Welsh Economy Research Unit
Yr Uned Ymchwil i Economi Cymru

CSA Catapult: Economic Impact Assessment

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Summary

CSA Catapult based in Newport assists private sector businesses through the provision of infrastructure, systems and processes for developing working prototypes for new devices and their placement within new systems.

The objectives of this report are to examine selected economic effects connected with CSA Catapult through its commercial and collaborative R&D activity. CSA Catapult has been involved in 156 separate R&D projects since 2019. These have involved a total of 176 firms and institutions. Headline impacts of projects are understood in terms of supply chain improvement, improved manufacturing capability and contribution towards net zero targets.

CSA Catapult has had a role in the evolution of the CS cluster in the local economy of South Wales. It has collaborated with each private and public organisation within the cluster. Separately CSA Catapult employs 96 people, and with an estimated 64% of staff in R&D facing roles. Over the period 2019-2023 employment in CSA Catapult has grown from 62 to 96, and this makes up an estimated 5.3% of CS cluster employment in South Wales. The cluster as a whole has seen its GVA more than double in the period 2019-2023 and it currently employs close to 1,800 people.

It is estimated that a total of 31 CSA Catapult projects since 2019 have led to either new job creation or safeguarded employment; 29 CSA Catapult projects have led to the estimated creation of 1,325 full-time equivalent (FTE) jobs, while 19 projects have been connected to an estimated 3,393 safeguarded FTE jobs. The total GVA supported by this employment is a little over £600m of UK GVA.

A key objective of CSA Catapult R&D collaboration is that businesses and institutions see an improvement in the technological readiness levels of products and services. The analysis shows that around half of CSA Catapult projects have achieved TRL levels of 6 of above.

The analysis in this report shows that CSA Catapult supports firms and institutions across the UK economy.

The firms with whom CSA Catapult engaged are in sectors which form part of the definition of advanced manufacturing activity. For example, CSA Catapult has collaborated with 23 firms who are within the computer, electronic and optical products sector (SIC 26) and here gross value added per employee is close to £114,000. CSA Catapult collaborations have occurred over a period of intense challenges for UK manufacturing and services sectors as a result of Covid-19 and then the cost of living crisis. The report reveals that a series of industries with whom CSA Catapult has collaborated have actually managed to grow employment through these challenging times. CSA Catapult is working with sectors of the UK economy where there are expectations of relatively fast productivity growth.

The analysis shows that median sales growth of private sector partners in the year following the R&D collaboration was 1.6%, then 11.6% after two years and 5.1% after three years. The employment growth numbers are particularly encouraging here showing 4.6% growth in year following collaboration, then 6.5% but then falling to 1.7% in the third year after collaboration.

The analysis suggests a long term benefit to multi-factor productivity in the UK economy

of between £55.7m and £85.7m, resulting from just over £15m of CSA Catapult R&D activity. This is a guide to how far CSA Catapult research activity could have wider UK impacts in terms of sustained total factor productivity improvements. For example, this might be understood in terms of improvements to business efficiency and performance

1.Introduction

Compound Semiconductor Applications (CSA) Catapult operates in a context of a huge UK opportunity in compound semiconductor (CS) devices and materials. CS technology has resulted in innovative activity in UK enterprises and in higher education institutions. However, there is a critical issue that the UK could fall behind its major competitors should products involving CS technology not be brought to market efficiently. It is in this space that CSA Catapult works assisting private sector businesses through the provision of infrastructure, systems and processes for developing working prototypes for new devices and their placement within new systems. In this respect CSA Catapult works on collaborative and commercial R&D projects with private and higher education institution partners and with this including work in design and development, testing products, developing skills, and providing market intelligence.

Previous research has shown that there are expected to be a diverse set of local, regional and national outcomes linked to the activity of Catapults. While large elements of CSA Catapult activity are funded centrally (core infrastructure and facilities funding from Innovate UK), the Catapult also engages with funded collaborative R&D (public and private sector) projects, and with a further income stream from commercial funding. There is the prospect then that businesses with whom the Catapult engages see improvements in performance and productivity through time although making these connections is not always easy.

The objectives of this report are to examine selected economic effects connected with CSA Catapult through its commercial and collaborative R&D activity.

The remainder of this short report is structured as follows. The second section reviews some of the issues that need to be considered in the economic evaluation of Catapult activity, and then we provide an outline of how an economic assessment is made in this report, with an associated logic model. The third section of the report describes the scale and scope of CSA Catapult activity since 2019 inception. This material is used in the fourth section to examine the economic effects associated with commercial and collaborative R&D activity. The fifth section concludes and with a discussion about the strengths and weaknesses of the method employed and what types of effects are omitted from the analysis.

2. High level evaluation of CSA Catapult

2.1 Evaluation problems

In this part of the report we consider some of the issues that need to be understood in undertaking a high level evaluation of the activities of CSA Catapult, or indeed any UK-based Catapult.

To begin with there are a series of common economic evaluation issues with any Catapult-style evaluation. First, by its very nature any commercial or collaborative R&D activity in which CSA Catapult engages might not yield economic benefits to both firms and society for many years. This time-related issue also means that it can be extremely difficult to estimate how early stage R&D activity actually links to final outcomes, and then disentangling the final outcomes that can be associated with a Catapult intervention or contribution. Prior research has typically sought to link a Catapult collaboration to business performance, but there are a wide range of factors that affect long term business performance (and included here in the period of CSA Catapult activity are the impacts of Covid-19 on firm performance and generally slower economy growth). Moreover, whereas we tend to seek the results of R&D in improved productivity and profitability, the results of successful R&D might mean that business productivity is stabilised, or that current performance levels are maintained. These types of difficulties are one of the reasons why academic studies which seek to link levels of R&D activity to productivity growth in firms show diverse results.

Second, in terms of the process of identification it can be the case that private sector businesses may not wish to divulge publicly the longer term effects of R&D, and with this problem expected to be more acute in R&D intensive sectors of the economy where the specifics of competitive advantage are closely guarded.

Third, the relative scale of the private and social returns to R&D activity might vary according to the absorptive capacity of the national economy. Then, for example, returns to similar types of R&D might vary across UK regions according to their capacity to take-up new knowledge and apply it.

Finally, there are common evaluation issues concerned with the additionality of Catapult activity. These are understood in terms of:

- Deadweight: the extent to which the business outcomes would have occurred without the activity of the Catapult.
- Displacement: the extent to which publicly funded Catapult activity displaces activity in firms which do not successfully collaborate with the Catapult.

- Leakage: the extent to which the private and social returns to R&D leak out of the reference economy and benefit other states, or businesses elsewhere. In this respect it is noted that many of the businesses with whom CSA Catapult collaborates are multinational in nature.
- Multiplier effects: how far improvements in one firm in terms of output and productivity might result in benefits to other firms through supply chain spending, for example.

2.2 A summary of prior research

It is not possible in this short report to give a complete review of literature that speaks to the expected effects of general Catapult activity, but we cite some of the more interesting academic work from which inference can be drawn. Work that has considered the impacts of R&D and innovation activity has typically been hindered by making hard connections between R&D inputs and R&D outputs, problems of using data on patents, and then with wider economy evaluations in terms of improvements to economic welfare having to grapple with how R&D success in one firm changes the competitive dynamics in an industry.[1]

Haskel et al. (2014)[2] found that there was "a statistically significant correlation between state support for research (in the form of research councils, QR funding and government research labs) and industry-level (total factor) productivity growth" (p8). This research considered data from seven different industries and covered the period from 1992 to 2007. The research revealed that were publicly funded R&D to go up £100m, then total factor productivity in the market sector goes up £20m in the reference year. However assuming that this results in a sustained increase in the level of output results then they calculated that there was a long term benefit of around £400m. This work then suggests considerable impacts from research activity, particularly where it is publicly funded.

The greater economic significance of public as opposed to private sector R&D is picked up by Guellec and van Pottelsberghe de la Potterie (2004).[3] They suggested that the long-run responsiveness or elasticity of total factor productivity to publicly funded research is 0.17 compared to 0.13 for private sector R&D. They showed that this was consistent with a view that the benefits of private sector R&D are more likely to be internalised by the private sector than is the case in publicly funded research, and with the latter perhaps more focused on basic as opposed to applied research.

[1] For a review of the historical issues here see Hay and Morris, Industrial Economics: Theory and Evidence, 1979.

[2] Haskel, J. et al. (2014) The Economic Significance of the UK Science Base, UK Innovation Research Centre, March 2014.

[3] Guellec D and Van Pottelsberghe de la Potterie (2004) Form R&D to Productivity Growth: Do the Institutional Settings and the Source of Funds for R&D Matter?, Oxford Bulletin of Econ & Stats, 66 (3) pp.353-378.

There is some need for caution here as several authors show that, as per the prior section of this report, that R&D impacts vary. For example, Cohen and Levinthal (1989; 1990) reveals that the effects of publicly funded research are expected to be impacted by the capacity of other players in the economic and innovation system to use the research outputs produced with public support.[4] Importantly, for the types of research in which CSA Catapult engages they also show that R&D activity has multiple faces i.e. it can lead to new knowledge development BUT can also lead to firms being able to more efficiently absorb new knowledge. In the realm of new technologies around compound semiconductors these improvements to absorptive capacity are likely to be significant but difficult to isolate within an evaluation framework.

Finally, here there have been some newer studies that have focused more on Catapult activity and seeking to develop methodologies to explore their effects. For example, Roper and Vanino (see ERC 2023a)[5] examine the business performance effects of Catapults analysing business engagements over the 2011 to 2016 period and then business growth over the subsequent three and six years. They find a strong positive effect on employment and turnover growth of firms that had engaged with Catapults. For example, in terms of employment it was shown to have grown by almost 16% faster in the 6 year period after the start of the intervention (p12). They also reveal more positive impacts of Catapults on employment and sales growth in micro and small firms as opposed to medium and large firms.

ERC (2023b)[6] also shows evidence that Catapults innovation centres provide a source of externalities for unsupported businesses located nearby, mainly by increasing their likelihood to collaborate in the future with the Catapult network. For example, this research showed: “a 2% increase in productivity for unsupported firms after the opening of a Catapult centre within a 1-kilometer radius.” (p.15)

The review suggests that there is a challenge to examine the performance of firms with whom Catapults collaborate but also to consider more local effects around Catapult facilities.

[4] Cohen W and Levinthal D (1990) Absorptive Capacity: A New Perspective on Learning and Innovation, Admin. Sci. Quarterly, 35.1, pp128-152.

[5] Vanino E and Roper S (2023) Evaluating the medium term business performance effects of engaging with Catapults: A propensity score matching – difference in difference study. ERC Insight Paper, January

[6] Vanino R and Roper S (2023) Catapulting into the Innovation System: Direct and Indirect Local Knowledge Spillovers from Innovation Hubs. ERC Research report, May.

2.3 The local context

While this report focuses more on the economic effects associated with UK-wide collaborative and commercial R&D connected to CSA Catapult it should be remembered that there is an important local economic context to the Catapult in South east wales. Figure 1 seeks to capture the local economic context in which CSA Catapult operates and shows elements of the recent regional economic context, the impacts of this, and then the intersection between these impacts and how the general activities of CSA Catapult might create opportunity on the right hand side of Figure 1.

Critically here CSA Catapult forms an important part of the CS cluster is South Wales as a whole. While it operates nationally, a considerable number of its R&D collaborations are with businesses which are part of the CS cluster including Microchip (Caldicot), IQE (Newport), KLA (Newport), Microlink Devices (Swansea) and Nexperia (now Vishay International at Newport). CSA Catapult provides businesses and higher education institutions within the CS cluster with a stream of research services. Moreover, the Catapult is part of the CS Cluster which has been shown to support close to 2,700 jobs in Wales (3,600 in the UK as a whole), and supports close to £543m of UK GVA.

Figure 1: CSA Catapult: a very local context?

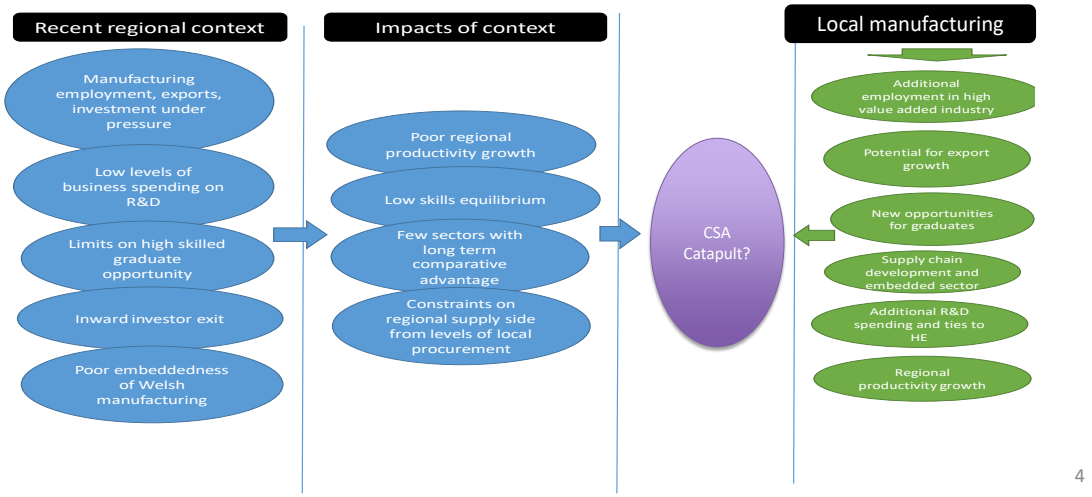
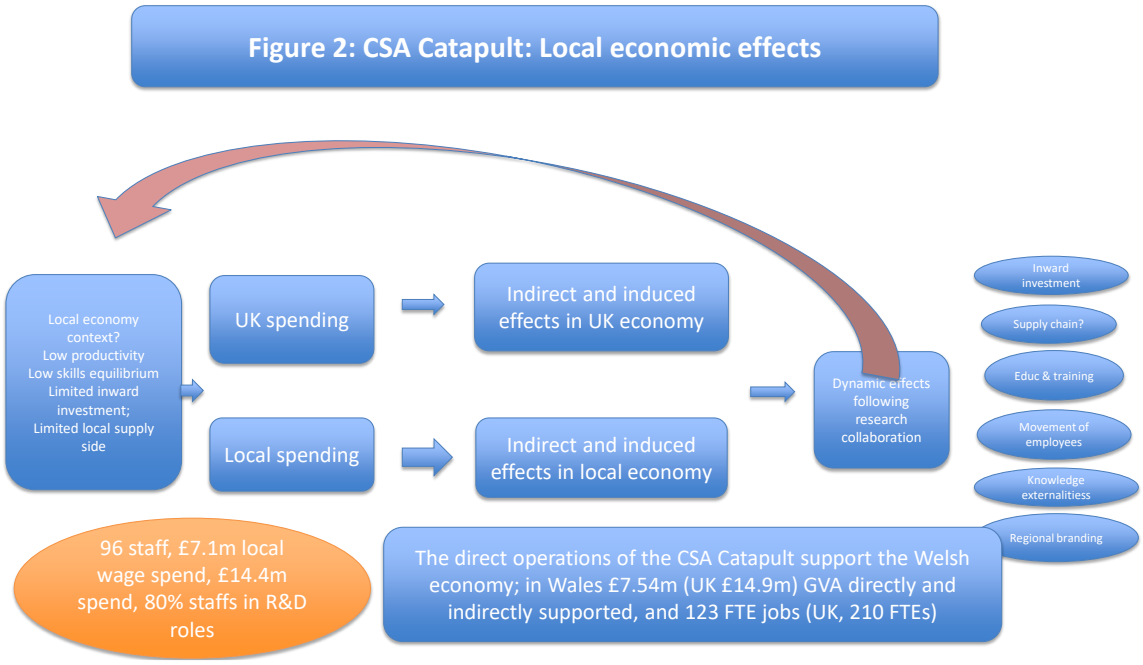


Figure 2[7] reveals that CSA Catapult activities form a significant component of the CS cluster in Wales. For example, Catapult in 2023 employed 96 people and with wage spending of over £7.1 m in South Wales[8], and with the vast majority of staff in R&D roles. Even through its spending alone CSA Catapult is estimated to support £14.9m of UK GVA and 210 jobs, and this is before a series of more dynamic effects associated with the Catapult activity in encouraging local value chain development, education and training, knowledge creation which link through to development impacts in the local economy.



2.4 Approach

Our review of the evaluation issues, prior literature on the effects of R&D activity, coupled with knowledge of the local economic context in which CSA Catapult works suggests that the main questions that need to be addressed are as shown in Figure 3.

CSA Catapult has provided information in terms of:

- CSA Catapult revenues from commercial (where CSA Catapult is paid by a client for a piece of R&D work or where another organisation has won funding and CSA Catapult are subcontracted to undertake part of the work) and collaborative

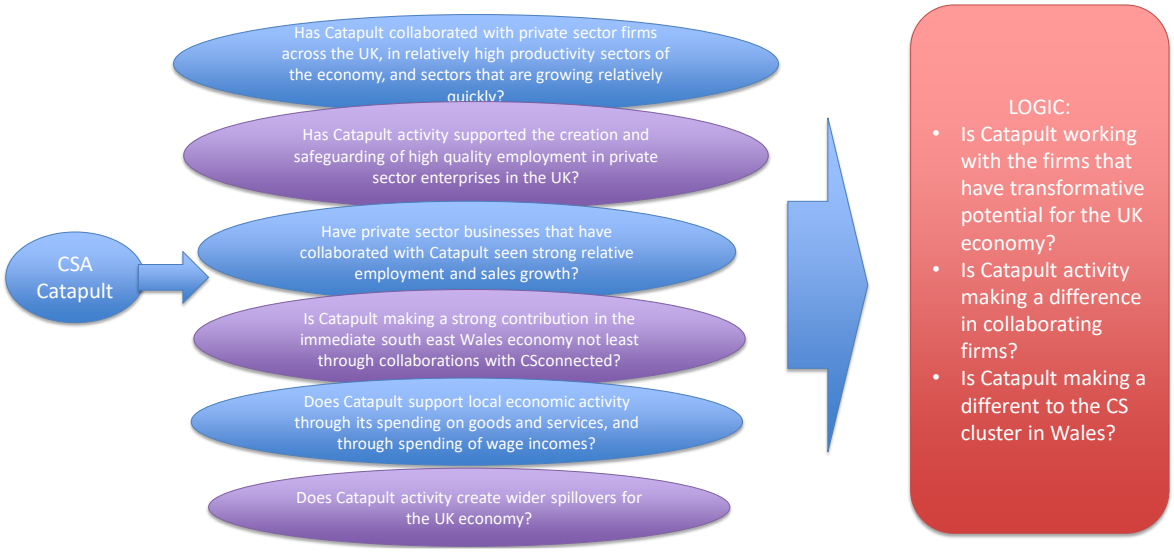
[7] Based on analysis of CSA Catapult return as part of CSconnected annual reporting. See https://csconnected.com/media/trijjr3n/csconnected-sipf-weru-annual-report-2023.pdf

[8] It is important to recognise here that selected of this information in Figure 2 is an estimate for 2023 and comes from the CSA Catapult return to the annual CSconnected survey. Then numbers here might differ from what is in statutory company accounts as this could reflect a different time period. It is also noted that employment can fluctuate through the year.

(where CSA Catapult is part of a consortium that has won funding for collaborative R&D).

- How these revenues are subdivided between areas such as packaging, photonics, power electronics, RF and microwave.
- Employment created and safeguarded by activity, and by R&D collaborator.
- Information in respect of the direct activity supported by CSA Catapult in terms of employment, sales, and wage spending in South East Wales.
- Individual project details in terms of dates of activity and collaborators.

Figure 3 Summary logic of the approach and questions



In seeking to answer the questions posed in Figure 3 we have used a series of data sources in combination with data from CSA Catapult.

First, using data from Companies House we have identified information in respect of 129 private sector collaborators of CSA Catapult. This exercise was not without problems, not least in matching the names of private sector collaborators with Companies House records, and with some business records unavailable. However, this data is useful in examining the recent performance of firms following their collaboration with CSA Catapult (although with some issues here where firms have had multiple collaborations with CSA Catapult in different years), and to examine the industries in which private sector partners operate and their productivity characteristics. This Companies House data was also used to examine the expected effects of employment supported by CSA Catapult collaboration with each firm.

Second, data from the ONS Business Register and Employment Survey is used to gain insight into the general productivity characteristics of the private sector firms with whom CSA Catapult has collaborated and to provide estimates of the Gross Value Added per Employee where employment has been created or safeguarded.

Third, data from the Annual CSconnected Survey to examine the effects of CSA Catapult in a South Wales context.

3 CSA Catapult activity headlines

In this part of the report we describe some of the R&D headlines reported by CSA Catapult for the period 2019-May 2024.

CSA Catapult has been involved in 156 separate projects over this period and with the largest number of projects involving R&D. Critical here given the aims and objectives of CSA Catapult is how far the projects involve private sector businesses. Figure 4 reveals that projects have engaged with a total of 215 SMEs and 40 large firms (it is important to note here that some firms have engaged with more than one project area; the total of businesses collaborated with is an estimated 149). Projects have also engaged with higher education institutions. In terms of departmental areas within CSA Catapult the key areas of engagement have been in photonics and power electronics.

Figure 4 Projects by CSA Catapult Departmental Area 2019 - May 2024

	Projects	SMEs	Large firms	Higher education	International
Internal projects	13				
Commercial	1	2	1		
DER	1	10		6	
Electronics	2			1	
Packaging[1]	17	15	3	1	
Photonics	38	59	14	30	
Power Electronics	54	91	18	20	3
RF/Microwave	22	29	4	6	2
Other and Cross Catapult Projects	8	1		1	
Grand Total	**156**	**207**	**40**	**65**	**5**

[1] Note that there are packaging components on other projects such that this row of information underestimates the significance of packaging activity.

Figure 5 highlights the nature of 81 collaborative projects by their impact headlines. It is noted here that projects could have more than one impact. Figure 5 reveals headline impacts in terms of technology acceleration, supply chain improvement and product development as well as a series of projects that have either grown or safeguarded employment (we consider these latter separately later). For some projects impacts are yet to be recorded.

Figure 5 CSA Catapult collaborative projects 2019-2024 by impact classification

Impact classification	Number of projects
Technology acceleration	45
Build supply chain	28
Product development	27
Identify new market opportunities	18
Job creation/safeguarding	16
Extending UK manufacturing	11
Cost reduction	10
Developing new SME capabilities	9
Skills development	9
R&D growth	8
Patent applications	3
Other	19
Total projects reporting impacts	**81**

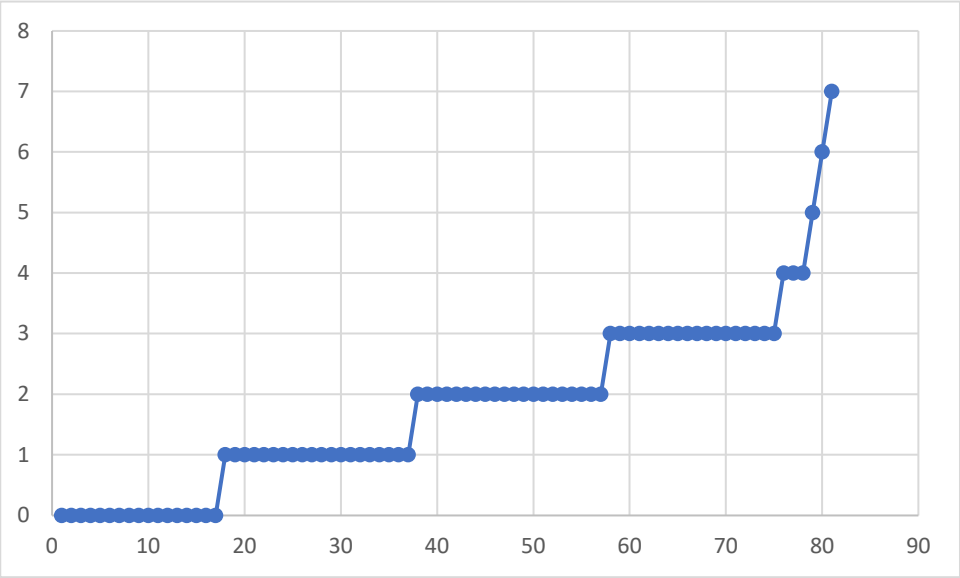
Since 2019, it is estimated that a total of 31 CSA Catapult projects have led to either new job creation or safeguarded employment; 29 CSA Catapult projects have led to the estimated creation of 1,325 full-time equivalent (FTE) jobs, while 19 projects have safeguarded an estimated 3,393 FTE jobs. It is important to recognise that other CSA Catapult projects might have also worked to improve long term employment prospects in businesses where there is new innovation activity.

A key objective of CSA Catapult R&D collaboration is that businesses and institutions see an improvement in the technological readiness levels of products and services. Figure 6 reveals the end TRL level achieved by projects in which CSA Catapult has been engaged. The average improvement in TRL level across the 79 projects where data was available was 1.8 (i.e. estimates from subtracting start TRL estimate form final TRL estimate, but note that some projects do not see an increase in TRL). Figure 7 reveals for the 79 projects the spread of increases in TRL levels with 6 projects increasing their TRL levels by 4 or above.

Figure 6 TRL improvements linked to CSA Catapult projects

TRL level	End TRL level achieved
1. Basic principles observed	
2. Technology concept formulated	1
3. Experimental proof of concept	9
4. Technology validated in lab	21
5. Technology validated in relevant environment	9
6. Technology demonstrated in relevant environment	15
7. System prototype demo	16
8. System complete and qualified	6
9. Actual system proven in operational environment i.e. competitive manufacturing	4
Total	81

Figure 7: Improvements in TRL Levels; CSA Catapult involvement projects (n=81)



Finally here Figure 8 shows the revenue achieved by CSA Catapult in terms of its collaborative R&D and other projects. This reveals a strong increase in revenues since inception of CSA Catapult and with 2023-24 external revenues at close to £14m over the whole period. It is important to recognise here that this does not include project revenues that are associated with research contracts that have been won but that will provide revenue for CSA Catapult in future periods.

Figure 8: CSA Catapult revenues from collaborative R&D projects and Internal project R&D spend 2019/20-2023/24

	Projects active in year	External revenue £000s	Internal R&D spend	External revenue Annual growth %
2019-20	7	481.5	na	
2020-21	29	1373.4	na	185.2
2021-22	43	3189.2	106.8	132.2
2022-23	63	4113.4	303.0	30.0
2023-24	81	4522.2	964.4	9.9
Total		13679.7	1374.2	

4. CSA Catapult: Selected impacts

4.1 Impact questions

In this part of the report we seek to answer a series of questions which speak to the economic impact of CSA Catapult activity, and seek to pick up on the significance of activity to date. The key questions addressed and following from the earlier review are as follows:

- Is CSA Catapult working with SMEs and large businesses that are in productive and fast growth parts of the economy?
- Is CSA Catapult working with firms throughout the UK economy i.e. is there involvement with businesses in different parts of the UK economy?
- Have firms that have engaged with CSA Catapult in collaborative and commercial R&D projects seen strong performances since this engagement?
- Where CSA Catapult projects have led to job creation and safeguarding, are these good quality employments and what is the impact of this on the UK economy?
- What is the impact of CSA Catapult in its local economy setting in South East Wales?
- What are the wider economy effects associated with the R&D projects occurring with CSA Catapult partners?

4.2 Is CSA Catapult working with leading UK business sectors?

We were able to identify 129 large firms and SMEs that have had engagements with CSA Catapult since 2019 using the Companies House database (search in June 2024). Note this is lower than the total number of firms and organisations through which there has been collaboration (i.e. an estimated 176, of which an estimated 149 are private sector firms, with the remainder being other Catapults and Academic institutions); this is because within the software employed it was not always possible to match firm names provided by CSA Catapult with company accounts of firms on the database. This can also be down to small differences in spelling but also with some firms having gone out of business. These 129 firms were connected with 253 total R&D and other collaborations involving CSA Catapult, and with some of these projects going on over multiple years. The average number of projects that firms were involved with was just under 2, but was as high as 6 in several cases.

Figure 9 reveals the firms with whom CSA Catapult has engaged by their main industrial classification. The first thing to observe here is that many of the firms are in sectors which form part of the definition of advanced manufacturing activity. For example, CSA Catapult has collaborated with 23 firms who are within the computer, electronic and optical products sector (SIC 26) and here gross value added per employee is close to £114,000. It is important to recognise that this is the SIC 26 average for GVA per employee but with a strong expectation that CSA Catapult is collaborating with businesses with higher levels of GVA per employee in terms of the manufacturing of semiconductors, and compound semiconductor materials. Figure 9 also reveals high levels of activity with businesses and institutions classified as R&D.

The final column of Figure 9 reveals strong growth in this sector of the economy between 2019-2022 (2022 being latest detailed employment figures available). In terms of the context of CSA Catapult collaborations it should be understood that these have occurred over a period of intense challenges for UK manufacturing and services sectors as a result of Covid-19 and then the cost of living crisis. Figure 9 reveals that a series of industries with whom CSA Catapult has collaborated have actually managed to grow employment through these challenging times. Critically, Figure 9 shows that CSA Catapult is working with those sectors of the UK economy where there are expectations of relatively fast productivity growth. The manufacturing sectors in Figure 9 are classified as being R&D intensive, and firms within advanced manufacturing in particular are among the most important exporters of goods form the UK economy.

Figure 9 Industries of firms with whom CSA Catapult has collaborated 2019-2022

SIC classification	Number of firms & institutions	Est GVA per employee 2021 average £103K	Employment growth 2019-2022 UK average 3.0%
26 Manufacture of computer, electronic and optical products	23	£113,648	-6.2%
27 Manufacture of electrical equipment	12	£95,206	-5.6%
28 Machinery and equipment	2	£111,331	2.3%
29 Manufacture of motor vehicles	5	£86,579	-13.3%
30 Other transport equipment	2	£93,895	-5.2%
32 Other manufacturing	6	£66,321	-5.3%
62 Computer programming	8	£75,178	7.7%
70 Management consultancy	5	£28,959	8.2%
71 Architecture and engineering	12	£44,508	-2.3%
72 R&D	16	£105,057	19.2%
74 Other professional services	14	£48,783	-4.1%

SIC classification	Number of firms & institutions	Est GVA per employee 2021 average £103K	Employment growth 2019-2022 UK average 3.0%
Other	24	na	na
Total	129	na	na

4.3 Geographical spread of CSA Catapult engaged businesses

CSA Catapult exists to support businesses and institutions across the UK. It is impossible to accurately gauge the geographical location of the underlying funded R&D activity. Some will occur on CSA Catapult premises while in other cases it will occur in the premises of partners. However some inference on the geographical spread of the immediate benefits of the collaborations can be gained by looking at the main locations of the beneficiary businesses. Some of the beneficiaries are very large firms with London based headquarters, but Figure 10 reveals that beneficiaries are spread throughout the UK but with a focus of firms in South East, South West and London, and then Wales and Scotland. Relatively higher numbers of beneficiary firms in East, Wales and Scotland, given the smaller size of these regions compared to London and South East, reflects the stronger presence of compound semiconductor businesses in these areas. For example, all of the CS cluster firms and organisations in the South Wales economy have engaged with CSA Catapult at some point since 2019.

Figure 10 Geographical spread of CSA Catapult collaborations

Region of business	Number of businesses
North east	7
North west	3
West Midlands	8
East Midlands	2
South West	12
South East	24
London	20
East	15
Yorks & Humber	4
Wales	11
Scotland	12
Northern Ireland	4
Other/not known	7

4.4 Employment creation and impact

Many of the projects with which CSA Catapult has engaged have no explicit employment created or safeguarded dimension. This is not to conclude that successful projects will have no longer term employment and output consequences but rather that such outcomes are not revealed in data held by CSA Catapult. However, some CSA Catapult projects have estimates of jobs created and safeguarded. In large measure these employment outcomes are outside the direct employment supported by CSA Catapult which is considered below.

Figure 11 shows the estimates of employment either created or safeguarded from CSA Catapult R&D collaborations. It was not possible from the data to identify precisely when this employment was created or safeguarded. We allocate jobs to sectors here based on the industry sector of the first stated partner in each R&D collaboration. In total R&D collaborations are connected to an estimated 1,325 jobs created and close to 3,400 jobs safeguarded. Much of the jobs safeguarded totals are within R&D and Other professional services. Jobs created are concentrated in Computer, electronic and optical products, Motor vehicles (although in large measure this is in relation to automotive components), Engineering and Other professional services.

Figure 11 also provides an estimate of the gross value added associated with this employment. Here we employ sector averages of GVA per employee derived from ONS estimates of GVA by industry for 2021 divided by an estimate of employment in the industry from the ONS *Business Register and Employment Survey* (BRES). The total GVA supported by this employment is close to £340m. The final column also provides an estimate of the direct and indirect GVA supported by each employment i.e. taking into account how activity in one sector supports activity in other sectors of the UK economy through supply chain effects. Estimates here are informed by GVA multipliers in the UK Input-Output table framework.[9] Then in total the employment could be directly and indirectly connected with a little over £600m of UK GVA.

Figure 11: Estimated employment outcomes from CSA Catapult R&D collaborations

SIC classification	Jobs created	Jobs safeguarded	GVA supported direct estimate	GVA total supported in UK estimate
26 Manufacture of computer, electronic and optical products	262	111	£42.4m	£61.1m
27 Manufacture of electrical equipment	31	126	£14.9m	£24.9m
28 Manufacture of machinery and equipment	6	24	£3.3m	£5.5m

[9] See UK input-output analytical tables: product by product - Office for National Statistics (ons.gov.uk)

SIC classification	Jobs created	Jobs safeguarded	GVA supported direct estimate	GVA total supported in UK estimate
29 Manufacture of motor vehicles	195	87	£24.3m	£54.9m
30 Manufacture of other transport equipment	3	32	£3.1m	£6.1m
61 Telecommunications	20		£3.0m	£4.1m
71 Architecture and engineering	405	2	£18.0m	£33.8m
72 R&D	106	1000	£116.2m	£194.1m
74 Other professional services	254	2004	£110.2m	£223.7m
Other	43	7	£3.4m	£4.9m
Total	1325	3393	£338.8m	£613.1

4.5 CSA Catapult and the CS Cluster in SE Wales

While earlier parts of this report highlighted the UK geographical context of CSA Catapult activity it is also important to comment on the more local context in South Wales where CSA Catapult is a key member of the CS cluster. CSA Catapult has had a role in the evolution of the CS cluster in the local economy. It has collaborated with each private and public organisation within the cluster. Separately CSA Catapult employs 96 people, and with an estimated 80% of staff in R&D facing roles. Figure 12 reveals the growth of employment in CSA Catapult itself set alongside the economic contribution of the CS cluster in Wales as a whole. Over the period 2019-2023 employment in CSA Catapult has grown from 62 to 96, and this makes up an estimated 5.3% of CS cluster employment in South Wales. The cluster as a whole has seen its GVA more than double in the period 2019-2023 and it currently employs close to 1,800 people.

Figure 12: CSA Catapult activity and the CS Cluster in Wales

	2019	2020	2021	2022	2023
CSA Catapult Headcount estimated FTE	62	78	89	89	96

	2019	2020	2021	2022	2023
% activity is South Wales CS cluster	4.9%	5.5%	5.6%	5.1%	5.3%
CS cluster employment	1,259	1,407	1,602	1,737	1,773
CS cluster direct GVA	£116.9m	£121.3m	£193.6m	£212.2m	£265.2m

Source: Data in this table derived from CSconnected Annual Report series. Numbers employed here in the first row of the table might vary from what is reported in statutory accounts of CSA Catapult because of different time periods employed in the Annual Report series i.e. calendar versus financial years, and with numbers here also in terms of full time equivalent employees.

Something of CSA Catapult contribution to the evolution of the CS cluster can be understood with reference to Figure 13. This reveals a total of 20 CSA Catapult collaborations involving public and private sector elements of the CS cluster in Wales and with an estimated 650 jobs either created or safeguarded. Perhaps more critical here is the actual/expected TRL changes, and with 12 projects with expectations of TRL levels of 6 or above by the end of the project.

Figure 13 CSA Catapult Collaborations in Wales

Start of project	Type of project	Cluster member	TRL change start to end project	Jobs created/safe guarded
2019	R&D	Swansea University	4-7	100
2019	R&D	Microsemi (see note below)	4-6	90
2020	R&D	Microchip (see note below)	2-4	95
2020	Commercial	Cardiff University	2-2	
2024	R&D	SPTS	3-4	
2020	R&D	Cardiff University	2-4	
2019	R&D	Microsemi, CSC	2-8	224
2020	Commercial	Nexperia	4-5	
2019	R&D	CSC, Swansea Uni, Nexperia, SPTS	4-8	100
2019	R&D	Microchip	5-7	30

Start of project	Type of project	Cluster member	TRL change start to end project	Jobs created/safe guarded
2021	R&D	Microlink Devices	3-5	5
2020	R&D	CSC, ICS, Microsemi, Cardiff Univ. Microchip, IQE	4-7	
2022	R&D	Cardiff University	3-4	7
2021	R&D	Cardiff Univ, IQE	3-5	
2020	R&D	CSC, IQE, Microchip, Swansea, Cardiff Univ, SPTS	3-6	
2020	R&D	CSC, IQE, Microchip, Swansea, Cardiff Unic, SPTS	3-6	
2020	R&D	Nexperia, Microlink, Microsemi, Swansea Univ	3-6	
2020	R&D	CSC, Cardiff Univ, Nexperia, SPTS, IQE	3-6	
2021	R&D	Cardiff Univ, CSC, Nexperia, IQE, SPTS, Microchip, Rockley	3-8	
2019	R&D	Cardiff, Univ, CSC, Nexperia, IQE, SPTS	3-6	

Note: In May 2018 Microchip acquired Microsemi; the use of Microsemi or Microchip reflects the name as recorded in internal CSA Catapult recording.

The collaborative activities involving CSA Catapult and the CS cluster is one factor that is better embedding the cluster into the local economy. The importance of this collaborative R&D activity is also of relevance given the very low levels of business expenditure on R&D in the Welsh economy.

4.6 Performance of firms who have collaborated with CSA Catapult

There are a series of difficulties in examining the performance of businesses with whom CSA Catapult has collaborated. In the first place it was not possible to identify financial records of all of the businesses that CSA Catapult has collaborated with since 2019. Second, while 129 business records were identified, there were some of these firms where financial data was not available in sufficient detail because of their small size. Third, there are some cases where the first project involving CSA Catapult and the business was in 2023 and then financial records were not available for the years following the collaboration. Finally, the timeframe for CSA Catapult collaborations covers the Covid 19 period when business performance and output dipped severely during 2020 and into 2021.

Given the large number of projects that started in either 2019 or 2020 it would be particularly difficult to draw any inference on the impacts of R&D collaborations separately from Covid-related effects. Ideally, for this type of analysis a control group would be developed and then the performance of the firms with which CSA Catapult had collaborated would have been compared to the performance of a control group. This type of analysis would require a much larger number of firms and a longer time-cale of financial results available to compare.

These issues notwithstanding some limited analysis are provided in Figure 14. This provides information in respect of sales and employment growth in collaborating firms in the years following the inception of the R&D project with CSA Catapult. Note here we report median as opposed to mean figures in terms of growth with the mean affected by very large outlying numbers in terms of sales growth such that the median is a better indicator of central tendency. For context the total underlying employment figures at t+1 for R&D collaborators were close to 313,000, while the underlying sales figures at T=1 were close to £200bn. Some of the R&D collaborators of CSA Catapult are among the largest UK publicly quoted businesses.

Figure 14 reveals that median sales growth in the year following the R&D collaboration was 1.6%, then 11.6% after two years and 5.1% after three years. Recall that many of the R&D collaborations started in 2019 or 2020, which meant the many of these firms would have seen sales severally impacted by Covid-19 in both 2020 and 2021 financial years. The employment growth numbers are particularly encouraging here showing 4.6% growth in year following collaboration, then 6.5% but then falling to 1.7% in the third year after collaboration. Note here that the number of firms falls very quickly with less data available the further one gets away from the first year of engagement.

Figure 14. Performance of businesses involved with CSA Catapult R&D collaborations

	Sales growth %			Employment growth %		
	T+1	T+2	T+3	T+1	T+2	T+3
Count firms	41	35	23	77	61	43
Mean	4. 7	174.1	4886.0	34.7	11.8	7.3
Median	1.6	11.7	5.1	4.6	6.5	7.7
Min	-70.7	-98.7	-36.5	-75.7	-58.3	-83.6
Max	353.3	5731.4	112285.7	466.0	142.9	69.0

We do not recommend that these sorts of numbers are used to show the effectiveness of R&D collaborations undertaken by CSA Catapult. Ideally this type of analysis would need a much longer timeframe. There is also the issue that sales and employment levels in collaborating firms are subject to a large level of influences and isolating the impacts of one set of R&D collaborations would be very difficult. Caution is also needed here because at the time of writing of this report some projects had not moved to the highest TRL levels which would be more likely observed in business performance.

4.7 Impact of CSA Catapult research

To conclude here we provide some very broad estimates of the scale of the productivity impacts connected with the R&D activity in which CSA Catapult has been engaged over the period 2019-2023. The review in Section 2 of this report showed prior estimates of the impact of research spending on total factor productivity in industry. In what follows we make some broad assumptions:

- That the external R&D revenue and internal R&D project expenditure was a little over £15m over the period 2019-2023 (see Figure 8) and with this being an estimate of CSA Catapult R&D activity.
- That for the purposes of estimation that this £15m occurs in one period rather than being subdivided evenly over the period 2019-23.
- We ignore here for our estimation that CSA Catapult contribution is typically part of larger projects; rather we are seeking an estimate of the value of CSA Catapult contribution. This means our estimate here would be conservative, particularly where CSA Catapult contribution to projects is deemed critical i.e. the large research project would not have occurred without CSA Catapult input.

The review of the literature suggested that every £1m of R&D spending is connected to between 0.13 and 0.20 change in total factor productivity (elasticity values). The elasticity here varies depending on whether R&D is publicly or privately funded, and in the case of privately funded R&D with some expectation that businesses internalise more of the benefit. It is accepted here that some CSA Catapult R&D collaborations are publicly funded and some privately funded. For the purposes of estimation we take an elasticity of 0.13 as a lower bound and 0.20 as an upper bound.

With these broad assumptions £15.054m is the total R&D activity assumed then a lower bound on elasticity would be £1.95m improvement in total factor productivity and an upper bound would be £3.0m. If it is assumed that these productivity increases are sustained into perpetuity then if discounted by the HM Treasury Green Book discount rate of 3.5% this would result in a long term benefit of between £55.7m and £85.7m. It is important to recognise that this is a broad estimate and would change in line with the underlying assumptions. However, it provides a guide to how far CSA Catapult research activity could have wider UK impacts in terms of sustained total factor productivity improvements.

5. Conclusions

This high level report examining the effects of CSA Catapult R&D collaborations serves to reveal some of the difficulties in making connections through to economy wide effects. At one level the outcomes from R&D can take many years to work through into firm performance and then with issues in respect of isolating the effects of R&D collaborations among the multitude of factors that affect sales and productivity growth. While there has been very good work in the UK to understand the impacts of Catapults, applying methods in wider UK studies to CSA Catapult case is problematic because of the small number of firm observations available and the difficult economic circumstances occurring over the 2019-2024 period.

Notwithstanding, this report highlights the breadth of business with whom CSA Catapult has been collaborating and confirms that support is being given to parts of the economy that are highly productivity, more likely to be R&D intensive, and represent some of the UK's main exporting sectors. The report also speaks to the geographical breadth of activity revealing how funded activity support firms across all UK regions. Critically, however, CSA Catapult has been shown to be an important part of the CS cluster in South Wales and has supported R&D activity in this nationally important cluster.

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