in place during 2020 - 21. However, some activities continued to be delivered online after the pandemic restrictions were lifted. This enabled some activities to be delivered to larger groups of participants in an effective and cost-efficient way.

STEM Cymru 2 has continued to attract considerable direct and in-kind contributions from participating employers, HEIs and schools, demonstrating the extent to which these stakeholders value STEM Cymru 2's activities. The main value generated by the Project is encouraging young people, particularly girls, to study STEM subjects and to consider a possible career in STEM industries.

The added value of the Project for participating schools, colleges, universities, and employers has been the level of engagement and new connections they have established. These are links that, in many cases, would not have been forged without participating in STEM Cymru 2 activities. New links between industry and education institutions have helped support young people gain an appreciation of potential career opportunities and insights into the wider world of work. In some cases, they have also supported greater industry-higher education cooperation. Moving forward, efforts should be made to maintain and strengthen the links generated through the Project.

Recommendation for Welsh Government and other funding bodies

Supporting strong connections between schools, universities and employers in STEM based industries should remain a key focus within any future delivery of projects similar to STEM Cymru 2.

6.4 Addressing cross-cutting themes (CCTs)

STEM Cymru 2's focus on the cross-cutting themes of sustainable development has been evident across all the activity strands delivered, ranging from a focus on renewable energy

sources within i2E sessions to challenging Sixth Form Project participants to come up with environmentally friendly solutions to engineering challenges.

STEM Cymru's 2's contribution to tackling poverty and social exclusion has been evident in the extent to which its activities have reached students within schools located in economically deprived areas. Through their participation in the STEM Cymru 2's Girls into STEM and Sixth Form Challenge Project, many employers have been able to reach schools that they have not been able to previously engage with.

By working with key partners such as the Ospreys Tackle project, STEM Cymru 2 has also been able to reach young people at risk of becoming NEET, and through i2E sessions, support these students to participate in STEM activities and introduce them to possible career paths in STEM related industries.

STEM Cymru 2's focus on addressing the cross-cutting theme of equal opportunities and gender mainstreaming is evident from the fact the activities it has delivered have been inclusive. Activities have also been delivered in Welsh as well as English although recruiting suitably qualified staff to deliver activities, particularly Welsh speaking staff, has been a challenge at times. The offer of activities delivered in either Welsh or English has not therefore always been possible, although this was not raised as a concern by any of those consulted during the evaluation fieldwork.

The programme has supported wider Welsh Government goals through its alignment with elements of the Wellbeing of Future Generations Act, particularly the drive for a more equal, prosperous and resilient Wales.

Recommendation for EESW, the Welsh Government and other funding bodies

Equality of opportunity for learners should continue to be integral to similar programmes in future. The overarching goals of the Wellbeing of Future Generations Act can provide a structure and context for programme design.

6.5 Staffing and monitoring challenges

Managing the level of administrative tasks required to organise, deliver, and monitor and report progress against achievements has been a challenge for the EESW team throughout the STEM Cymru 2 project period. These challenges were further increased in 2022 as a combined result of the staff shortages encountered resulting from low staff retention in some posts at the time, and an increase in the number of schools and young people wishing to participate in activities. These challenges were largely addressed through the flexibility of EESW staff.

Not being able to record individuals taking part in more than one activity as multiple participants has also been a challenge over time. When the Project started in 2015 all those taking part in STEM Cymru 2 activities could be counted as individual participants. However, in subsequent years young people who had previously participated in one activity strand could not be counted as an additional participant if they participated in another activity. This was also identified as a challenge in the 2018 evaluation which also outlined that encouraging and recording progression of participation across activity strands 'could be viewed as key to increasing the uptake of STEM subjects in school as well as in further and higher education'.

Recommendation for Welsh Government and other funding bodies

Individuals participating in two or more activity strands that are distinctly different from each other, should, within any future delivery of STEM Cymru 2 or equivalent projects, be considered and recorded as a new participant within each activity.

6.6 What would have happened without STEM Cymru 2?

It was not possible as part of this evaluation fieldwork to include a suitable control group against which the outcomes of STEM Cymru 2 could be measured. As such, it is not possible to quantify how many STEM Cymru 2 participants, who have continued to study STEM, did so as a direct result of the activities they took part in. However, anecdotal evidence gathered during 2022 -23 and previously in 2018, indicate that teachers believe that the Project has had a positive effect on encouraging young people to study STEM. It is therefore reasonable to conclude that fewer young people would have considered this study option without the support of the Programme.

Survey responses from schools and stakeholders suggest that it is unlikely students would have gained the same experiences as they did without the support of the STEM Cymru 2 project. For example, it is likely that many schools would not have been able to access equipment to deliver sessions similar to those delivered through i2E; and most schools would not have been able to engage with local employers to provide students with real work experiences gained through the Sixth Form Project and the Girls in STEM site visits. It is also unlikely that large events such as the Sixth Form Project awards and presentation events and F1 in Schools Challenge would have been available to schools without the Project.

As noted above, the added value of the project to participating, schools, colleges, universities and employers has been the level of contact and engagement they have established with each other. The ability of STEM Cymru 2 to facilitate these connections

has been key to this, and therefore, in the absence of the Project it is likely that these contacts would not have been made. The consequence of this is that without the Project, young people would have had fewer opportunities to learn new skills, understand how STEM is used in industry, gain insights into STEM career opportunities or gain experience of studying STEM subjects at university.

Recommendation for EESW

It is unlikely that STEM Cymru 2 participants would be able to gain the same experiences and benefits as those gained through the Project elsewhere. The findings indicate an ongoing need for activities and support delivered to date. EESW should therefore aim to access funding sources that enable the delivery of the Project to continue in the future.

6.7 Future funding options

Overall, the STEM Cymru 2 project has been well delivered, generated positive outcomes for participants, demonstrated good value for money and led to sustainable partnerships between industry and higher education. However, the need to encourage more young people, particularly girls and those from disadvantaged areas of Wales, to study STEM subjects and to pursue a career in engineering or in other STEM related industries remains. The Project should therefore be supported to continue in the future in line with the goals of the Wellbeing of Future Generations Act, the new curriculum, Cymraeg 2050 and support for equality of opportunity for young people.

The availability of European funding through ESF which has funded most of the Project's activities will come to an end in June 2023. Options for future funding sources include the UK Shared Prosperity Fund (UKSPF) which is available until March 2025 and direct funding from the Welsh Government.

UKSPF offers opportunities to continue with the project within individual local authority areas. However, given that some aspects of the Project's success to date e.g. the regional awards and presentation events, require regional or national funding support, any local level UKSPF support may need to be supplemented with additional national funding support from Welsh Government. This funding could be linked to further alignment of the project to key Welsh Government goals as outlined above and support a coherent and consistent offer across Wales.

A further option would be to ask individual schools to pay to participate in the activities delivered by STEM Cymru 2. However, the findings the school survey conducted the EESW indicate that only a small number of schools would have the budget to do this. Many

schools would discontinue with their participation completely with most reducing their participation significantly.

Recommendation for Welsh Government and other funding bodies

Funding should be made available to support the continued delivery of the STEM Cymru 2 project. To ensure that the opportunities and benefits provided by the Project continue to be available to schools and employers across all areas in Wales, locally-focused funding sources should be accompanied by at least some national level funding provided by the Welsh Government.

Annex 1

The five main activity strands supported through the STEM Cymru 2 project.

1. **EESW Sixth Form Project**
   This strand encourages current AS students to continue with their study of STEM subjects, particularly triple science to Advanced level and to encourage progression into HE. Physics has a higher student dropout rate after AS-level than most subjects, and particularly amongst females.

   The EESW Sixth Form strand links teams of Year 12 students (or their equivalent in FE colleges) to develop STEM skills through industry linked practical projects. By working with professional engineers on real industry problems, they develop a better understanding of engineering as a career and realise the importance of pursuing maths and science to level 3 to become the engineers of the future.

   The strand begins with links being created between schools and companies at Welcome events in October, followed by company visits and school-based work with support from their engineer. In December, the students attend workshops in colleges and universities, where they can progress their solutions with support from college or university staff and their company engineer.
   The strand culminates with two prestigious Awards and Presentation Day events, one in north Wales and one in south Wales. At these events, the participants display their solutions to the given brief and teams of assessors discuss their work. There are also a range of visitors from industry, the Welsh Government and others who come to see the excellent work on display. Following the event, the teams receive feedback on their solution and their methodology.

   From experience with the STEMCymru 2 Project, we have evidence that students value this experience and develop a range of essential employability skills industry is telling us they need. We also have evidence that industry gains by having solutions they can implement and they also appreciate the contact with talented young people who are the workforce for the future. This strand also gives participants an insight into the variety of engineering disciplines and a better understanding of the level of attainment required to study a STEM related degree.

2. **Introduction to Engineering (i2E)**

   i2E is a series of workshops and activities that develops young peoples' interests and skills in Science, Technology, Engineering and Mathematics (STEM) through practical engagement with a range of practical activities. The importance of science and maths in careers in engineering is emphasised and support materials are used to highlight the career opportunities to apply knowledge from these subjects. It is targeted at pupils in Years 7 to 9.

   At Year 9 level, the aim is to encourage take-up of STEM subjects, and participation is particularly useful to add value before students commence GCSE and vocational BTEC engineering coursework. This strand is flexible in its activity content to adapt to changing technological opportunities and related activities. Some activities have

been developed for online or virtual delivery, which has expanded EESW's school reach.

The activity is supported by resources for practical activities in schools during the day session delivered or on loan over the course of a half term. A STEM Cymru 2 Activity Deliverer spends time in schools leading sessions and supporting pupils with activities and developing their understanding of the importance of science and maths in solving practical tasks. There are many opportunities in this strand for students to develop computer coding skills through a range of applications.

The i2E strand is dynamic and progressive so that, over the life of the Project, new technologies and teaching materials are incorporated to ensure that the best and most recent resources are used with the participants.

3. Girls into STEM

This strand is especially designed to target the female participation cross cutting theme, by encouraging female pupils to consider STEM pathways and to make Engineering and Technology easily accessible, interesting and relevant. It also enhances participants' understanding of STEM subjects. The strand offers half day or one day interventions which involve a group visit to an appropriate company, followed by an afternoon session where a role model will speak to the participants and they will engage with a hands-on STEM activity.

This strand aims to help females to understand the need to succeed in maths and science and, where appropriate, to study triple science. Although it has a short engagement time, it involves focussed activity with a view to increasing interest in STEM and particularly Engineering. It also encourages participants to engage in further strands of the STEMCymru 2 Operation, and it has been shown during the previous STEMCymru Project that this re-engagement can have a very positive lasting impact on participants and encourages recruitment into other strands. It also gives teachers the opportunity to experience STEMCymru 2 with minimal time required, increasing the STEMCymru 2 reach amongst educators.

4. F1 school challenge

F1 in Schools is a well-established national project that involves pupils of all ages and abilities in designing model F1 cars. The activity involves the use of industry standard computer aided design (CAD) software. The design drawings are converted into actual models on CNC machines thus giving pupils a thorough understanding of modern digital manufacturing.

The participants are highly motivated by the context, and they are able to develop a range of employability skills in addition to enhancing literacy and numeracy. The activity fits well with Welsh Government introduction of Digital Literacy as a core component of the curriculum in Wales and is also cross-curricular which will fit into the new Curriculum for Wales 2022. The exciting context of this activity lends itself to developing a better understanding of maths and science through application, and participants can gain completion of training from the various roles they undertake during the project and assessment. More recently, the activity has been approved by

the WJEC for participants to satisfy the criteria for the Enterprise and Employability Challenge of the KS4 Welsh Baccalaureate from September 2021.

Annex 2

Figure A2 15: Output achievement against indicator targets by quarter (2015 and 2023)