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# External Evaluation of the ASTUTE 2020 Operation

## Inception Evaluation

To: Swansea University

Version 2.1

January 2017

UNDEB EWROPEAIDD EUROPEAN UNION
Llywodraeth Cymru Welsh Government
Cronfa Datblygu Rhanbarthol Ewrop
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# Executive Summary

This report documents the findings of the inception evaluation[1] of the five-year ASTUTE 2020 Operation[2]. The Operation was awarded £14.7m funding from the European Regional Development Fund (ERDF) and its partners.[3] It will provide support to enterprises to facilitate the adoption of advanced, sustainable manufacturing technologies in West Wales and the Valleys (WW&V).

The Operation sits within Priority 1, Specific Objective 1.2 of the ERDF Operational Programme. The aim of which is to increase the number of small and medium sized enterprises innovating to bring new products and processes to the market.[4] The Operation will focus on three Adaptive Smart Specialisation areas.[5] The areas were chosen to target support where there are the best economic opportunities for manufacturing within WW&V.

The inception evaluation set out to identify a suite of indicators that will enable an assessment of the impact of the Operation at the mid-term, and final evaluation stages. And then, to establish a baseline position against which subsequent progress can be compared. The approach taken was largely desk-based with a small amount of primary research with key stakeholders. A logic model and monitoring and evaluation framework were developed through consultation with the Operation team following a review of existing operation documentation. Then, baseline data was collected from National Datasets, to establish a 'control group'.

A mid-term evaluation is expected to take place during 2017/8. This stage of evaluation will utilise the framework to understand the effectiveness of activities carried out (a formative assessment). Suggestions to improve delivery for the rest of the Operation will

1 *One of three evaluation stages during the course of the Operation. A mid-term and final evaluation will follow.*
2 *ASTUTE 2020 builds on the success of its predecessor ASTUTE.*
3 *£10m funding from the ERDF and £4.7m from partner universities, namely: Swansea University, Cardiff University, Aberystwyth University, and University of Wales Trinity Saint David.*
4 [https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/342297/ERDF_Operational_Programme.pdf]
5 *Computational Engineering Modelling, Advanced Materials Technology, and Manufacturing Systems Engineering.*

be identified. A final (summative) evaluation will be carried out towards the end of the Operation's delivery.

### The Monitoring and Evaluation Framework

The evaluators used a Theory of Change(ToC)[6] approach as the theoretical framework to develop the evaluation logic model. It shows the key dependencies in the Operation process and aims to map out 'what happened' and 'why'. Then, the evaluators developed a monitoring and evaluation framework based on HM Treasury's Green Book guidance.[7] That involved the identification of a process chain of inputs, activities, outputs, interim outcomes and emerging (desired) impacts. Subsequently, the evaluation team and Operation team identified a set of indicators to link observable outputs, outcomes and eventually impacts to direct and proxy variables. These variables indicate 'how' change will be measured. Further, the framework takes each element of the logic model and identifies evaluation questions that will need to be answered to understand what has changed as a result of intervention.

A summary of the monitoring and evaluation framework is included below:

**Policy Drivers & Needs:** the main evaluation question is 'how coherent is the fit of the objectives with current policy? Which will be answered by the evaluation team following a desk review of relevant Operation documentation and policies, as well as interviews with key stakeholders.

**Objectives:** the framework details seven objectives taken from the Operation business plan. The evaluation team will assess the extent to which ASTUTE 2020 is expected to contribute to each objective.

**Inputs:** the framework lists the expected Operation inputs. They are: the amount of funding the Operation is expected to require, the amount of time, effort and knowledge expected of delivery staff as well as other inputs such as communication and marketing,

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[6] *C. Weiss (1995). Nothing as Practical as Good Theory: Exploring Theory-Based Evaluation for Comprehensive Community Initiatives for Children and Families (Connell, J, Kubisch, A, Schorr, L, and Weiss, C. (Eds.) 'New Approaches to Evaluating Community Initiatives' ed.). Washington, DC: Aspen Institute.*

[7] *[https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf]*

demand from companies and referrals from other schemes. The external evaluation team will assess whether the inputs are sufficient, and are being used effectively for delivery, at the mid-term evaluation stage.

**Activities:** the activities expected to be carried out as part of the Operation are noted in the monitoring and evaluation framework. They are the logical link between inputs and outputs.

**Outputs:** the Operation's outputs can be categorised as either ERDF indicators (those required to be collected as agreed with the funding body) and additional, recorded indicators. This latter group are intended to capture impacts beyond that measured by the ERDF and so ensure the full impact of the Operation is understood. The report notes that data to inform the ERDF indicators will be collected by the Operation team. The external evaluators are responsible for the data collection to inform all other indicators.

**Outcomes:** The outcomes of the ASTUTE 2020 are the short-term and medium-term effects of the Operation outputs. There are six distinct outcomes, for which there are eleven individual indicators. Two of the outcome indicators are monitored ERDF indicators that have been approved by WEFO. They each have an associated target level. All other outcome indicators are additional, recorded indicators which are felt express the full impact of the intervention.

**Impacts:** The activities of the ASTUTE 2020 Operation are expected to generate substantial long-term impacts for the companies supported and the wider economy of WW&V. Although many of these benefits will be realised after the completion of the Operation, several indicators have been identified which are expected to be influenced by ASTUTE 2020. These will be assessed at the final (summative) evaluation stage. The report notes that consideration of the counterfactual will be an import aspect of the final evaluation, to ensure that only benefits which would not otherwise have occurred are credited to the Operation.

The ASTUTE 2020 Operation sets out a commitment to carry out activities in accordance with current best practice guidance on the ERDF's cross-cutting themes (CCTs).

## Baseline Position

The baseline position provides an evidenced position against which the subsequent evaluations can make comparison. The following provides a summary of each evaluation element.

**Policy Drivers & Needs:** an external review evidenced the need for intervention, which is clearly set out in the Operation business plan. It identified three distinct RD&I needs within industry in WW&V[8]. To reduce costly 'trial and error' approaches, to introduce new materials and to improve the utilisation of resources. The Operation takes a strong stance on its support of Smart Adaptive Specialisations. It notes the Operation's alignment with policy areas, its relevance to industry and the expected high level of impact on economic performance (among others). This approach shows that the choice of areas, and thus the focus of ASTUTE 2020 has intentionally been constructed to address identified need.

**Inputs:** Generally, stakeholders felt that the level of funding for ASTUTE 2020 – although less than ASTUTE, was sufficient. A small number of stakeholders highlighted the importance of having the right partners or being able to find the right academics and Project Officers as an essential factor in ensuring that ASTUTE 2020 can comprehensively meet industry demand.

**Activities:** There is no baseline position as such, to inform the assessment of the effectiveness of ASTUTE 2020 activities. Rather, stakeholder were interviewed to understand their views on the planned activities. Headline findings were that the new approach[9] to the project approval process was more rigorous and transparent than the previous approach. The Operation team are aware of the need to test for and avoid private sector displacement during the approval process. Stakeholders felt that the inclusion of Industry Wales and EEF – The Manufacturers' Organisation added value to the approval process, as well as referral to other schemes. The Operation will carry out a horizon scanning exercise to ensure that it delivers support in Smart Adaptive Specialisation areas.

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8 *Also acknowledging that this applies to the rest of Wales also and that impacts would spread out of the region.*

9 *New compared to the previous ASTUTE Project.*

**Outputs:** Theoretically, the baseline for all the outputs is currently zero. Although the indicator targets have been reduced in absolute terms, compared with the previous ASTUTE Project, (although increased when comparing pro-rata outputs), the choice of targets was based on sound rationale as expressed in the business plan. Further, there have been changes to WEFO's[10] definition of the jobs created indicator, which means that any jobs created must take into consideration the change (potential loss) in jobs elsewhere in the supported enterprise. Several stakeholders commented that the level of engagement between companies and the partner universities would have a big influence on the success of the ASTUTE 2020 Operation.

**Outcomes:** it is not possible to obtain a comparison value from existing datasets for the current level of private sector investment in R&D nor the amount of private investment matching public support in innovation or R&D projects

The external evaluators will use 2014 gross domestic expenditure on research and development. (GERD) data as an approximation of the general rate of change over time.

The external evaluators will collect data from supported companies regarding the indicator: average share of total turnover from product / process innovation, and innovation: new to market, new to business and significantly improved. This will be compared with the change in the equivalent indicator obtained from the UKIS.[11]

The external evaluators accessed BRES[12] data to derive the change in employment numbers between 2011 and 2015 (the most recent dataset), for the SIC codes[13] of enterprises supported during ASTUTE[14] - which is being used as an approximation of the companies that could be expected to engage with ASTUTE 2020. Over the three-year period 2013 to 2015 the rate of change in the employment level was 7 per cent. This

[10] *The Welsh European Funding Office.*
[11] *The United Kingdom Innovation Survey. Also referred to as the Community Innovation Survey.*
[12] *The Business Register and Employment Survey.*
[13] *At the 5-digit level. See Appendix 3 for a definition of the SIC codes.*
[14] *The top 25 SIC codes (at the 5-digit level), which accounted for 52% of all companies engaged during ASTUTE was used to derive an approximation of the industry with which ASTUTE 2020 can be expected to operate in. Through a separate exercise, the SIC codes which are expected to relate to the SMART areas was established but this yielded more than 100 individual 5-digit SIC codes which was too large to derive data from BRES (the sample exceeded the maximum number of cells that can be processed using NOMIS). Thus, the top 25 SICs were used as the best alternative estimate of what the list of SIC codes for companies that engage with ASTUTE 2020 might look like.*

change could be considered the 'general' rate of change in employment levels across the ASTUTE 2020 target area. The observed change in the supported companies will be compared with this at the mid-term and final stages.

The external evaluators will collect baseline data from the supported companies during the mid-term evaluation, for all other outcome indicators.

**Impacts:** the external evaluators will establish the baseline position for all the impact indicators from the companies that are engaged through the external evaluation.

The evaluators will compare any increases in sales revenue in the treatment group with the general change in turnover among similar companies. Between 2015 and 2016 the mid-point estimate[15] of turnover for the proxy industry in Wales increased by 4%.

The external evaluators will collect baseline data from the supported companies during the mid-term evaluation, for all other impact indicators.

### Conclusion

The ASTUTE 2020 Operation has been designed through a very robust and comprehensive process which has clearly set out to identify industrial RD&I needs - which it then intends on meeting. As a result, the efforts of the Operation are concentrated on the areas of support which display potential for high economic impact. Thus, the ASTUTE 2020 Operation appears to have a strong coherence to the identified needs of the manufacturing sector in WW&V. Further, the ASTUTE 2020 Operation has a strong fit with overarching policy and strategic objectives.

The business plan sets out a comprehensive delivery plan, which has been well designed to ensure that the aims and objectives can be met. If carried out to plan, the external evaluators are confident that the ASTUTE 2020 Operation will lead to the expected and identified outcomes and impacts noted in this report.

Stakeholder noted that the main area which requires close attention is the level of engagement that ASTUTE 2020 can achieve with the target industrial sectors. Furthermore, the ability of the Operation team to find the right Project Officers that are

[15] *ONS provides turnover bands for 2-digit SIC codes by region. A mid-point estimate value was obtained based on the number of enterprises recorded in each category band.*

needed to meet the needs of industry are essential for it to succeed. The length of contract being offered by the partner universities may negatively impact on the Operation's ability to recruit the right staff.

The Operation team should ensure that mitigating the risk of private sector displacement is given a high priority during the approval process to alleviate any concerns which may arise from industry.

The mid-term evaluation will follow approximately 9 months after the publication of the inception evaluation report. At that time, the external evaluators will gather the data collected as set out in this report to carry out an independent review of progress.

### Recommendations

Based on the evidence presented in this report, the following recommendations are put forward for consideration:

- Request a boost to the UKIS Wales sample so that further cross-tabulations are possible. For example, a cross-tabulation between question 5 (amount of expenditure on innovation related investments) and question 21 (total turnover) would enable an estimation of the amount of private sector investment as a proportion of total turnover in WW&V, which could be used as a control group comparison for indicator OC.1a.
- To continually monitor the effectiveness of the project approval process in avoiding private sector displacement.
- To monitor the effectiveness of referral mechanisms between Welsh Government's support team and ASTUTE 2020.

# 1 Introduction

This report documents the findings of the inception evaluation[16] carried out as part of the external evaluation of the ASTUTE 2020 Operation. Swansea University commissioned Miller Research to undertake the inception and mid-term (formative) evaluation of the Operation. A final evaluation (summative) will be commissioned separately, by the ASTUTE 2020 team in due course.

The ASTUTE 2020 Operation aims to build on the success of its predecessor (ASTUTE) and will provide support to enterprises to facilitate the adoption of advanced manufacturing and related technologies in West Wales and the Valleys (WW&V). The Operation which is part funded via the European Regional Development Fund (ERDF) will be delivered through a partnership of universities (Swansea University, Cardiff University, Aberystwyth University, and University of Wales Trinity Saint David)[17].

The primary purpose of the inception evaluation is to identify a suite of indicators that effectively enable assessment of the impact of the ASTUTE 2020 Operation – and then to gather baseline data against which future progress can be compared. The inception (and subsequent mid-term) evaluation forms a critical part of ASTUTE 2020 reporting, linking activities into sectoral development and changes at individual company level. As such, it will serve to provide the evidence base to inform the delivery of the Operation and lay the foundations for assessing the overall contribution of ASTUTE 2020 to developing the advanced manufacturing sector in Wales.

A key requirement of the external evaluation is to understand the full extent of the impact that the ASTUTE 2020 Operation has had. The inception evaluation builds on the original ASTUTE 2020's and sets out a comprehensive monitoring and evaluation plan providing an external view and evaluation process, which, if adhered to, should ensure that evidence can be collected to evidence the impact of the Operation at the formative and summative evaluation stages.

[16] *One of three evaluation stages during the course of the Operation.*
[17] *See Chapter 2 for further details about the Operation's funding.*

The report is structured into five chapters. Chapter one provides a short introduction. Chapter two provides an overview of the ASTUTE 2020 Operation, a summary of the previous ASTUTE Project, and sets out the evaluation approach. Chapter three describes the logical process underpinning the Operation and sets out the detailed monitoring and evaluation framework. Chapter four provides a baseline by drawing on existing information for the impact indicators and Chapter five provides concluding remarks, offering recommended actions that could be considered to ensure the Operation achieves maximum impact.

# 2 About ASTUTE 2020

ASTUTE 2020 is a five-year, £14.7m Operation which has specified the following aim:

> *To enable transformational and sustainable growth in the manufacturing industry of WW&V by facilitating the adoption of advanced technologies, increasing competitiveness and future proofing. This will be achieved via an Adaptive Smart Specialisation approach, whereby a partnership of Welsh Universities will harness the world-leading and internationally excellent manufacturing expertise within them to improve the economic prosperity of the Region by means of demand-led collaborative research, development and innovation, and knowledge exchange with industry.*[18]

The Operation is part funded with £10m from the European Regional Development Fund (ERDF) via the Welsh European Funding Office (WEFO) and £4.7m funding being provided by the partner universities mainly in the form of the monetary value of the time of academics employed by the university.[19] It seeks to address Priority 1, Specific Objective 1.2 of the ERDF Operational Programme which is to increase the number of small and medium sized enterprises innovating to bring new products and processes to the market.[20] The Operation will be delivered in the West Wales and the Valleys (WW&V) region.

ASTUTE 2020 will build on the success of its predecessor – the ASTUTE project[21], by focussing on the areas which had the highest impact - as well as considering areas which have been identified as important, based on consultation with industry stakeholders. As such, it will draw on the expertise of the partner universities[22] to provide support to enterprises operating in the following Adaptive Smart Specialisation areas:

- Computational Engineering Modelling
- Advanced Materials Technology

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[18] *ASTUTE 2020 Business Plan v36 Page 12, Section 1.3.*
[19] *Equipment purchases and the university overheads.*
[20] *[https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/342297/ERDF_Operational_Programme.pdf]*
[21] *See Section 2.1.1 for more details.*
[22] *And, the expertise of other academic experts from other universities if necessary.*

- Manufacturing Systems Engineering

As specified in the Operation business plan, the rationale for focusing efforts on these areas is to ensure that the ERDF investment is targeted at areas that offer the best economic opportunities for manufacturing within WW&V.

The delivery of the Operation will be through collaborative applied research between the university and companies. The research must be novel and must comply with State Aid regulations. The key measurable output from the collaboration is expected to be the economic impact gains achieved because of the launch of new and improved products and processes that came about because of the ASTUTE 2020 funded research and development activity.

The ASUTE 2020 Operation team are required to gather evidence to report to WEFO on the achievement of its targets. The external evaluators are responsible for collecting information that goes beyond the ERDF indicators to illustrate the impact that the Operation has had. This process is discussed in greater detail in Chapter three of this report.

### 2.1.1 The Previous ASTUTE Project

ASTUTE 2020 aims to build on the success of its predecessor, the ASTUTE (Advanced SusTainable manUfacturing TEchnologies) project which ran from 2010-2015. ASTUTE, was a £27m project, which also received ERDF funding (£14m), and which provided support for more than 300 companies in WW&V. ASTUTE was a partnership of all eight higher education institutions (HEIs) in Wales and focussed on advanced technologies related to manufacturing. The ASTUTE project exceeded its target for new or improved products, processes or services launched by more than 200%[23], created more gross jobs (174 compared with a target of 130) and more enterprises (10 compared with 5) than targeted – and attracted more than double the amount of investment (£9.3m compared with £4m) it set out to attract. In short, the ASTUTE project was highly successful having exceeded expectations. The success of ASTUTE was credited to its strong selection process and quicker, more efficient problem solving process than was available

[23] *The original target of 120 was surpassed as the achieved total was 383.*

elsewhere. The model of providing responsive, demand-led, easy-to-use collaborative support to address complex problems through applied research was highly praised by beneficiary companies. As such, ASTUTE has received high praise as an exemplar model of industry / academia collaboration. The ASTUTE team gained invaluable knowledge and practical experience from delivering the project – which has been applied to ASTUTE 2020.

## 2.2 Evaluation Approach

The approach to the inception evaluation was largely desk-based, with a small amount of primary research with key stakeholders. The team of external evaluators reviewed all existing Operation documentation, so that an independent opinion on the rationale and need for ASTUTE 2020 could be garnered. Subsequently, and as specified in the Operation business plan, the external evaluators worked with the ASTUTE 2020 Operation team and WEFO to review and to identify appropriate indicators that would sufficiently enable the impact of the Operation to be measured. Thus, the Operation logic model and monitoring and evaluation framework were modified as necessary. The outcome of this exercise is set out in Chapter three of this report.

Once the logic model and monitoring and evaluation plan were finalised, baseline data was gathered for relevant indicators, so that future comparisons are possible. The approach to this task was to utilise existing datasets – primarily to reduce the burden of data collection requirements on the beneficiaries of the Operation, and to make use of existing data. National Datasets available via the Office of National Statistics were used where applicable and the UK Innovation Survey data was accessed[24] so that a 'control group' could be identified. The rationale for this approach was to understand the general change in measurable indicators during the time period, against which observed changes in the same indicator among the treatment group can be compared. So, for example, if the rate of change in a chosen indicator among the sample of the UK Innovation Survey was lower than that of the treatment group, then we might infer that the observed change, over and above that of the control group is the result of the intervention that the treatment group received.

Finally, a series of twelve stakeholder interviews[25] were carried out to inform the inception evaluation. The purpose of the interviews was to discuss the rationale and need for ASTUTE 2020 from the views of the stakeholders, to discuss their views on the planned

[24] *For which authorised access was obtained.*
[25] *See Appendix 1 for a list of stakeholder organisations from which twelve representatives were interviewed.*

activities for the Operation and the extent to which this was expected to achieve the targeted outcomes.

This process will be repeated at the mid-term evaluation stage, which is expected to take place during 2018[26]. The mid-term evaluation stage will focus on understanding the effectiveness of the activities being carried out as part of the Operation (formative assessment) with a view to ensuring that subsequent and remaining actions are geared towards ensuring maximum impact of the intervention.

[26] *A draft report is expected to be completed during April 2018.*

# 3 Logic Model & Evaluation Framework

## 3.1 Theory

A Theory of Change (ToC)[27] approach was applied as the theoretical framework within which to develop the necessary evaluation instruments that would enable an effective assessment of the impact of the ASTUTE 2020 Operation. This approach is commonly used in programme evaluations because it explains the process of change by outlining causal linkages in an initiative, i.e. its shorter-term, intermediate, and longer-term outcomes. The identified changes are mapped – in an 'outcomes pathway' – to show each outcome in logical relationship to all others, as well as in a chronological sequence. Each link in the chain gives rise to a series of questions relating to the intervention, and these support the design of a comprehensive evaluation framework linked to effective survey instruments.

Adhering to the ToC approach, a logic model was developed (Figure 1) by taking the findings of the desk-based review of documentation[28] to firstly frame the market failure that creates the need for publicly-funded interventions via the ASTUTE 2020 Operation, and then by creating and populating a process chain of inputs, activities, outputs, interim outcomes and emerging (desired) impacts as recommended in HM Treasury's Green Book guidance[29]. To capture the full impact, the model takes account of long-term impacts and induced impacts arising in addition to the direct impacts of the intervention. It shows the key dependencies in the process and ultimately aims to map out 'what happened' and 'why'.

Having established the logical processes, an evaluation framework was constructed; by building on the set of indicators and other measures that were identified by the ASTUTE 2020 Operation team during the business planning process - to link observable outputs,

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[27] *C. Weiss (1995). Nothing as Practical as Good Theory: Exploring Theory-Based Evaluation for Comprehensive Community Initiatives for Children and Families (Connell, J, Kubisch, A, Schorr, L, and Weiss, C. (Eds.) 'New Approaches to Evaluating Community Initiatives' ed.). Washington, DC: Aspen Institute.*

[28] *Particularly the ASTUTE 2020 Business Plan and the Draft Monitoring and Evaluation Plan.*

[29] *[https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf]*

outcomes and eventually impacts to direct and proxy variables. These variables indicate ‘how’ change will be measured. The resultant monitoring and evaluation framework – which was developed by the external evaluators in consultation with WEFO and the Operation team will be used during the evaluation to ensure that insightful data is secured, to enable assessment of the Operation’s impact.

## 3.2 Logical Process

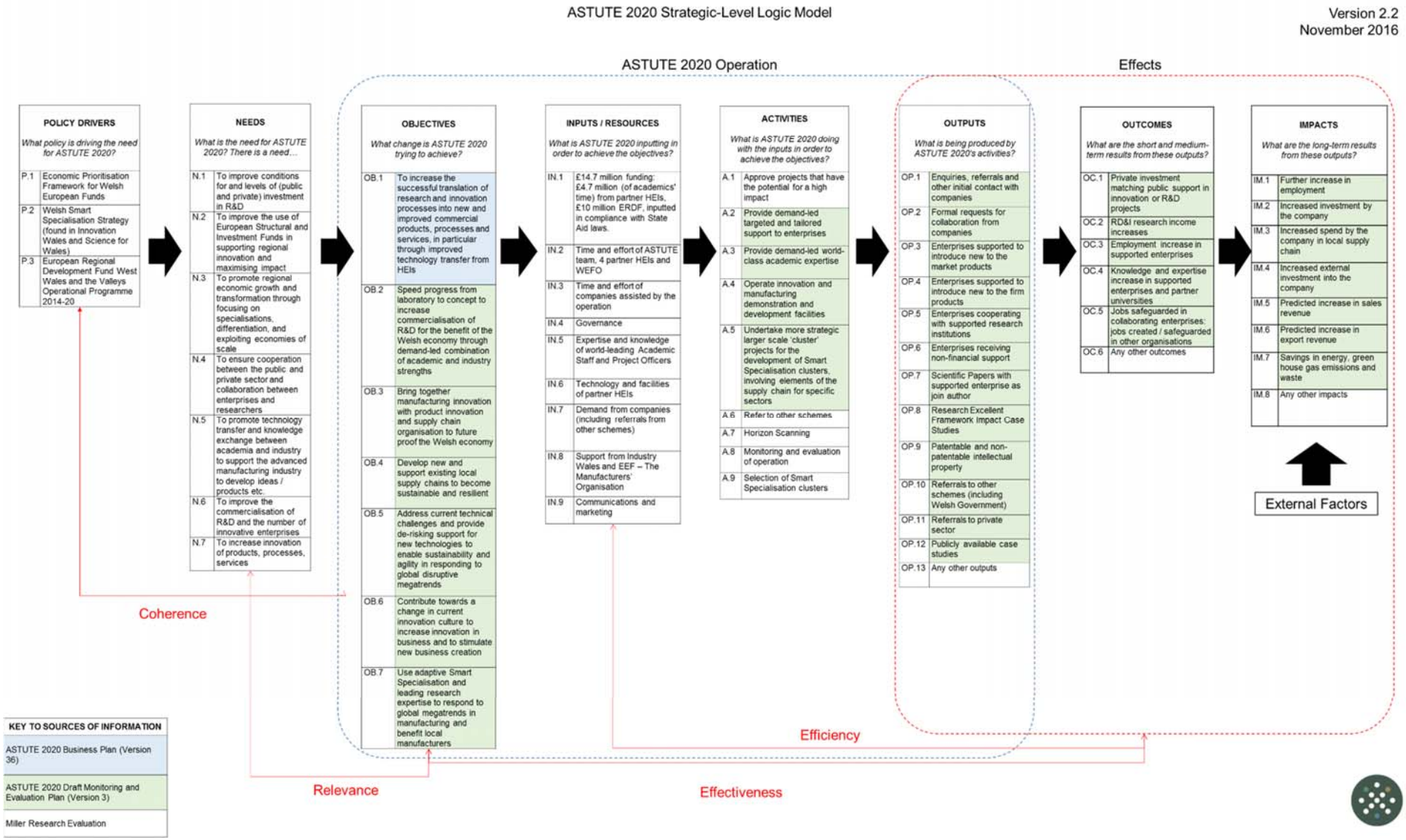
The logic model (Figure 1) depicts a flow diagram from the identification of policy drivers and the need for ASTUTE 2020, through to the Operation objectives, inputs, activities, outputs, outcomes (shorter-term), and finally impacts (longer-term). The diagram shows the ASTUTE 2020 intervention by framing it with a dotted-blue line. These are the activities and expected outputs that the Operation team is directly responsible for. Thus, they directly relate to the activity of the Operation. The effects of this intervention are grouped with a dotted-red line and are the targeted observable changes that are expected to follow as a result of the Operation intervention. That is, they are the expected impacts of the Operation which follow on from the activities carried out. If these changes are monitored and measured, then the impact of the intervention can be understood. That is the purpose of the external evaluation.

To ensure a holistic evaluation is carried out, the EU Better Regulations framework has been included in the logic model to show where key relationships between the elements of the model will be evaluated. For example, the ‘coherence’ of the Operation in meeting the driving policy factors will be considered. Similarly, the extent to which the Operation objectives are ‘relevant’ to the identified needs will be assessed. Then, the effectiveness of the Operation in meeting expected effects and the ‘efficiency’ of converting inputs into observed effects will also be considered.

The ASTUTE 2020 Operation does not exist in a vacuum, therefore there will be many external factors that will also contribute towards any observed changes in indicators during its delivery and beyond. The extent to which ASTUTE 2020 contributes towards observable change over and above that which would have taken place anyway is termed ‘additionality’ in the HM Treasury’s Green Book. It is essentially the net impact of the intervention after considering what would have happened in its absence (the deadweight).

In the logic model, this effect is acknowledged by the ‘external factors’ reference, which indicates that there will be other factors contributing towards observed changes. It will be the focus of the summative evaluation to determine the extent to which the observed impacts are additional. That being said, it is important that the process is put in place at the inception stage that will allow for such effects to be measured.

## Figure 1 ASTUTE 2020: Operation Logic Model for External Evaluation (Version 2.2)




*Source: Miller Research (UK) Ltd.*

## 3.3 Monitoring and Evaluation Framework

The agreed monitoring and evaluation framework takes forward the indicators arising from the logic model by identifying observable direct (or proxy) variables which can be measured during the Operation evaluation. There are a core set of monitored indicators that are approved with WEFO as ERDF outputs and some additional reported indicators as defined in the business plan that will be included in claims to WEFO. The former are the set of indicators that will ultimately determine the success of the Operation, according to its core funding body, however, the full impact of intervention is expected to be far greater than would be captured by these indicators alone. Therefore, the business plan and monitoring and evaluation plan include several additional indicators that are intended to capture the full impact of the intervention. It is these additional indicators that will be the focus of the external evaluation.

The monitoring and evaluation framework takes each element of the logic model and identifies evaluation questions that will need to be answered to understand what has changed as a result of intervention. It then identifies indicators which will enable an assessment of the extent to which the evaluation question(s) has been met. The potential source of the data is identified and then the person(s) responsible for data collection is specified. Where there are target levels for an indicator, these are indicated in the framework. In the Operation business plan, the set of indicators were grouped into four distinct categories termed; activity evidence, innovation evidence, growth evidence, and long-term benefits. For continuity, this has been continued into the extended monitoring and evaluation plan. The full monitoring and evaluation framework can be found in Appendix 2. Each element of the monitoring and evaluation framework is explained below.

### 3.3.1 Policy Drivers & Need

The logic model identifies the key policies driving the rationale for ASTUTE 2020 (P.1 to P.3 in Table 1). The evaluation aims to assess how coherently the objectives meet policy drivers, thus, the key evaluation question is:

*How coherent is the fit of the objectives of ASTUTE 2020 with current policy?*

Similarly, Table 1 details the identified needs that ASTUTE 2020 aims to address (N.1 to N.7). The extent to which these needs justify ASTUTE 2020 intervention will need to be assessed as part of the evaluation – hence the evaluation question:

*Do these needs justify ASTUTE 2020 intervention?*

Both evaluation questions require qualitative assessment to formulate a robust answer. Table 1 indicates that the collection of the necessary qualitative data will be carried out via desk research and interviews with key stakeholders – which is the responsibility of the external evaluation team. It is expected that the answer to these questions will be covered during the inception evaluation stage – based on the assumption that neither the rationale nor need for intervention will change during the Operation's delivery. Thus, the baseline findings in Chapter 4 aim to provide the independent viewpoint of the external evaluators regarding the extent to which the evaluation questions have been met by the proposed activity which will be delivered as part of the ASTUTE 2020 Operation.

### 3.3.2 Objectives

Table 2 sets out the monitoring and evaluation framework for ASTUTE 2020 objectives. It details seven objectives which have been taken from the Operation business plan and monitoring and evaluation plan. The objectives drive the activity that is carried out during the Operation, which in turn lead to the identified outputs, and then which, in turn lead to observable outcomes and impacts. Therefore, the objectives are important in understanding whether the Operation, as designed, will achieve its overall goal. The external evaluation is primarily concerned with assessing the extent to which the stated objectives are expected to (or are / have) be (being / been) met. At the inception stage, therefore, the key evaluation question, which applies to each of the individual objectives is:

*To what extent is ASTUTE 2020 expected to…*

Findings from the desk research and interviews with key stakeholders will be used to provide a qualitative response to this series of questions. It will also be possible to re-assess the extent to which the objectives are being met or have been met at the mid-term (formative) and final (summative) evaluation stages respectively. The external evaluators

are responsible for collating the necessary information to enable this aspect of the evaluation to be completed.

At the inception evaluation stage, commentary on the extent to which it is believed that the objectives will be met is included in Chapter 4.

## Table 1 M&E Framework: Policy Drivers & Needs

| | Policy Drivers & Needs<br><br>What are the key policies driving the rationale for ASTUTE 2020? The key policy drivers are… | Evaluation Question | Data Type | Data Source |
|---|---|---|---|---|
| P.1 | Economic Prioritisation Framework for Welsh European Funds | How coherent is the fit of the objectives of ASTUTE 2020 with current policy? | Qualitative | Desk Research |
| P.2 | Welsh Smart Specialisation Strategy (found in Innovation Wales and Science for Wales) | | | |
| P.3 | European Regional Development Fund West Wales and the Valleys Operational Programme 2014-20 | | | |
| | What is the need for ASTUTE 2020? There is a need… | | | |
| N.1 | To improve conditions for and levels of (public and private) investment in R&D | Do these needs justify ASTUTE 2020 intervention? | Qualitative | Interviews with strategic stakeholders & Desk research |
| N.2 | To improve the use of European Structural and Investment Funds in supporting regional innovation and maximising impact | | | |
| N.3 | To promote regional economic growth and transformation through focusing on specialisations, differentiation, and exploiting economies of scale | | | |
| N.4 | To ensure coOperation between the public and private sector and collaboration between enterprises and researchers | | | |
| N.5 | To promote technology transfer and knowledge exchange between academia and industry to support the advanced manufacturing industry to develop ideas / products etc. | | | |
| N.6 | To improve the commercialisation of R&D and the number of innovative enterprises | | | |
| N.7 | To increase innovation of products, processes, services | | | |
| | **Data Collection Responsibility:** | External Evaluation Team | | |
| | **Evaluation Stage:** | Inception | | |
| | **Indicator:** | N/A | | |
| | **Targets:** | N/A | | |

*Source: Miller Research (UK) Ltd.*

## Table 2 M&E Framework: Objectives

| | Objectives<br>What change is ASTUTE 2020 trying to achieve? | Evaluation Question | Data Type | Data Source |
|---|---|---|---|---|
| OB.1 | To increase the successful translation of research and innovation processes into new and improved commercial products, processes, and services, through improved technology transfer from HEIs | To what extent is (will / has) ASTUTE 2020 expected (lead) to… | Qualitative | Interviews with strategic stakeholders & Desk research |
| OB.2 | Speed progress from laboratory to concept to increase commercialisation of R&D for the benefit of the Welsh economy through demand-led combination of academic and industry strengths | | | |
| OB.3 | Bring together manufacturing innovation with product/process innovation and supply chain organisation to future proof the Welsh economy | | | |
| OB.4 | Develop new and support existing local supply chains to become sustainable and resilient | | | |
| OB.5 | Address current technical challenges and provide de-risking support for new technologies to enable sustainability and agility in responding to global disruptive megatrends | | | |
| OB.6 | Contribute towards a change in current innovation culture to increase innovation in business and to stimulate new business creation | | | |
| OB.7 | Use adaptive Smart Specialisation and leading research expertise to respond to global megatrends in manufacturing and benefit local manufacturers | | | |
| | **Data Collection Responsibility:** | External Evaluation Team | | |
| | **Evaluation Stage:** | Inception | | |
| | **Indicator:** | N/A | | |
| | **Targets:** | N/A | | |

*Source: Miller Research (UK) Ltd.*

### 3.3.3 Inputs

The ASTUTE 2020 Operation inputs are detailed in Table 3. It shows the amount of funding the Operation is expected to require, the amount of time, effort and knowledge expected of delivery staff as well as other inputs such as communication and marketing, demand from companies and referrals from other schemes. If all inputs are effectively utilised, then it is expected that the Operation will meet its objectives.

At the inception evaluation stage, the purpose of the external evaluation is to draw on the knowledge and expertise of the key stakeholders to infer whether the inputs are sufficient for the objectives to be met. This will be carried out by the external evaluation team. During the mid-term (formative) evaluation, the focus will be on understanding how the inputs are being used and whether more (or less) is required for the Operation to meet its goals. Then, the final (summative) evaluation will assess whether the inputs were used in the most effective manner. The sentiment of the key stakeholders regarding the amount of funding is offered in Chapter 4 of this evaluation report.

### 3.3.4 Activities

The activities expected to be carried out as part of the ASTUTE 2020 Operation are noted in Table 4. These activities are the linkage between the Operation inputs and its outputs. The effectiveness of delivering these activities determines the success of the Operation in meeting target outputs. For the purpose of the evaluation, the effectiveness of the activities can only be assessed based on qualitative information, which will be gathered by the external evaluation team through the review of Operation documentation (to understand the planned activity) and key stakeholder interviews (to understand the expectation of whether the activities will lead to the desired outcomes. Commentary about the baseline understanding of the activities is included in Chapter 4.

### 3.3.5 Outputs

The Operation's outputs are listed in Table 5. It distinguishes between the monitored ERDF indicators[30] approved by WEFO and the additional, recorded indicators[31] (i.e.

[30] *Denoted in the monitoring column as ERDF.*
[31] *Denoted in the monitoring column as R. Taken from the ASTUTE 2020 business plan.*

those that are intended to capture impacts beyond that measured by the ERDF indicators) which collectively illustrate the full range of expected Operation outputs. The purpose of the on-going Operation monitoring will be to collect data for the indicators relating to ERDF so that progress against output targets can be measured. The external evaluation will be concerned with collecting evidence to inform the additional recorded output indicators.

The Operation team are required to report on progress for these indicators to WEFO on a quarterly basis. Target levels for the monitored ERDF indicators were chosen and agreed with WEFO as part of the business planning process.[32] The additional, recorded indicators have been identified to ensure that the full impact of the Operation can be measured. The achievement of outputs will be monitored via the Operation documentation.

In the Operation's monitoring and evaluation plan, explanations were provided for each of the indicators specified. This information is summarised in Table 6. The process for collecting data was also noted in the monitoring and evaluation plan where necessary.

[32] *A detailed explanation of how the target levels were determined can be found in the Operation business plan.*

Table 3 M&E Framework: Inputs

| | Inputs<br>What is ASTUTE 2020 inputting to achieve the objectives? | Evaluation Question | Data Type | Data Source |
|---|---|---|---|---|
| I.1 | £14.7 million funding | Does ASTUTE 2020 have the necessary inputs/resources to achieve its objectives? | Qualitative | Interviews with strategic stakeholders |
| | £4.7 million (monetary value of academics' and technical specialists time, equipment, and overheads) from partner HEIs inputted in compliance with State Aid laws | | | |
| | £10 million ERDF, inputted in compliance with State Aid laws | | | |
| I.2 | Time and effort of ASTUTE 2020 team in 4 partner HEIs and WEFO | | | |
| I.3 | Time and effort of companies collaborating with the Operation | | | |
| I.4 | Governance | | | |
| I.5 | Expertise and knowledge of world-leading Academic Staff and Project Officers | | | |
| I.6 | Technology and facilities of partner HEIs | | | |
| I.7 | Demand from companies | | | |
| | Referrals from other schemes | | | |
| I.8 | Support from Industry Wales and EEF – The Manufacturers' Organisation | | | |
| I.9 | Communications and marketing | | | |
| | **Data Collection Responsibility:** | External Evaluation Team | | |
| | **Evaluation Stage:** | Inception | | |
| | **Indicator:** | N/A | | |
| | **Targets:** | N/A | | |

*Source: Miller Research (UK) Ltd.*

## Table 4 M&E Framework: Activities

| | Activities<br>What is ASTUTE 2020 doing with the inputs to achieve the objectives? | Evaluation Question | Data Type | Data Source |
|---|---|---|---|---|
| A.1 | Approve projects that have the potential for a high impact | How effective are the activities being carried out as part of the ASTUTE 2020 Operation? | Qualitative | Review of Operation Documentation & Key Stakeholder Interviews |
| A.2 | Provide demand-led targeted and tailored support to enterprises | | | |
| A.3 | Provide demand-led world-class academic expertise | | | |
| A.4 | Provide innovation and manufacturing demonstration and development facilities to future proof and de-risk technology development for industry | | | |
| A.5 | Undertake more strategic larger scale 'cluster' projects for the development of Smart Specialisation clusters, involving elements of the supply chain for specific sectors | | | |
| A.6 | Refer to other schemes | | | |
| A.7 | Horizon Scanning | | | |
| A.8 | Monitoring and evaluation of Operation | | | |
| A.9 | Selection of Adaptive Smart Specialisation areas | | | |
| | **Data Collection Responsibility:** | External Evaluation Team | | |
| | **Evaluation Stage:** | Inception & Mid-term | | |
| | **Indicator:** | N/A | | |
| | **Targets:** | N/A | | |

*Source: Miller Research (UK) Ltd.*

In summary, it indicates that company details for all enquiries will be logged on an 'enquiry form'. This includes company enquiries which do not progress to an application for support as well as those deemed more suitable to another scheme and so are referred. If a company is deemed to be potentially eligible for support it is offered to complete a 'request for industrial project form'[33], which is the first step in the application process.

If approved, a second stage 'project proposal form' is completed with support from an ASTUTE 2020 project officer, which requires comprehensive project information. This form includes details about the expected level of private sector investment contribution from the company as well as any baseline information that is needed to describe current activity, products, patent pending etc., including market gap analysis, so that future comparisons are possible. This is then assessed and scored by the Project Committee. If approved, a 'collaboration agreement' is signed and the project commences. Progress is monitored by the project officer and the Project Committee during project delivery. Once a project is approved, companies are required to provide additional data via an 'enterprise data form'.

On completion of a project phase and upon full project completion, a 'project status report' is completed which combined with completed 'indicator forms' provide the necessary evidence to meet any indicators relevant to that project, as specified in Table 6. The project status report is intended to provide an overview of the project explaining its aims etc. whereas the indicator form will collect evidence to inform the indicators. These forms are signed by the company and the ASTUTE 2020 Principle Investigator. All this information will be collected by the ASTUTE 2020 Operation team and will be made available to the external evaluators to inform the evaluation assessment.

[33] *Companies that employ less than 1- people at a base in WW&V or which have been trading for less than 2 years will also have to complete a micro-company form'.*

## Table 5 M&E Framework: Outputs

| | Outputs | | | | |
|---|---|---|---|---|---|
| | How well do these outputs relate to the ASTUTE 2020's activities and objectives? | **Monitoring** | **Group** | **Indicator** | **Target** |
| OP.1 | Enquiries, referrals, and other initial contact with companies | R | Activity Evidence | Number of enquiries, referrals, and other initial contact with companies | n/a |
| OP.2 | Formal requests for collaboration from companies | R | Activity Evidence | Number of formal requests for collaboration from companies | n/a |
| OP.3 | Enterprises supported to introduce new to the market products | ERDF | Innovation Evidence | Number of enterprises supported to introduce new to the market products / processes | 8 |
| OP.4 | Enterprises supported to introduce new to the firm products | ERDF | Innovation Evidence | Number of enterprises supported to introduce new to the firm products / processes | 39 |
| OP.5 | Enterprises cooperating with supported research institutions | ERDF | Activity Evidence | Number of enterprises cooperating with supported research institutions | 40 |
| OP.6 | Enterprises receiving non-financial support | ERDF | Activity Evidence | Number of enterprises receiving non-financial support | 42 |
| OP.7 | Scientific Papers with supported enterprise as joint author | R | Innovation Evidence | Number of scientific papers with supported enterprises as joint authors | n/a |
| OP.8 | Research Excellent Framework Impact Case Studies | R | Innovation Evidence | Number of research excellent framework impact case studies | n/a |
| OP.9 | Patentable and non-patentable intellectual property | ERDF | Innovation Evidence | Number of patents registered for products / processes and items of non-patentable IP (no target value attached) | 5 |
| OP.10 | Referrals to other schemes (including Welsh Government) | R | Activity Evidence | Number of referrals to other schemes | n/a |
| OP.11 | Referrals to private sector | R | Activity Evidence | Number of referrals to private sector | n/a |
| OP.12 | Publicly available case studies | R | Innovation Evidence | Number of publicly available case studies on projects with supported companies | n/a |
| OP.13 | Any other outputs | n/a | n/a | Assessment of any other outputs | n/a |
| | **Data Type:** | Qualitative & Quantitative | | | |
| | **Data Source:** | Operation Documentation & Evaluation Interviews / surveys | | | |
| | **Data Collection Responsibility:** | ASTUTE 2020 Team & External Evaluation Team | | | |
| | **Evaluation Stage:** | All | | | |

*Source: Miller Research (UK) Ltd.*

Table 6 ASTUTE 2020 Output Indicators and Descriptions

| Ref. | Indicator | Description |
|---|---|---|
| OP.1 | Number of enquiries, referrals, and other initial contact with companies | When ASTUTE 2020 first receives an enquiry from a company, or a referral from an external organisation, this will be logged on an enquiry form, under this indicator- regardless of whether they subsequently receive support. |
| OP.2 | Number of formal requests for collaboration from companies | Companies wishing to proceed to requesting support will be required to provide a formal application form. The number of formal applications received will be recorded for this indicator. |
| OP.3 | Number of enterprises supported with the intention of introducing new to the market products / processes | ASTUTE 2020 intervention is expected to lead to innovative new products and processes. The number of enterprises supported who are working on projects that are expected to lead to products / processes which can be classed as sufficiently new to the market will be counted against this indicator. To determine whether the product or process is new to the market, evidence highlighting a gap and the activity required to fill the gap will be required. |
| OP.4 | Number of enterprises supported with the intention of introducing new to the firm products / processes | The number of enterprises supported who are working on projects that are expected to lead to products or processes that can be classed as new to the company. The company will be required to provide evidence of their baseline position describing their current activity so that comparison can be made. |
| OP.5 | Number of enterprises cooperating with supported research institutions | This indicator will count the number of enterprises cooperating in projects involving one or more HEI partners of ASTUTE 2020 and one or more manufacturing enterprises in WW&V.[34] |
| OP.6 | Number of enterprises receiving non-financial support | All enterprises to which ASTUTE 2020 will provide innovation support, be it via collaborations or knowledge Transfer activities, will be counted towards this indicator. Each enterprise can only be counted once[35]. |
| OP.7 | Number of scientific papers with supported enterprises as joint authors | Scientific papers will be written and published in expert reviewed journals and conferences. People from collaboration companies can be included as joint authors if desired. Papers accepted for publication will be counted. |
| OP.8 | Number of research excellent framework impact case studies | Any published research which leads to an impact as defined in the REF guidelines. |
| OP.9 | Number of patents registered for products / processes | A record of the number of patents registered as a result of involvement in an ASTUTE 2020 collaboration project. |
| OP.10 | Number of referrals to other schemes | When an enquiry is more suited to another scheme it will be referred and this will also be logged on the enquiry form and counted towards this indicator. |
| OP.11 | Number of referrals to private sector | All enquiries which are referred to existing solution providers in the private sector will be logged. |

[34] *This indicator will measure the number of parties (enterprise or HEI) involved in a cooperation project (they must have an 'effective collaboration'). There needs to be at least one enterprise (receiving support) and one HEI for it to be considered a cooperation project (there is no upper limit to the number of parties to the cooperation). The count is the total number of parties (HEIs and enterprises) for each project, irrespective of their location. Where there is a cooperation (effective collaboration in RDI terminology) and the research is industrial research or experimental development there should, for instance, always be an intention to introduce a new product or process to the enterprise.*

[35] *A minimum of 12 hours of support through active innovation advisory or innovation services should be provided.*

| | | |
|---|---|---|
| OP.12 | Number of publicly available case studies on projects with supported companies | Companies will be encouraged to produce a short case study of the project. Case studies that enter the public domain will be counted. |
| OP.13 | Assessment of any other outputs | During the external evaluation, additional outputs not considered at this stage of delivery may emerge and will be recorded against this indicator. |

*Source: Miller Research (UK) Ltd.*

## Table 7 M&E Framework: Outcomes

| | Outcomes | What are the short and medium-term results from these outputs? | | | | |
|---|---|---|---|---|---|---|
| | | **M** | **Group** | **Data Source** | **Indicator** | **Target** |
| OC.1 | Private investment matching public support in innovation or R&D projects | R | Innovation Evidence | Operation Documentation & Evaluation survey | Current level of private sector investment in R&D | n/a |
| | | R | Innovation Evidence | Evaluation survey & Secondary data | Ratio of private to public R&D investment among target group companies | n/a |
| | | ERDF | Innovation Evidence | Operation Documentation | Private investment matching public support in innovation or R&D projects | £5m |
| OC.2 | RD&I research income increases[36] | R | Innovation Evidence | Evaluation survey & Secondary data (UKIS) | Average share of total turnover from product innovation, and novel innovation: new to market, new to business and significantly improved (UKIS) | n/a |
| | | R | Innovation Evidence | Evaluation survey & Secondary data (UKIS) | Ratio of R&D as a proportion of turnover | n/a |
| | | R | Innovation Evidence | Operation Documentation | Amount of RD&I research income achieved | n/a |
| | | R | Innovation Evidence | Secondary & Stakeholder Interviews | Percentage of attribution of R&D increases to ASTUTE 2020 among supported companies | n/a |
| OC.3 | Employment increase in supported enterprises | ERDF | Growth Evidence | Operation Documentation | Number of additional employees in supported enterprises | 80 |
| OC.4 | Knowledge and expertise increase in supported enterprises and partner universities | R | Innovation Evidence | Stakeholder Interviews & Evaluation survey | Assessment of extent to which knowledge and expertise has increased. | n/a |
| OC.5 | Jobs safeguarded in collaborating enterprises; Jobs created / safeguarded in other organisations | R | Growth Evidence | Operation Documentation<br>Stakeholder Interviews<br>Secondary data (e.g. ABI) | Number of jobs safeguarded<br>Number of jobs created | n/a |
| OC.6 | Any other outcomes | n/a | n/a | Evaluation survey<br>Stakeholder interviews | Assessment of any other outcomes | n/a |
| | **Data Type:** | OC.1 - OC.3 Quantitative, OC.4-OC.6 - Qualitative | | | | |
| | **Responsibility:** | ASTUTE 2020 Operation team: OC.1c, OC.2c, OC.3 & OC.5, All others: External Evaluators | | | | |
| | **Evaluation Stage:** | Mid-term & Final | | | | |

*Source: Miller Research (UK) Ltd.*

[36] *This does not include match funding from the HEIs.*

### 3.3.6 Outcomes

The outcomes of the ASTUTE 2020 are the short-term and medium-term effects of the Operation outputs. Several observable indicators have been identified which are thought to best illustrate the expected outcomes associated with ASTUTE 2020 outputs (Table 7). There are six distinct outcomes, for which there are eleven individual indicators. Two of the outcome indicators are monitored ERDF indicators that have been approved by WEFO. They each have an associated target level. All other outcome indicators are additional, recorded indicators which are felt express the full impact of the intervention. Indicators marked ERDF in Table 7 will be monitored by the Operation delivery team, the others, marked 'R', will be collected by the external evaluation team.

The Operation monitoring and evaluation plan provides an explanation for some of the outcome indicators and the external evaluators have provided an explanation for any additional indicators. This information is shown in Table 8. Baseline information relating to these outcomes is included in Chapter 4.

### 3.3.7 Impacts

The activities of the ASTUTE 2020 Operation are expected to generate substantial long-term impacts for the companies supported and the wider economy of WW&V. Although many of these benefits will be realised after the completion of the Operation, several indicators have been identified which are expected to be influenced by ASTUTE 2020. They are:

- Further (long-term) increases in employment in supported companies
- Increased investment by supported company(s)
- Increased spend by the company(s) in local supply chain
- Increased external investment into the company
- Predicted increase in sales revenue
- Predicted increase in export revenue
- Savings in energy, greenhouse gas (GHG) emissions and waste
- Any other impacts

The external evaluators will be responsible for collecting interim and final stage (summative) data from supported companies to assess the extent to which the expected impacts have been realised. An important factor to take into consideration at this stage will be the amount of deadweight or displacement that has occurred (also referred to as counterfactual). As stated in HM Treasury's Green Book guidance, only benefits which have occurred over and above those which would have happened in the absence of the intervention should be considered in an assessment of benefits. Thus, the extent to which deadweight and displacement has occurred must be estimated. The approach to carrying this out will be to survey those companies that received support and ask them to self-assess the extent to which they believe the impacts are the direct result of ASTUTE 2020 and would not have happened without support. The three types of deadweight that will be considered for the ASTUTE 2020 Operation are:

- **Deadweight 1:** the extent to which the supported companies would have found alternative support elsewhere
- **Deadweight 2:** the extent to which the supported company would have made the observed changes anyway (i.e. without receiving support form ASTUTE 2020)
- **Deadweight 3:** the extent to which the supported companies believe that the observed changes are the result of the intervention (ASTUTE 2020)

The final evaluation should include an assessment of additionality, by considering the above factors.

Table 8 ASTUTE 2020 Outcome Indicators and Descriptions

| Ref. | Indicator | Description |
|---|---|---|
| OC.1a | Current level of private sector investment in R&D | To understand the impact of ASTUTE 2020 the 'current level' of private sector investment in R&D will need to be established from the supported companies. The impact of ASTUTE 2020 on private sector investment will be measured through a survey of beneficiaries as part of the final evaluation, carried out by the external evaluators. |
| OC.1b | Ratio of private to public R&D investment among target group companies | As for OC.1a, a control group will be established of target group companies in WW&V using the UKIS so that comparisons can be made. |
| OC.1c | Amount of private investment | The sum of the actual formal contribution amount to ASTUTE 2020 projects from private companies own resources as recorded and evidenced at the project closure. |
| OC.2a | Average share of total turnover from product/process innovation, and novel innovation: new to market, new to business and significantly improved. | The average share of total turnover from product/process innovation etc. will be established from a comparable group of companies operating in WW&V in the UKIS. This will be compared to the equivalent value among the treatment group. |
| OC.2b | Ratio of R&D as a proportion of turnover | The ratio of R&D as a proportion of turnover will be established from the UKIS and compared with the value obtained from the treatment group of companies. |
| OC.2c | Amount of RD&I research income achieved | Any project with collaborating companies which leads to further (separate) public support (e.g. Innovate UK projects) will be recorded in this indicator. |
| OC.2d | Percentage of attribution of R&D increases to ASTUTE 2020 among supported companies | The treatment group will be surveyed at the final evaluation stage to gather their perception of the extent to which R&D increases are the result of ASTUTE 2020 support received. |
| OC.3 | Number of additional employees in supported enterprises | Gross employment increase across the whole local Operational base in WW&V among supported companies. Any additional jobs created in supported enterprises will also be recorded. |
| OC.4 | Assessment of extent to which knowledge and expertise has increased. | A qualitative assessment of knowledge and expertise increases will be undertaken by the external evaluators. |
| OC.5 | Number of jobs safeguarded | The number of jobs created or safeguarded in organisations not supported by ASTUTE 2020. This could include jobs created / supported in companies who are suppliers / customers of the supported enterprises as well as partner universities. |
| OC.6 | Assessment of any other outcomes | During the external evaluation, additional outcomes not considered at this stage of delivery may emerge and will be recorded against this indicator. |

*Source: Miller Research (UK) Ltd.*

Table 9 M&E Framework: Impacts

| | Impacts | What are the short and medium-term results from these outputs? | | |
|---|---|---|---|---|
| | | **Group** | **Data Source** | **Indicator** |
| IM.1 | Further increase in employment | Long-term Benefits | Evaluation survey & Secondary data (e.g. ABI) & Stakeholder Interviews | Increased employment in supported companies |
| IM.2 | Increased investment by the company | Long-term Benefits | | Increased investment in supported companies |
| IM.3 | Increased spend by the company in local supply chain | Long-term Benefits | | Increase spend in the local supply chain |
| IM.4 | Increased external investment into the company | Long-term Benefits | | Increase in external investment in supported companies |
| IM.5 | Predicted increase in sales revenue | Long-term Benefits | | Increase in sales revenue because of new processes / products implemented |
| IM.6 | Predicted increase in export revenue | Long-term Benefits | | Increase in export revenue because of new processes / products implemented |
| IM.7 | Savings in energy, greenhouse gas emissions and waste | Long-term Benefits | | Savings in GHG emissions and waste avoidance because of support |
| IM.8 | Any other impacts | Long-term Benefits | | Any other observed impacts |
| | **Data Type:** | Qualitative & Quantitative | | |
| | **Data Collection Responsibility:** | External Evaluators | | |
| | **Evaluation Stage:** | Interim & Final | | |
| | **Monitoring** | External Evaluation | | |

*Source: Miller Research (UK) Ltd.*

### 3.3.8 Cross- Cutting Themes

The ASTUTE 2020 Operation set out its commitment to carry out activities in accordance with current best practice guidance on the EU funding requirement's cross-cutting themes (CCTs). The business plan notes that during ASTUTE, a specialist person was appointed to deal with the cross-cutting themes both internally (within the partner universities) and externally (with the collaborating companies). Thus, targets were exceeded and positive feedback from WEFO regarding their approach was received. For this Operation, the business plan notes WEFO's preference for cross-cutting theme support to be centralised at the WEFO level and the team notes their commitment to actively engage in this process. It is understood that case level indicators have been established by WEFO, for the HEIs to implement. They are; to develop CCT 'champions' who will be responsible for ensuring adherence to CCT objectives in general, and; to develop an Eco Code for sustainable travel plans and transport initiatives – to address the sustainable development aims of the CCTs.

To ensure these case indicators are addressed during ASTUTE 2020 "*Swansea and Cardiff Universities have each identified members of Operation staff to act as a Champion to promote ownership of the CCTs*"[37]. The partners in Aberystwyth and UWTSD will link with the CCT champions in Swansea University and Cardiff University to look at integration of CCTs in their respective institutions. The performance of the ASTUTE 2020 Operation in meeting its commitment to carrying out activities per CCTs objectives will be assessed by the external evaluation teams.

The business plan continues, to note *"that a baseline analysis is being undertaken which will identify the most appropriate method to deliver the CCT indicators for the RD&I area."* and it stresses that the CCT indicators will be re-considered by WEFO when the findings for the analysis have been reached. Nonetheless, the business plan discusses the partners' existing policies which will help to ensure that CCTs are met, as well as noting linkages between activities and their contribution towards CCTs. The plan also refers to its intention that the external evaluation (mid-term and final evaluation stages) will provide evidence to enable assessment of ASTUTE 2020's contribution to CCTs. A detailed description of ASTUTE 2020's

[37] *ASTUTE 2020 Business Plan v36, Page 41.*

commitment to CCTs can be found in the Operation business plan [38], but for this evaluation, a summary is offered below:

### Equal Opportunities and Gender Mainstreaming

The business plan notes that all four partner HEIs have Strategic Equality Plans in place – which are publicly available, [39] and stresses their commitment to equality in their recruitment processes. It highlights that recruitment to the ASTUTE 2020 management group is based on role, rather than gender. It also states that all partners are committed to carrying out all activity in adherence to the Welsh Language Act 1993 – each with a Welsh Language scheme in place at the university. The plan states that all promotional material will be bilingual and made available in other formats[40] upon request. Finally, the plan commits to ensure that all event venues are accessible to disabled people and that public transport routes are considered to promote sustainable transport.

### Sustainable Development

Each partner HEI has publicly available sustainability strategies[41]. The plan also notes its intention to comply with the Well Being of Future Generations Act (2015) by integrating new and improved systems to "help in the sustainable process and encourage the ASTUTE 2020 team to implement sustainable practices within their work."[42]. Of note, the plan commits to encouraging sustainable travel for all staff and indicates intention to consider Skype and video conferences as an alternative wherever appropriate. Finally, the plan notes commitment to local and sustainable supply chain practices in procurement practices.

### Tackling Poverty and Social Inclusion

The business plan makes the point that ASTUTE 2020's focus of providing RD&I support for enterprises in WW&V will result in economic growth and sustainable jobs – thus helping to tackle poverty. By providing support to SMEs, and in doing so helping to overcome barriers to RD&I related growth, it is expected that new jobs will be created and supported – helping enterprises to employ people new to the labour market as well as people returning to the labour market – thus contributing towards social inclusion. Through these effects, the plan

[38] *Pages 41 – 45.*
[39] *Refer to ASTUTE 2020 Business Plan V36, Page 41-42 for hyperlinks.*
[40] *Such as braille, large print & audio.*
[41] *Refer to ASTUTE 2020 Business Plan V36, Page 43 for hyperlinks*
[42] *Page 44.*

notes a contribution to Welsh Government's Tackling Poverty action areas of 'helping people into work' and 'preventing poverty'.

# 4 Baseline Position

The purpose of this chapter is to provide an evidenced baseline position against which the subsequent evaluations can make comparisons, so that it is possible to estimate the impact of the ASTUTE 2020 intervention. Firstly, the chapter provides commentary on the policy context within which the Operation fits. Then, existing data sources, and the findings of the key stakeholder interviews are utilised to establish a baseline position for the evaluation indicators of the monitoring and evaluation plan, and discussed in the previous chapter.

## 4.1 Policy Drivers & Needs

The previous chapter listed the policy drivers and identified needs that justify the rationale for the ASTUTE 2020 intervention. This section of the report provides commentary on the policy drivers and the needs and aims to firstly provide an independent viewpoint and secondly, where appropriate to provide an evidence base that identifies need.

### 4.1.1 Justifying Need

The business plan describes the processes that have been undertaken to inform the design of the Operation. This includes receiving advice from external consultants[43] regarding global megatrends in manufacturing and their relevance to the Welsh manufacturing industry. Based on this advice as well as the Operation team's own knowledge and experience, the business plan notes three distinct RD&I needs from Industry in WW&V which ASTUTE 2020 aims to address. They are summarised as the need(s) to:

- Reduce costly 'trial and error' approaches in improving manufacturing (and understanding of) complex processes / products
- Introduce new materials into products to adopt more innovative processing techniques – and to better understand their behaviour
- Improve the utilisation of all resources in the manufacturing process and supply chain – including exploiting digital processes and connectivity in the manufacturing process.

[43] *GWOS Consulting Ltd. ' ASTUTE Welsh Manufacturing Futures to 2050 – A Strategic Analysis, 2014.*

The business plan also makes the point that these needs are not unique to WW&V and will also apply to the rest of Wales. They note a degree of demand from the other regions in Wales, illustrating that the potential benefits of ASTUTE 2020 will spill over from WW&V to the other regions. Finally, the plan highlights the cross-sectoral nature of the advances that ASTUTE 2020 will make to complex computer and systems modelling – which are expected to improve manufacturing processes and products in all sectors with a demand on any form of manufacturing.[44]

The ASTUTE 2020 Operation takes a strong stance on the areas it will support – adopting a Smart Specialisation approach which focusses only on key target areas with a potential for high economic impact based on industrial demand and provision of relevant academic expertise. Further, it notes that specialisations are both 'smart' and 'adaptive'. They are smart in the sense that they are;

- aligned with Innovation Wales' grand challenge areas,
- highly relevant to the needs of industry,
- underpinned by world class expertise from participating HEIs,
- proven to have economic impact and,
- will be achieved within a specific timescale.

And adaptive because the intention is that they will react to the findings of a horizon scanning exercise – which aims to review industry needs and global manufacturing trends, that will be carried out during delivery. The Operation will also draw on its Stakeholder Advisory Group and industry partners to ensure that any changes to the specialisation are indeed key target areas for manufacturing companies in WW&V. As a result of this approach, the ASTUTE 2020 Operation is confident that its Adaptive Smart Specialisations[45] are such that will effectively and coherently meet industry demand.

The Operation intends on materialising the ambition of smart specialisation through the establishment of a robust selection process which sets out clear criteria that must be

[44] *Specifically, the plan notes the following sectors: Aerospace, automotive, energy generation, oil and gas, medical devices, white goods, electronics, foods, etc.*
[45] *As termed in the business plan.*

satisfied by the specialisation. They are listed in the business plan in detail[46] and summarised here. The chosen criteria are that each specialisation must:

- Address one or more of the identified industrial needs,
- Be based on recognised expertise and facilities within the partner HEIs,
- Either:
    - Have shown evidence of successful projects that generated results, or
    - Be an emerging technology area with genuine potential.

To conclude the assessment of the fit with the planned activities of ASTUTE 2020 and the identified need, the business plan indicates where its adaptive smart specialisation meet the identified industry need.[47] It shows that the choice of areas, and thus the focus of ASTUTE 2020 has intentionally been constructed to address identified need.

### 4.1.2 Fit with Policy Drivers

Europe 2020 - the EU's growth strategy, identifies innovation as a key measure for achieving "smart, sustainable, and inclusive growth".[48] Research, and research and development (R&D) investment are considered a precondition for, and positively associated with, technological innovation. This in turn can, depending on region-specific socio-economic characteristics, be transformed into improved regional economic growth and competitiveness.

As a result of this association, EU cohesion policy has come to incorporate the concept of smart specialisation within the context of integrated place-based agendas. The impact of EU funds should be maximised through thematic concentration and a focus on developing a small number of specialisations or research and innovation (R&I) strengths that match business needs.

The UK is identified as a 'strong innovator'[49], performing 15% above the EU average in 2015 but with identified weaknesses in terms of business R&D expenditure and in-house innovation by SMEs. The European Commission views the stagnation of R&D&I

[46] *Page 14.*
[47] *Table 1.2, Page 15.*
[48] *https://ec.europa.eu/info/european-semester/framework/europe-2020-strategy_en*
[49] *http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en*

investment in the UK as a serious challenge to and vulnerability of the UK's competitiveness. The UK ESIF programmes seek to increase business R&D expenditure directly and through levering in higher levels of private sector investment, encouraging the commercialisation of R&D and/through collaboration between enterprises and research institutions.

As a region, Wales had the lowest level of expenditure on R&D of all the UK regions in 2012 and in 2014 was recognised on the Regional Innovation Scoreboard as an 'innovation follower'.[50] Weaknesses identified are the level of public R&D expenditure and the number of SME's innovating in-house. Welsh enterprises report greater barriers to innovation and a lower percentage of turnover relating to new products and services compared to their equivalents in other parts of the UK. Under specific objective 1.2, the 2014-2020 ERDF programme for West Wales and the Valleys looks to increase the successful translation of research and innovation processes into new and improved commercial products, processes, and services through improved technology transfer from HEIs and industry-academia collaboration.

As a sector, manufacturing makes a significant and increasing contribution to UK GDP; its businesses are more likely to engage in R&D, to innovate and to export than other sectors.[51] The UK Partnership Agreement identifies that manufacturing SMEs are not meeting their productivity potential and that the UK has a competitive advantage in advanced manufacturing.[52] In Wales, the 'economic prioritisation' framework recognises Advanced Manufacturing as a thematic economic opportunity and ASTUTE 2020 as a core strategic backbone Operation under knowledge infrastructure. Wales' smart specialisation strategy (Science for Wales and Innovation Wales) looks to translate science into innovation, setting out 'Grand Challenge' areas that should form a focus for investment and the development of excellence and clusters, including in advanced engineering and materials. It focuses on providing flexible support for innovation and improving collaboration, utilising Welsh world class expertise in academia for commercial

[50] *https://ec.europa.eu/growth/industry/innovation/facts-figures/regional_en*
[51] *https://www.gov.uk/government/collections/future-of-manufacturing*
[52] *https://www.gov.uk/government/publications/european-structural-and-investment-funds-uk-partnership-agreement*

potential. Taking Wales Forward, the Programme for Government for 2016-2021 promotes manufacturing as a key sector for growth in the Welsh economy and looks to work with the universities and colleges to stimulate innovation and growth in the sector.[53]

ASTUTE 2020 provides demand-led collaborative research with manufacturing companies enabling technology transfer and innovation within enterprises, the commercialisation of R&D and launch of new products, processes, and services. Key target areas are identified based on their potential for high economic impact and where Welsh HEIs have world-leading expertise to address industrial R&D needs and add value to SMEs - Computational Engineering Modelling, Advanced Materials Technology, and Manufacturing Systems Engineering.

## 4.2 Inputs

Generally, stakeholders felt that the level of funding for ASTUTE 2020 – although less than ASTUTE, was sufficient. And, even though the target outputs have also been reduced in absolute terms (which would suggest that they are more achievable), they have been increased when comparing outputs as a proportion of funding secured. Nonetheless, stakeholders agree that although the target levels for the level of funding secured are highly challenging, they are based on sound rationale and they are confident that they will be achieved.

The point was raised that ASTUTE 2020 is building on a successful predecessor and so lessons have been learnt by those delivering - which should result in more efficient processes, in turn leading to a more efficient conversion of effort into outputs. It was also noted that the change in focus to adaptive SMART specialisation areas – which play to the individual strengths of the partner HEIs and are informed by industry demand from the previous project should make ASTUTE 2020 more successful than its predecessor (which had a broader offering and so received a wider spectrum of interest).

A small number of stakeholders highlighted the importance of having the right partners or being able to find the right academics as an essential factor in ensuring that ASTUTE

[53] *http://gov.wales/docs/strategies/160920-taking-wales-forward-en.pdf*

2020 can comprehensively meet industry demand. Of course, it may be the case that academics with the necessary expertise do not exist, that their services cannot be secured, or that Project Officers[54] cannot be seconded/appointed – for example they may already be contracted elsewhere. It was noted that the delivery timeframe in which ASTUTE 2020 must operate (governed by the structural funds period) may affect the ability to secure availability of Project Officers. For example, the length of contracts that can be offered to Project Officers must fit within the duration of the Operation, and this may not fit with the needs of the individuals (an individual may be looking for a longer contract than that which can be offered via the Operation for example). Further, it was noted that each partner university can determine the length of contract, based on their own recruitment protocol and preferences – which might also affect the ability of the university to secure the services of Project Officers with a certain expertise. Clearly, these factors contribute towards the risk that the partner universities might not be able to provide the necessary knowledge and expertise to meet demand. Nonetheless, the Operation is aware of this potential risk and has put in place a robust project approval process to mitigate this risk which should, in theory, ensure that the right partners are in place – or that academics with the necessary expertise are identified and Project Officers with the right expertise are appointed to meet the demand. Given the importance of this factor for the future success of the Operation, it is essential that the effectiveness of this process is continually monitored by the Operation team to ensure that it is effective at matching the needs of companies with the knowledge and expertise in the partner universities – as well as identifying when there are gaps in knowledge which cannot be filled by existing knowledge. Particularly, this should be a high priority for the ASTUTE 2020 team during the early stages of industry engagement.

## 4.3 Activities

There is no baseline position as such, to inform the assessment of the effectiveness of ASTUTE 2020 activities. Rather, at the baseline stage, stakeholders were interviewed to understand their views on the planned activities for the ASTUTE 2020 Operation. The

[54] *A project officer is a researcher that is employed specifically to deliver the ASTUTE 2020 Operation, and will typically be on a fixed term contract.*

findings from the interviews provide some answers to the evaluation questions which will need to be considered further, as part of the subsequent evaluation stages.

**A.1 - What is the process for approving high-impact projects? How does the partnership ensure that high impact projects are selected?**

Stakeholders commented that the approach to approving projects for ASTUTE 2020 is more rigorous, transparent, and robust than was the case in the previous ASTUTE project. This has been an improvement in the delivery process – a lesson learnt from the previous project. The new project approval process comprises two-stages and is based on a modified version of Innovate UK's system.[55] This system includes questions that require an answer so that an informed decision can be made. As such, it is more formal than the previous process. Critically, the new process includes input from industry via Industry Wales and EEF- The Manufacturers' Organisation. Although they were members of the previous ASTUTE Stakeholder Advisory Board (SAB), they were not previously involved in the project approval process. For ASTUTE 2020, Industry Wales and the EEF – The Manufacturers' Organisation are full members of the Project Committee. Previously during ASTUTE, questions did already include checking for intellectual property, State Aid, and private sector displacement and these were part of the internal project approval process discussions, but the criteria were not formally assessed using a form. These considerations, which now also includes the views of the external, industrial experts, have now been formalised via the approval process, including explicitly assigning scores to specific criteria. One stakeholder group mentioned that this latter point was particularly important. The Stakeholders felt that it was essential that a robust process was in place and that criteria and projects are scrutinised on an ongoing basis throughout the delivery of the Operation.

The focus of ASTUTE 2020 on SMART specialisation areas is also expected to lead to high impact projects being selected as it will ensure that key strengths of both industry and academia are capitalised upon.

[55] *Reference needed.*

During the project approval process, the possibility of private sector displacement will be thoroughly tested, including asking the company and Project Officers as part of the overall assessment of every project, whether this work is novel research, or whether it already exists. If there is a view that there is no 'off the shelf' solution available, then the proposed project is eligible subject to other eligibility checks. If it is novel research work rather than something the private sector can offer then it is expected to lead to publications, which requires a peer review, which in turn assesses novelty. Each case is assessed through a thorough discussion by the Project Committee including external industrial views supported by assessments of the Smart Specialisation leaders.

**A.2 - How will ASTUTE 2020 provide this support to enterprise? What are the mechanisms to ensure that the support is tailored to industry needs?**

The greater involvement of Industry Wales and the EEF – The Manufacturers' Organisation in the project approval process (an improvement on ASTUTE which was noted by several stakeholders) is expected to lead to ASTUTE 2020 support being well-aligned to industry need. The referral process is also expected to ensure that the right projects are being proposed to the ASTUTE 2020 Operation (see A.6 below) – thus ensuring the Operation meets industry need.

Moreover, through collaboration between the universities and enterprises, ASTUTE 2020 aims to jointly fill gaps in existing knowledge of sometimes complex manufacturing processes. A company directly approaches ASTUTE 2020 or is signposted to ASTUTE 2020 with an industrial problem of relevance to ASTUTE 2020. The ASTUTE 2020 team contributes fundamental knowledge, applied to the real-life problem, while the company provides in-depth knowledge of the problem. In discussions, a joint work plan is defined which facilitates a collaborative approach to fully understand and to solve the problem in a timely manner. During the project work, ASTUTE 2020 will seek to embed the newly found knowledge in the company, but it is up to the company to take the results further and to produce a marketable product / process / service. The academics' role is to apply fundamental research principles and to support their application to industry problems by advising and guiding the Project Officers.

### A.3 - How will ASTUTE 2020 provide this academic expertise?

ASTUTE 2020 has a robust project approval process as described above, which includes the identification of the right academic expertise to address the industry led problem. Once an enquiry is received it is reviewed by the central team who determine what expertise is required to consider it further. A Project Officer will then be assigned to the enquiry if necessary and they may meet with the company to get a better understanding of their requirement so that ASTUTE 2020 can assemble the technical team with the right expertise. At this point, a first stage filter process is undertaken to check for eligibility (as discussed above). If the project is not deemed eligible then it is signposted mainly to the Welsh Government and the SMART teams or to the wider private sector, naturally without naming individual companies. If the project is eligible then it will go through the formal project formulation and the project approval process, which starts with the development and local assessment of a 'Request for Industrial Project' followed by a detailed project proposal for the collaboration. The next stage of the formal process is for the proposal to be considered by the Project Committee who provide feedback – typically points/questions for clarifications. Once replies to these are obtained, the Project Committee considers the proposal and the clarifications – based on set assessment criteria that require an answer. A decision is made on whether it progresses. In most cases, further clarifications are sought. Once the Project Committee has formally approved the project, a collaboration agreement is drawn up, which in combination with the project proposal underpins the collaborative project including clarifications on intellectual property. Once approved, Technical Project Officers are assigned to the projects. These have been recruited for the SMART specialisation areas, and typically have PhDs in this or in a closely related field. They tend to be 'applied researchers' rather than fundamental researchers, ensuring that their skillset is geared towards providing adaptive support (thus connecting industry need with academics' expertise most effectively).

### A.4 - How/where will ASTUTE 2020 provide these facilities?

The support that ASTUTE 2020 can offer has been aligned with the expertise and facilities available at the partner HEIs – via the identified Adaptive SMART Specialisation areas.

### A.5 - How will ASTUTE 2020 ensure that it will undertake this?

The project approval process will help to ensure that high impact and/or strategic, larger scale 'cluster' projects are given priority as appropriate.

### A.6 - How will ASTUTE 2020 refer to other schemes?

For ASTUTE 2020 there are established and 'new' referral routes following closer and more active collaboration with Industry Wales and the EEF – The Manufacturers' Organisation as well as referrals with the Welsh Government (WG). Through close collaboration, it was felt that the relevant colleagues at the WG have a much better understanding of what ASTUTE 2020 is about – partially due to the focus on the SMART Specialisation areas and working with the WG SMART teams, and partially due to a much more active engagement driven by both the ASTUTE 2020 team and the WG SMART teams. Furthermore, Industry Wales and the EEF – The Manufacturers' Organisation have already, and will continue to provide several specific referrals based on their interaction with the industry they represent.

### A.7 - How will ASTUTE 2020 undertake horizon scanning?

The ASTUTE 2020 team plan to use their existing, extensive networks of national and international links to identify 'outside experts' who will contribute to horizon scanning and future proofing exercises for the benefit of Welsh industry.

### A.8 - How will ASTUTE 2020 monitor and evaluate the Operation? Are the mechanisms appropriate?

The Operation's monitoring and evaluation plan sets out in detail the approach to monitoring and evaluation, which is also partly the purpose of this baseline report (see Chapter 3). The choice of monitoring documentation for ASTUTE 2020 has largely been informed by the experiences of the previous ASTUTE Project and to take into consideration the requirements expected of the ASTUTE 2020 Operation. An aspect of on-going monitoring is to understand the risks that the Operation might face. During stakeholder discussions, several potential risks were noted, including:

- Not being able to find the academics required to meet the needs of industry.

- Not being able to find the Project Officers with the right expertise required to meet the needs of industry.
- Match funding not being secured.
- Losing staff.
- Economic ups and downs – especially considering that ASTUTE 2020 is demand led. Current uncertainty is a concern, notably the unknown impact of BREXIT etc.[56]

The monitoring mechanisms in place appear to be well structured and well thought-out. There are structures in place to ensure ongoing assessment of the effectiveness of monitoring systems is carried out. It will be possible to assess the effectiveness of the systems when data has started to be collected from approved projects.

**A.9 - Why and how have these areas been selected? How will the relevance be monitored?**

The areas of Adaptive Smart Specialisation were selected based on a combination of lessons learnt from and demand shown by industry during the previous ASTUTE Project as well as identified industry need. Then, criteria were established which were used to select the specialisations[57]. In short, the criteria was that the specialisation area should meet an identified industrial need, it should be based on recognised expertise and facilities within the partner HEIs and finally that it has previously shown evidence of success in creating growth (jobs, investment etc.) or be an emerging technology with true potential.

The relevance of the specialisations will be monitored through on-going Operation monitoring as well as several activities including Horizon Scanning exercises to review industrial RD&I needs of Welsh companies, manufacturing trends across the globe and technology availability within Welsh HEIs.

[56] *Of note, the business plan highlights that because the adaptive smart specialisation areas - which are the focus of the Operation, address industrial RD&I needs across a diverse range of sectors then the impact of economic shocks (which affect entire sectors) will be minimised.*
[57] *ASTUTE 2020 business plan v36, Page 14.*

## 4.4 Outputs

Theoretically, the baseline for all the outputs is currently zero. That is, the starting point from which ASTUTE 2020 will produce outputs which are the result of intervention, by definition must be zero. Nonetheless, the extent to which the intervention has increased outputs in supported enterprises, will of course change. Thus, the true starting point from which to measure the extent of change will be the baseline position from for the relevant anticipated outputs and outcomes. Thus, when projects are approved, a project specific company level baseline will need to be established for some of the indicators. Commentary from stakeholders regarding the choice of output targets is offered below.

Although the targets have been reduced in absolute terms, compared with the previous ASTUTE Project, (although increased when comparing pro-rata outputs), the choice of targets was based on sound rationale as expressed in the business plan. Therefore, the ASTUTE 2020 team is confident these targets can be achieved despite being very challenging. However, it was reiterated that the achievement of the targets and therefore the success of ASTUTE 2020 was highly dependent on general economic conditions and specifically the rate of growth in the manufacturing sector, which is, of course, out of the control of the Operation.

It was noted that there has been a change in the definition of WEFO's jobs created indicator for the new funding period when comparing with the previous funding period. It is now a net job growth figure across a company location, which means that to the total number of new jobs resulting from an intervention must take into consideration the change (potentially loss) of jobs elsewhere in the company which received intervention. Nonetheless, the jobs created indicator is good indicator for the success of ASTUTE 2020and so the indicator 'jobs created' will be recorded.

There is also a difference in the definition of the creation of new products and processes. The main and crucial difference is that for the ASTUTE 2020 Operation the team can count only enterprises whereas for the previous ASTUTE Project each product/process was counted. The result is that shorter projects with a higher number of companies result now in more targets under the new definition than longer projects with fewer companies. Longer projects tend to give higher economic impact and lead to good relationships with

companies that can be built on in the future. The previous ASTUTE Project has fostered long term relationships between industry and academia whereas the new definition counteracts this, which is likely to have a detrimental influence on the potential overall impact of the Operation.

Several stakeholders commented that the level of engagement between companies and the partner universities would have a big influence on the success of the ASTUTE 2020 Operation. It was noted that being able to engage with companies 'beyond the usual suspects' and to engage with companies other than those who engaged with ASTUTE is essential if the Operation is to have the maximum impact that it can. Of course, the Operation will be heavily dependent on the referral mechanism from the WG's business support programmes – which was the engagement method imposed on the Operation by WEFO, despite an initial request from the Operation to have its own business development budget. Thus, the effectiveness of the referral mechanism is highly important to the overall success of the Operation and so should be monitored closely.

## 4.5 Outcomes

This section of the report provides baseline evidence for the indicators identified and detailed in the monitoring and evaluation framework (see Chapter 3).

**OC.1 - Private investment matching public support in innovation or R&D projects**

OC.1a - Current level of private sector investment in R&D

The level of private sector investment as a proportion of total turnover will need to be gathered by the external evaluators, from collaborating companies during the mid-term and final evaluations. Ideally, the level of investment before intervention and after intervention will be obtained, so that the effect of the intervention can be estimated. Given the current level of approved projects and the lower level of completed projects there is no meaningful baseline value yet. it is not possible to obtain a comparison value from existing datasets.[58] Therefore,

[58] *The UKIS does not collect data relating to the amount of private sector investment as a proportion of total turnover. It does provide data for the total amount of expenditure on internal research and development and separately total turnover, however, due to disclosure requirements it is not possible to obtain a comparable value for WW&V. Depending on future sample sizes, it may be possible to establish a ratio for WW&V. Or, the ratio for the whole of Wales may be possible. This would require a sample boost for Wales.*

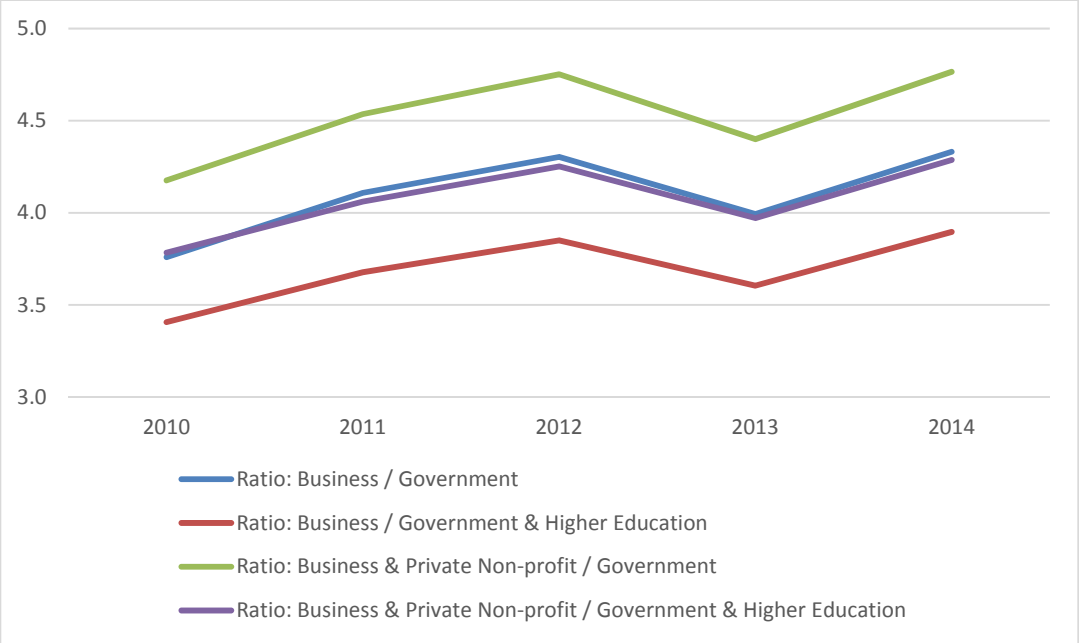
there is currently no baseline data or comparison group available for this indicator.

OC.1b - Ratio of private to public R&D investment among target group companies

The amount of private and public investment will need to be collected by the external evaluators from projects during the mid-term and final evaluations. This will be carried out via an evaluation survey with collaborating companies.

The ONS provide detailed gross domestic expenditure on research and development. (GERD). The change in the ratio of GERD for the UK economy could be used as an approximation of the general rate of change of this indicator over time. Any observed changes in the treatment group (companies receiving ASTUTE 2020 support) can then be adjusted by the general rate of change in the indicator, so that externalities (unrelated events which impact on the indicator) are considered in the assessment. The ratio of GERD between 2010 and 2014 for the different groups of funders as categorised by ONS is shown in Figure 2. For this evaluation, it is suggested that 2014 is used as the base year for future comparisons (Table 10).

Figure 2 Ratio of Private / Public GERD in Constant Prices 2010 to 2014




*Source: ONS GERD*[59]

Table 10 Ratio of Private / Public GERD, 2014 (Base Year)

| Sector of GERD Funding | 2014 |
|---|---|
| Business / Government | 4.3 |
| Business / Government & Higher Education | 3.9 |
| Business & Private Non-profit / Government | 4.8 |
| Business & Private Non-profit / Government & Higher Education | 4.3 |

*Source: ONS GERD*[60]

OC.1c - Private investment matching public support in innovation or R&D projects

Evidence to inform this indicator will be collected by the ASTUTE 2020 Operation team via the project proposal form (anticipated amount) and the project status report (actual contribution) as projects are completed, as well as information collected by the external evaluators. Therefore, there is currently no baseline

59 *[https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/datasets/governmentexpenditureonresearchanddevelopment]*

60 *[https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/datasets/governmentexpenditureonresearchanddevelopment]*

data. It may be possible to establish a baseline once a sizeable number of projects have been completed.

**OC.2 - RD&I research income increases**

OC.2a - Average share of total turnover from product / process innovation, and innovation: new to market, new to business and significantly improved.

The external evaluators are required to gather evidence from the supported companies to provide data relating to this indicator. This will be carried out at the interim and final evaluation stages through an evaluation survey. The results of the survey will be compared with the equivalent indicator obtained from the UKIS, to understand how the ASTUTE 2020 Operation has had an impact over and above that which would have happened anyway[61].

The UKIS asks its sample to estimate the percentage of its business' total turnover from goods and services that were new to the market, new to the business, or significantly improved[62]. Innovation activity as a proportion of total turnover between 2012 and 2014 among the sample of companies is shown in Table 11. It shows that new to market and significantly improved innovation activity accounts for a marginally smaller proportion of total turnover compared with the average across companies in the rest of the UK.[63]

Table 11 Innovation Activity as a Proportion of Total Turnover (2012 to 2014)

| | WW&V | Rest of UK |
|---|---|---|
| New to market | 9% | 10% |
| New to business | 13% | 12% |
| Significantly improved | 14% | 15% |

*Source: UKIS 2014[64]*

[61] *Refer to discussion on counterfactual in Chapter 3.3.7 of this report.*
[62] *For each category, the period of time for the goods or services to be new was 2012 to 1014.*
[63] *It should be noted that the sample size for WW&V for this question was relatively small and so there may be a significant margin of error. It is recommended that the sample size for Wales is boosted to improve the reliability for future comparisons.*
[64] *Average of responses in WW&V and Rest of UK (UK not including Wales).*

OC.2b - Ratio of R&D as a proportion of turnover

The ratio of expenditure on research and development as a proportion of total turnover will be established through the external evaluation survey, which will be carried out at the final evaluation stage. For comparison purposes a baseline value will be collected from supported companies, also via the final stage evaluation survey[65].

It is not possible to derive an equivalent figure from the UKIS as the sample size for WW&V is currently too small to provide meaningful results.[66]

OC.2c - Amount of RD&I research income achieved

Companies receiving ASTUTE 2020 intervention as well as Welsh HEI partners will be required to provide data relating to this indicator as part of the Operation monitoring documentation. It is recognised that income received by the Welsh HEI partners will also have economic impact through increased number of employees and increased expenditure on equipment / supplies. This will also be monitored.

Specifically, the project status report document will be used to record this data, as specified in the Operation monitoring and evaluation plan.[67] Data for this indicator will not become available until such income has been realised. As such, there is no baseline comparator.

OC.2d - Percentage of attribution of R&D increases to ASTUTE 2020 among supported companies

The external evaluators will collect evidence to inform this indicator. The purpose of collecting data for this will be to inform the additionality assessment[68]. It will be carried out through the evaluation survey and the stakeholder interviews and will

[65] Companies will be asked to provide their R&D expenditure and turnover values prior to and post their involvement in ASTUTE 2020.
[66] It may be possible to establish a value in the future by cross-tabbing the results from the UKIS (2012-14) question 5 with question 21, if the sample in Wales is larger.
[67] Document entitled '80814 - ASTUTE 2020 Draft Monitoring and Evaluation Plan' Version 3, *Page 12.*
[68] See section 3.3.7 in this report.

require self-assessment of the extent of deadweight among the companies receiving support.

**OC.3 - Employment increase in supported enterprises**

OC.3 - Number of additional employees in supported enterprises

As specified in the Operation monitoring and evaluation plan, the number of additional employees in supported enterprises, in WW&V will be recorded by the Operation team, collected on the indicator form. The gross number of jobs across the whole relevant Operational base[69] of the supported companies will be considered against the target of 80. Given the nature of the indicator there is currently no baseline. The current number of employees will of course be collected as projects are approved, so that additional employees can be identified.

The level of employment in WW&V will vary over the course of the ASTUTE 2020 delivery period. These effects will also impact on the employment levels in supported companies, therefore, any observed changes will need to consider general fluctuations in employment levels caused by externalities. It is possible to monitor employment changes in related companies in WW&V using the BRES[70].

To establish a baseline position, the BRES has been accessed to derive the change in employment numbers between 2011 and 2015 (the most recent dataset), for the SIC codes[71] of enterprises supported during ASTUTE[72] - which is being used as an approximation of the companies that could be expected to engage with ASTUTE 2020.

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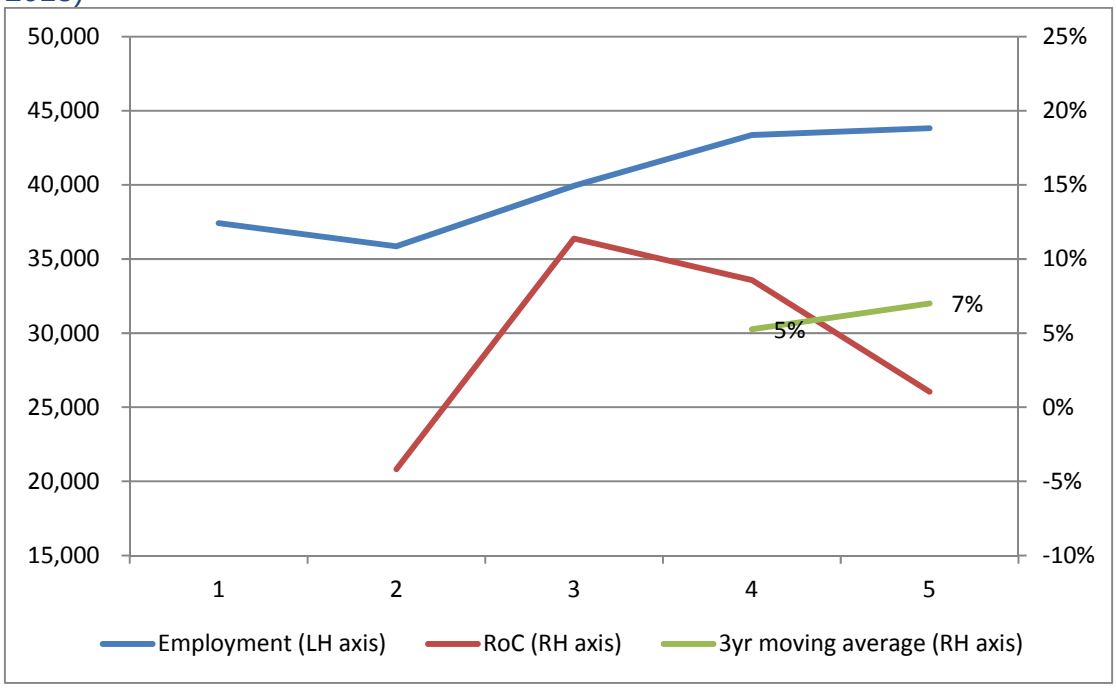
69 *The relevant Operational base relates to the portion of the company that is directly affected by the intervention, in recognition that some companies will have other sites located around the world.*

70 *Business Register and Employment Survey, ONS.*

71 *At the 5-digit level. See Appendix 3 for a definition of the SIC codes.*

72 *The top 25 SIC codes (at the 5-digit level), which accounted for 52% of all companies engaged during ASTUTE was used to derive an approximation of the industry with which ASTUTE 2020 can be expected to operate in. Through a separate exercise, the SIC codes which are expected to relate to the SMART areas was established but this yielded more than 100 individual 5-digit SIC codes which was too large to derive data from BRES (the sample exceeded the maximum number of cells that can be processed using NOMIS). Thus, the top 25 SICs were used as the best alternative estimate of what the list of SIC codes for companies that engage with ASTUTE 2020 might look like.*

Figure 3 Employment Level & Change in Employment in Target SIC codes (2011 to 2015)




*Source: BRES 2011 to 2015[73]. Analysis and Interpretation by Miller Research UK Ltd.*

Shown in Figure 3, employment in SIC codes in which companies that will engage with ASTUTE 2020 will be categorised has changed from around 36,000 in 2011 to around 44,000 in 2015, a change of 17 per cent over the period (8,000 additional people in employment). The rate of change (RoC) between 2014 and 2015 was 1 per cent, equivalent to an increase of 455 people on the previous year. Over the three-year period 2013 to 2015 the rate of change in the employment level was 7 per cent. This change could be considered the 'general' rate of change in employment levels across the ASTUTE 2020 target area. Then, the rate of change in employment among supported companies can be compared with this general rate of change to indicate the employment change that has taken place over and above that which might have happened anyway (the deadweight of ASTUTE 2020 intervention).

[73] *Data accessed under ONS notice ref: NTC/BRES15-P0508.*

**OC.4 - Knowledge and expertise increase in supported enterprises and partner universities**

OC.4 - Assessment of extent to which knowledge and expertise has increased.

The extent to which knowledge and expertise has increased in supported enterprises and partner universities will be assessed qualitatively through stakeholder interviews and the evaluation survey where possible. It is not possible to identify a baseline value given the subjective nature of the indicator.

**OC.5 - Jobs safeguarded in collaborating enterprises; Jobs created / safeguarded in other organisations**

OC.5 - Number of jobs safeguarded

The number of jobs safeguarded / created will be monitored by the Operation team, as specified in the monitoring and evaluation plan document, using the indicator form. No meaningful baseline can be obtained for this indicator, however general changes in employment in the economy will be considered as discussed above (see indicator OC.3).

**OC.6 - Any other outcomes**

OC.6 - Assessment of any other outcomes

During the evaluation, any other outcomes not already considered will be identified and evidence collected as necessary.

## 4.6 Impacts

The baseline position for all the impact indicators will need to be established from the companies that engage with the ASTUTE 2020 Operation. The indicators have been chosen to reflect the long-term effects of ASTUTE 2020 intervention, therefore, a baseline position for each indicator can be obtained from the supported companies at an early stage of engagement with the Operation. Then, during the final evaluation stage, the same data can be collected from the companies to monitor change over time. Given the high propensity for a significant element of the observed changes in indicators to be the result of externalities it is suggested that the final evaluation of the ASTUTE 2020 Operation establishes a general rate of change in observable indicators where possible (see section 4.5 for baseline data).

The suggested approach to measuring the impact of each of the chosen impact indicators at the final evaluation stage is offered below:

**IM.1 - Further increase in employment**

This indicator will aim to measure any observable increases in employment which are the result of the support received via ASTUTE 2020, over and above that which is already considered as part of the outcome assessment (specifically OC.3 and OC.5). One method of estimating this impact is to use industry multipliers which aim to express the supply chain effect of an increase in output in each industry. Industry input-output tables for Wales show the interactions between industries in the Welsh economy which allow changes in output and employment across the whole Welsh economy as a direct investment / increase in output to be estimated. This approach could be used at the mid-term and final evaluation stages to estimate the direct, indirect, and induced impact of increases in output and employment brought about by the ASTUTE 2020 intervention.

**IM.2 - Increased investment by the company**

The current level of investment as a proportion of turnover should be gathered from supported companies and monitored over time to observe change. Then, through self-assessment, the companies could estimate the extent to which the observable changes are the result of ASTUTE 2020 intervention. There is no known publicly available dataset to provide a comparison for this indicator. The closest is the ratio of the research and

development expenditure as a proportion of turnover which is already being utilised to assess the outcomes of the Operation (see section 4.5).

**IM.3 - Increased spend by the company in local supply chain**

The amount of spend by the company in the local supply chain pre-and post ASTUTE 2020 engagement can be collected from the supported companies by the external evaluators. It should be noted that some enterprises may not be willing or able to provide this information, therefore the quality of evidence data is unknown. This information should be collected at the earliest possible opportunity following engagement to ensure that systems are in place to provide a benchmark. Thus, the external evaluators should work with the Operation team to engage with companies as projects become approved.

**IM.4 - Increased external investment into the company**

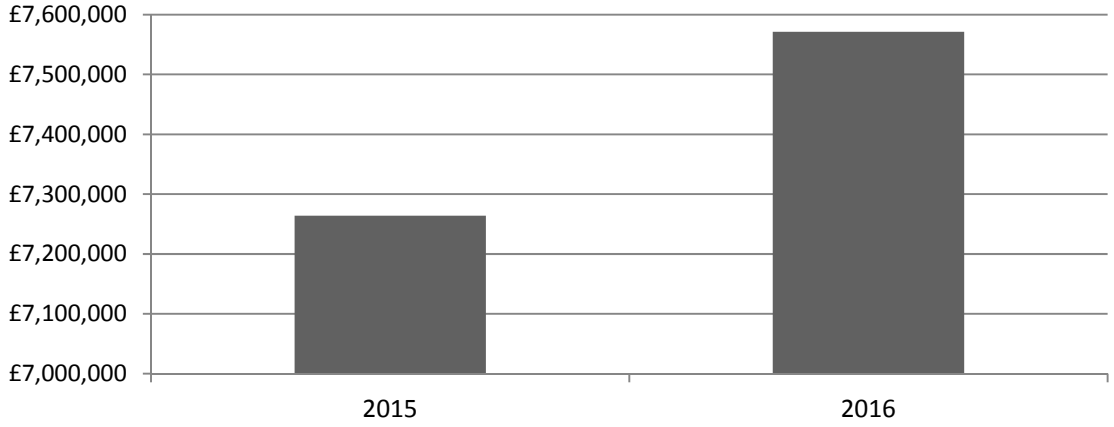
The change in external investment into the company will need to be collected directly from supported companies[74] after collaborative project completion and subsequently at the final evaluation stage.

**IM.5 - Predicted increase in sales revenue**

The general change in turnover can be used as a benchmark rate of change against which any increases in the treatment group (ASTUTE 2020 supported companies) can be compared. The rate of change in turnover (as a proxy for sales revenue) for a range of industry groups can be obtained from the Office for National Statistics[75]. The rate of change of turnover between 2015 and 2016 for the group of 2-digit SIC codes is used here as a proxy for potential ASTUTE 2020 companies for comparison purposes[76]. Between 2015 and 2016 the mid-point estimate[77] of turnover for the proxy industry in Wales increased by 4%.

[74] *By the external evaluators.*
[75] *Turnover bands provide regional turnover data only, and for 2-digit SIC codes only.*
[76] *The following 2-digit SIC codes are used, which are the 2-digit equivalents of the 5-digit SIC codes used in Section 4.5: 20,21,22,24,25,26,28,29,32,62,70,71,72,74,82,96.*
[77] *ONS provides turnover bands for 2-digit SIC codes by region. A mid-point estimate value was obtained based on the number of enterprises recorded in each category band.*

Figure 4 Turnover (£000's) Among Companies Operating in ASTUTE 2020 Target SIC codes (2 digit)




*Source: ONS, UK Business - Activity, Size, and Location: Enterprise by 2 Digit SIC, Turnover size band and Region, 2016. See Appendix 3 for list of 2-digit SIC codes.*

This rate of change can be used as the benchmark change in general change in turnover in the potential ASTUTE 2020 treatment group. Therefore, changes above this figure could be said to have occurred over and above general increases in turnover.

**IM.6 - Predicted increase in export revenue**

The change in predicted export revenue increases will need to be collected directly from supported companies after completion of a collaborative project/at mid-term and subsequently at the final evaluation stage. There is no comparable, existing data to enable comparisons with general changes.

**IM.7 - Savings in energy, greenhouse gas emissions and waste**

The amount of energy saved because of ASTUTE 2020 intervention must be collected directly from the engaged companies after completion of a collaborative project/at mid-term and subsequently at the final evaluation stage. It may be possible to gather data to observe general changes in energy use, green-house gas emissions and waste amongst similar companies from existing datasets. This can be explored further at the final evaluation stage.

**IM.8 - Any other impacts**

During the evaluation, any other impacts not already considered will be identified and evidence collected as necessary.

At the inception stage, stakeholders noted that a potential benefit of the Operation which is not already being captured by the listed indicators is the positive impact that the Operation might have on the recruited Project Officers' careers. Their involvement with ASTUTE 2020 will provide Project Officers with exposure to both academia and industry and so post-Operation the individual will have the opportunity to pursue either career route in the future. This phenomenon could be captured through qualitative research with the recruited Project Officers – albeit after the end of the Operation (and so after the conclusion of the external evaluation).

## 4.7 Cross-cutting themes

A baseline position for the current situation regarding the chosen cross-cutting theme indicators (when they are determined) should be established. Thus, at present there is no baseline position.

# 5 Conclusion, Recommendations & Next Steps

The ASTUTE 2020 Operation has been designed through a very robust and comprehensive process which has clearly set out to identify industrial RD&I needs - which it then intends on meeting. The use of Adaptive Smart Specialisation areas – which were based on an evidence report identifying industry needs in Wales (including observing global megatrends in manufacturing and how Welsh manufacturing can capitalise on changes), has resulted in a concentration in the areas of support which display potential for high economic impact – which is the result of analysis of the areas of support provided under the previous ASTUTE Project. By demonstrating where technologies generated economic impact (in terms of jobs, investment and products launched), it has been possible to focus effort for ASTUTE 2020 on areas expected to yield the highest return. Clearly therefore, the ASTUTE 2020 Operation appears to have a strong coherence to the identified needs of the manufacturing sector in WW&V.

This baseline report has also shown that the ASTUTE 2020 Operation has a strong fit with overarching policy and strategic objectives. Consideration of the plans for ASTUTE 2020 and the Economic Prioritisation Framework (EPF) show a high degree of coherence. It is evident that the business plan has been shaped to ensure a close fit with the overarching EPF. As described above, the Operation appears to directly contribute to key demand drivers (e.g. global megatrends in manufacturing), facilitating collaboration between industry and academia to improve the translation of knowledge into commercial products / services, in Welsh Government target sectors. Similarly, the Operation promises a high level of collaboration with existing capacity given its premise on transferring existing knowledge and expertise in HEIs to address industry RD&I demands.

The business plan sets out a comprehensive delivery plan, which has been well designed to ensure that the aims and objectives can be met. It is evident that lessons have been learnt from the ASTUTE Project, and have been integrated into the design of ASTUTE 2020. If carried out to plan, the external evaluators are confident that the ASTUTE 2020 Operation will lead to the expected and identified outcomes and impacts noted in this report. The monitoring and evaluation framework set out in this report provides a framework to enable the evaluation of the success of the ASTUTE 2020 Operation. It was

designed in collaboration between the Operational team, the external evaluators with consultation input from WEFO. Much of the data that needs to be collected as stated in this report will need to be collected by the external evaluators upon project completion / during the mid-term and final evaluation stages. It is essential that effective monitoring systems that are fit for purpose are established at the earliest opportunity and are tested to ensure that the data being collected will enable an effective evaluation to be undertaken.

At the inception stage, a small number of potential issues or difficulties that might be encountered during the Operation delivery have been identified by stakeholders or the external evaluators. The main area which requires close attention is the level of engagement that ASTUTE 2020 can achieve with the target industrial sectors. The successful connection between the companies who require support and ASTUTE 2020 is reliant upon the effectiveness of referral mechanisms between the Welsh Government support services and the Operation team. Therefore, it is critically important that these mechanisms are in place, and are effective. It is suggested that the referral process is monitored closely during the early stages of delivery. If referral mechanisms are ineffective then alternatives should be considered at the earliest possible stage so that overall targets can be met within the delivery timeframe.

The second area of concern is the ability of ASTUTE 2020 to find the right Project Officers that are needed to meet the needs of industry. The success of ASTUTE 2020 will be determined by the ability to transfer knowledge from HEIs to address an industry need / problem, which in turn will lead to a commercial output. Therefore, being able to source or match the right Project Officers to the right problem is critical. There are no concerns that the project approval process will not lead to the most appropriate allocation of *existing* HEI academics to industry problems because the process has been well thought out and is thorough – rather, an issue may arise if the industry need(s) requires *additional* knowledge and expertise over and above that which already exists in partner HEIs and the necessary Project Officers are hard to find or whose services cannot be procured for ASTUTE 2020. The length of contract that is / can be offered may be a determinant in securing Project Officers and each partner HEIs approach to contracting Project Officers

should consider the impact to ASTUTE 2020 if it proving difficult to secure the necessary expertise.

Another area for concern is the extent to which ASTUTE 2020 displaces private sector activity. Again, the project approval process which has been constructed for the Operation takes on board lessons learnt from ASTUTE and has been designed with this potential problem in mind. This process now includes external, industrial views. Nonetheless, it is recommended that a high priority is given to the consideration of private sector displacement during the approval process to alleviate any concerns which may arise from industry.

The mid-term evaluation will follow approximately 12 months after the publication of the inception evaluation report. At that time, the external evaluators will gather the data collected as set out in this report to carry out an independent review of progress. The purpose of the mid-term evaluation will be to assess progress to date, to check that the Operation is on-target to meet its objectives and to identify any lessons learnt or ways in which the Operation could be re-shaped if necessary to maximise its impact for the duration of the Operation's delivery.

## 5.1 Recommendations

Based on the evidence presented in this report, the following recommendations are put forward for consideration:

- Request a boost to the UKIS Wales sample so that further cross-tabulations are possible. For example, a cross-tabulation between question 5 (amount of expenditure on innovation related investments) and question 21 (total turnover) would enable an estimation of the amount of private sector investment as a proportion of total turnover in WW&V, which could be used as a control group comparison for indicator OC.1a.
- To continually monitor the effectiveness of the project approval process in avoiding private sector displacement.
- To monitor the effectiveness of referral mechanisms between Welsh Government's support team and ASTUTE 2020.

# Appendix

## Appendix 1 – List of Key Stakeholder Organisations

- Swansea University
- Cardiff University
- Aberystwyth University
- University of Wales Trinity Saint David
- Industry Wales
- Welsh Government
- EEF

# Appendix 2 – ASTUTE 2020 Monitoring and Evaluation Framework

Insert hyperlink to monitoring and evaluation framework

# Appendix 3 – List of SIC codes (5-digit & 2-Digit) used to estimate the Industry of Companies that might engage with ASTUTE 2020 for deriving a comparable employment rate change

| 5 Digit SIC | 2 Digit SIC | SIC Description | Number of Enterprises Engaged in ASTUTE |
|---|---|---|---|
| 72190 | 72 | Other research and experimental development on natural sciences and engineering | 20 |
| 32990 | 32 | Other manufacturing nec | 13 |
| 82990 | 82 | Other business support service activities nec | 12 |
| 22290 | 22 | Manufacture of other plastic products | 11 |
| 32500 | 32 | Manufacture of medical and dental instruments and supplies | 10 |
| 29320 | 29 | Manufacture of other parts and accessories for motor vehicles | 7 |
| 96090 | 96 | Other personal service activities nec | 7 |
| 25110 | 25 | Manufacture of metal structures and parts of structures | 6 |
| 26511 | 26 | Manufacture of electronic instruments and appliances for measuring, testing, and navigation, except industrial process control equipment | 6 |
| 62012 | 62 | Business and domestic software development | 6 |
| 62020 | 62 | Computer consultancy activities | 6 |
| 24450 | 24 | Other non-ferrous metal production | 5 |
| 70229 | 70 | Management consultancy activities (other than financial management) | 5 |
| 25620 | 25 | Machining | 4 |
| 28990 | 28 | Manufacture of other special-purpose machinery nec | 4 |
| 62090 | 62 | Other information technology and computer service activities | 4 |
| 71122 | 71 | Engineering related scientific and technical consulting activities | 4 |
| 74100 | 74 | Specialised design activities | 4 |
| 20590 | 20 | Manufacture of other chemical products nec | 3 |
| 21100 | 21 | Manufacture of basic pharmaceutical products | 3 |
| 24100 | 24 | Manufacture of basic iron and steel and of ferro-alloys | 3 |
| 25990 | 25 | Manufacture of other fabricated metal products nec | 3 |
| 28490 | 28 | Manufacture of other machine tools | 3 |
| 71200 | 71 | Technical testing and analysis | 3 |
| 74909 | 74 | Other professional, scientific, and technical activities (not including environmental consultancy or quantity surveying) | 3 |