Centre for Connected
& Autonomous Vehicles

International Perceptions of the UK's Connected and Automated Mobility Sector: Market Study

Final Report

June 2021

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Executive Summary

The Centre for Connected and Autonomous Vehicles (CCAV) has commissioned this study to gather international perceptions of the UK's Connected and Automated Mobility (CAM) sector

The contents of this report were correct at the time of writing.

This study has collected and analysed perceptions from over 240 automotive sector stakeholders in Germany, the US, South Korea, Japan, and Israel to help to inform UK policy, investment, trade, and international engagement strategy in respect of our Connected and Automated Mobility capabilities and industrial strategy. The study was delivered by:

- **Developing a baseline view of the UK CAM sector's marketed capabilities** through desktop research and interviews of stakeholders from UK Government, public bodies, and industry associations.

- **Gathering international perceptions of the UK CAM sector** through an anonymous survey of 200+ senior decision-makers from four target markets (Germany, Japan, South Korea, and the United States).

- **Enriching the above analysis through in-depth qualitative interviews** of 45 senior decision-makers from the above markets as well as Israel, and one from France.

Responses to the study demonstrate that there continues to be international interest and involvement in the UK as both an investment destination for sourcing of CAM products and services

- **Investment destination: Over two-thirds of survey respondents whose companies are investing internationally have some form of investment in the UK** (higher for South Korea and Japan, and slightly lower for the US and Germany). **60% of those not investing in the UK would consider it in the next 10 years.**

- **Source of CAM products: 69% of survey respondents who are procuring internationally are sourcing from the UK CAM market**, with 67% of those not procuring internationally saying they would consider it within 10 years.

There are areas of both alignment and divergence between the UK's CAM industry's priorities and demands from the international market

- **Strengths:** The UK's **R&D capabilities** and **skills ecosystem** were emphasised as key strengths by both the international market and UK CAM sector, with niche offerings such as Sensors, Autonomous Control Systems, Artificial Intelligence/Machine Learning (AI/ML), CAM pods, and Computer chip architecture being highlighted. Use cases of CAM in **passenger vehicles** and **public transport** were also emphasised as specific strengths by the international market.

- **Weaknesses: Cybersecurity and modelling/simulation services** which were viewed as strengths by the UK market did not emerge strongly in international preferences. In respect of use cases, while UK stakeholders highlighted freight and logistics as important areas, international participants did not see long-haul logistics as a strength though many rated first and last mile delivery quite highly. International and UK stakeholders both considered the UK's **relative lack of manufacturing capabilities** to be a barrier to scale.

- **Drivers:** International investors said that their investment into the UK is driven by a perception of the country's high **innovation potential**, an **expectation of high growth** in UK CAM, and an expectation of a high degree of **end user or customer acceptance** of CAM among the UK population. Meanwhile, international procurers emphasised **availability**, **quality**, and the clarity and flexibility of the **policy environment**. Some of these drivers resonated with UK stakeholders who felt that the UK's R&D, software, and university capabilities have helped create high-quality niche offerings (like the ones noted above), and that the UK has emerged as an early policy leader.

- **Barriers:** International investors and procurers who are not currently investing in or procuring from the UK said that they were held back by a **lack of information** and insight into UK CAM, a lack of cost-effective or strong **pre-existing relationships**, a perception that growth will be impeded by **high costs** (for example, of labour), or a lack of **availability** of specific products. This view was broadly in alignment with UK stakeholders, who felt that international engagement and marketing of CAM has been insufficient, partly due to a lack of funding in recent years. UK and international stakeholders also agreed that a strong focus on the electrification agenda was preventing CAM investment. Interestingly, **while UK stakeholders were concerned about the UK's exit from the European Union being an impediment to investment and sourcing, international survey respondents did not rate this as a significant barrier.**

- **The value of government funding in CAM innovation:** UK stakeholders emphasised past funding as a key driver of previous investment, and the decline in funding in recent years as a barrier to future investment. However, there were mixed messages from the international market on this subject. On the one hand, it emerged as one of the top three drivers of future investment among survey respondents, and some interviewees highlighted that they would be encouraged to invest more in the UK if it offered more incentives like China and other markets. On the other hand, those who have already invested in the UK did not rate the availability of government funding as a key driver for them. This could potentially be because those who have already invested undervalue the importance of funding post facto.

- **The value of the UK's testing infrastructure:** UK stakeholders felt that the UK's testbeds are an important driver of investment into the UK, and a key offering for the international market. However, again, there were mixed views from the market. On the one hand, a significant proportion of survey respondents, particularly for the US and Japan (40% and 38% respectively) are sourcing testbed services from the UK. On the other hand, survey respondents did not rate testbeds as a strong USP for the future from a sourcing perspective, and did not view it as a strong current or future opportunity for investment in the UK. It would, however, be premature to conclude that the testbeds are not a valuable proposition because, as described later, the relatively low ratings could potentially be due to a lack of awareness since the international market was less aware of Zenzic and Testbed UK than other sources of CAM information. After being informed of Testbed UK, some interviewees said that this would be a valuable proposition for them.

  As a driver of investment, a third of respondents (compared to half for other physical and communications infrastructure), consider testbeds important, although the US market, as an outlier, rates testbeds more highly. This could be because European road infrastructure is markedly different from the US' road infrastructure, and the UK testbeds offer a unique testing environment for the local market.

International participants shared views on their current and desired engagement with the UK CAM sector

Three-quarters of survey respondents said they would like to receive more information on the UK CAM sector and **68% want this to be through official reports or trade shows**.

Both survey and interview respondents had **varying knowledge about the different sources of UK CAM information** that they were asked about, although most respondents said they were most familiar and knowledgeable with CCAV and UK trade shows, and less so about Zenzic, gov.uk and UK policy initiatives.

29% of survey participants said they found the quality of information they have consumed about UK 'CAM' to be 'very informative and insightful', indicating that there is an **opportunity for improvement in messaging.** The information they would most like to see are details of CAM-related **infrastructure**, information on the **skills base**, and comparisons with **other countries' CAM sectors**.

Overall, the UK stakeholders' perceptions of engagement efficacy are aligned with those of international stakeholders, with both emphasising the need for **more engagement and marketing to promote UK CAM** (for example, Zenzic and Testbed UK) and for **a coherent, joined-up CAM strategy**.

Based on the findings of the report, the following points stood out for the UK CAM sector as considerations for action

Key pillars of CAM investment and sourcing
(Note: Country-specific insights are included in the body of the report)

Technology and Innovation	■ Continue to invest in and promote CAM products that are viewed as the UK's current and future strengths (including R&D capabilities, Sensors, etc.) especially since these are also popular products internationally. ■ Deploy CAM capabilities in specific use cases like passenger vehicles and public transport ■ Conduct a mapping exercise to compare UK skills against competitor markets ■ Examine the divergence between UK and international perceptions ■ Establish strategic partnerships with high-value targets in other markets ■ Include other markets (e.g. China and Israel) in the analysis ■ Consider how best to attract high-value talent from other markets
Policy and regulation	■ Continue to monitor regulatory developments (e.g. in Singapore) and be ready to adapt to keep the UK at the forefront of regulatory innovation ■ Market the UK's favourable policy environment more strongly ■ Identify potential financing partnerships between the public and private sector ■ Improve the tools and guidance available to roads authorities to support trialling and deployment ■ Consider providing tax and other fiscal incentives to international investors
Infra-structure	■ Develop a clear value proposition for Testbed UK and market it more strongly in international engagement ■ Critically assess whether future Government investment in Testbed UK will improve investment into, and sourcing from the UK

	▪ Develop a targeted investment and trade strategy to identify areas of future strategic value for CAM infrastructure investment (i.e. "build versus buy")
	▪ Consider establishing a 'CAM specialist zone' targeting international developers and investors (e.g. in and around Freeports, giving consideration to fiscal incentives per above)
Customer acceptance	▪ Ensure that regulation remains safety-focused to maintain positive consumer acceptance
	▪ Ensure that successful projects and initiatives are promoted to the public
	▪ Highlight end user acceptance as a key differentiating feature of the UK CAM market where applicable
	▪ Evaluate how best to link CAM with other significant initiatives, especially Net Zero 2050 and the decision to end the sale of new petrol and diesel cars and vans by 2030

Key considerations for future international engagement

(Note: a country-by-country breakdown is included in the body of the report)

Channels	▪ Expand the UK CAM sector's level of engagement with all markets, particularly through Government channels and trade shows
	▪ Ensure that industry and consulting reports have correct and up-to-date data
	▪ Ensure that developments in UK CAM are circulated to reputable news sources
	▪ Engage with UK-based sales teams of large international organisations to feed relevant information to company headquarters
Focus areas	▪ Emphasise R&D and Engineering capabilities, AI/ML software, Autonomous Control Systems, and Sensors
	▪ Improve the value proposition and marketing of Zenzic and Testbed UK
Messages	▪ Develop and release a clear 'UK CAM strategy' setting out future plans and milestones for regulation, technology and innovation, acceptance and use cases
	▪ Ensure that marketing materials are aligned, coherent, and consistent across UK stakeholders
	▪ Develop clear messaging around the impact of UK's departure from the EU, cost of doing business with and in the UK, and investment support initiatives
	▪ For investors, provide information on innovation strengths and potential, availability of infrastructure, details on projected growth, details on end user acceptance of CAM within the UK, linkages with the offering on Zero Emission Vehicles, a 'how-to' guide on establishing new relationships in the UK; and, details of government funding available to attract innovation.
	▪ For procurers, provide information on the suite of available CAM offerings in the UK, information about quality, reassurance about costs, clarity regarding policy; and, a how-to guide for establishing new supplier relationships.

Key messaging and framing for each market
(Note: a more detailed country-by-country breakdown is included in the body of the report)

Germany	▪ Include messaging on the strength of the **skills base**, details on **infrastructure**, and information on **Government funding**.
	▪ **For investors specifically,** also include information on **innovation potential** and **testbeds**.
	▪ **For procurers specifically**, also include information on the suite of UK CAM offerings and policy.
Japan	▪ Include messaging on **infrastructure availability**, strength of the **skills base**, and **industry size and growth** across the board. (The last is particularly important as potential Japanese investors hold back because they do not see the potential for returns).
	▪ **For investors specifically,** include information on **innovation potential** and **clarity of the policy regime**.
	▪ **For procurers specifically**, include information on the suite of UK CAM offerings and quality.
South Korea	▪ Include messaging on **infrastructure availability**, strength of the **skills base**, and **comparisons with other markets (e.g. notable strengths of the UK CAM sector compared to other markets)**.
	▪ **For investors specifically,** also include information on **innovation potential**.
	▪ **For procurers specifically**, also include information on the suite of UK CAM offerings, cost of doing business, and quality.
USA	▪ Highlight the benefit of investing in the UK as a way of circumventing US regulation and consequently enabling organisations to attempt to accelerate development of their products and services (as Kittyhawk have achieved by investing in the NZ market).
	▪ Include messaging on **industry size and growth, infrastructure availability**, and **comparisons with other markets**.
	▪ **For investors specifically,** also include information on **innovation potential**.
	▪ **For procurers specifically**, also include information on the policy environment and quality of offerings.

The perceptions of the international market as covered in this study will be a critical input to the UK's wider industrial strategy for the CAM sector since they indicate what products and offerings the market values, what factors drive investment and sourcing, and what they perceive as the UK's strengths, weaknesses and opportunities. However, to definitively answer questions around where the UK should invest, and what its competitive or comparative advantages are in reality, these findings will have to be juxtaposed against market research and analysis such as comparative trade and FDI flows.

1 Introduction

1.1 Purpose and objectives of the Study

The global market for connected and automated vehicle (CAV) technology is forecast to be £650 billion by 2035; with the UK market expected to capture approximately 6% of this, at £41.7 billion[1]. Should this opportunity be realised, there is a potential for over 20,000 new jobs in the UK automotive sector by 2030, with 55% of these being high skilled[2]. As the Connected and Automated Mobility (CAM) market develops, a global race to develop CAM technologies and capabilities has begun, with government and industry looking to capitalise on growing investment and procurement opportunities. In the UK, this has included joint investment by government and industry of over £400 million into more than 90 CAM projects, involving over 200 organisations, thus helping to stimulate the UK CAM sector[3].

The Centre for Connected and Autonomous Vehicles (CCAV), a joint policy unit of the Department for Business, Energy & Industrial Strategy (BEIS) and Department for Transport (DfT) is responsible for working with industry and academia to support the safe emergence of connected and automated vehicles in the UK and by leading the Government's Future of Transport strategy.

CCAV is developing regulation, investing in innovation and skills, and engaging the public to realise the benefits of new transport technologies, and create a thriving connected and self-driving vehicle sector in the UK. It uses its unique position to bring together world-class expertise from across the public, private and academic sectors to create an environment in the UK for new technologies and business models where innovation, safety and regulation are delivered in unison.

The purpose of this study is to understand the extent to which the UK's CAM strategy has resulted in CAM capabilities that are attractive and relevant to the international market – especially markets with mature and extensive automotive sectors. Furthermore, the study seeks to understand how future spending, investment or fiscal incentives by both Government and industry can be best targeted, and to identify potential mechanisms to assess the efficacy of the UK's engagement with the international market. Specific territories of interest in the study are Germany, Japan, South Korea, and the United States (US), given that they are the key international markets for the UK CAM sector. Israel is also considered given its vibrant CAM start-up community and niche specialisms in CAM technology.

> **The objectives of the study are to:**
> 1. Understand perceptions of UK's strengths, weaknesses, opportunities, and threats (SWOT) in the CAM sector.
> 2. Understand intentions for organisations to invest into the UK CAM sector, or procure goods and services from the UK CAM sector.
> 3. Understand the drivers and barriers of investment and/or sourcing decisions facing such organisations.
> 4. Understand how individuals and organisations form their opinion of the UK CAM sector.

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[1] Connected Places Catapult, (2020), Market Forecast for Connected and Autonomous Vehicles. Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/919260/connected-places-catapult-market-forecast-for-connected-and-autonomous-vehicles.pdf
[2] SMMT (2019) Connected And Autonomous Vehicles 2019 Report / Winning The Global Race To Market. Able to requested from: https://www.smmt.co.uk/reports/ Accessed 26 May 202
[3] HM Government (2020) *Innovation Is Great Connected And Automated Vehicles*. Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/929352/innovation-is-great-connected-and-automated-vehicles-booklet.pdf Accessed 26 May 2021

5. Understand how individuals and organisations source their information and assess opportunities in relation to CAM investment and sourcing.

6. Understand how organisations would like to be engaged by the UK CAM sector going forward.

7. Develop an efficacy framework for CCAV to use to assess the efficacy of the UK's engagement with the international market going forward.

The outputs of this will study will be used by CCAV and its partners to inform development of world-leading CAM policy to encourage international sourcing from, and investment into, the UK CAM sector.

All market engagement activities undertaken were agreed to on the premise of anonymity. Accordingly, market engagement respondents are not identified in this report, neither as named individuals nor organisations.

1.2 Approach

To deliver the objectives of the study, a mixed qualitative and quantitative research approach was adopted, combining quantitative data sourced through a survey of, and qualitative insights sourced through targeted interviews with relevant stakeholders in the automotive market. An overview of the study approach is outlined below, with more detail on the methodology and specific questions provided in the appendices.

Table 1 - Approach to study

Activity	Approach
Baselining	▪ A baseline review of the UK CAM sector was undertaken, identifying key features and trends, to inform the research and provide context for the study.
	▪ A high-level assessment of UK CAM capability 'marketing' material was undertaken, to inform the research and to provide an evaluation of the comprehensiveness, quality, differentiation, and availability of UK CAM marketing material.
	▪ Interviews were conducted with UK stakeholders with knowledge of the UK CAM sector, including Government departments, non-departmental public bodies, and industry groups sector. The interviews were designed to collate extant knowledge regarding the UK's sector offerings to the international market. The findings from the interviews informed an in-going hypothesis regarding the Strengths and Weaknesses of, Opportunities for, and Threats to the UK CAM sector, to be compared against views provided by the international market.
Quantitative market engagement	▪ A detailed questionnaire was developed to source and collate views from the market about perceptions of the UK CAM sector, intentions related to sourcing and investment, and views on strengths and weaknesses of international engagement by UK Government and industry players
	▪ The survey was completed online by 200+ senior decision makers from the automotive industry in the four territories in scope for this study: Germany (51), Japan (50), South Korea (52), and the United States (50). These markets were selected by CCAV because of their strong automotive markets.

Activity	Approach
	▪ The participants represented a range of companies – the largest proportion being from automotive Original Equipment Manufacturers (OEMs) and automotive parts suppliers, followed by software technology providers, hardware technology providers, service providers, and infrastructure providers. ▪ The companies represented by the participants were of varying sizes – about 45% in smaller companies with less than 1,000 people, 27% in the range of 1,000-20,000 employees, and 28 percent in the range of over 20,000 employees. ▪ The participants were all senior decision-makers – CXOs, Senior Vice Presidents, Vice Presidents, Senior Directors, Directors, and Heads of Departments, primarily representing Research & Development, Manufacturing, Strategy or Operations. 64% claimed to have an in-depth understanding of their company's CAM offering and strategy, while 36% claimed to have some understanding of this.

Qualitative market engagement	▪ To augment the quantitative market engagement, semi-structured interviews were conducted with senior decision-makers from the automotive industry. Interviews focused on obtaining a richer set of insights on the aforementioned topics.
	
	 ▪ Interviews were conducted with decision-makers from the four territories in scope for this study: Germany, Japan, South Korea, and the United States. Additionally, and to provide further insight and value for this study, interviews were conducted with respondents from Israel and France. Israel, in particular, was added as a market because of its strong start-up sector.
	
	 ▪ In total the following interviews were conducted:
	    ◦ 10 interviews with Japanese stakeholders
	    ◦ 10 interviews with US stakeholders
	    ◦ 10 interviews with German stakeholders
	    ◦ 4 interviews with South Korean stakeholders
	    ◦ 10 interviews with Israeli stakeholders
	    ◦ 1 interview with a French stakeholder
	
	 ▪ The participants represented a range of companies – covering Original Equipment Manufacturers (OEMs) and automotive parts suppliers, software technology providers, hardware technology providers, service providers, automotive industry consultants, and infrastructure providers.

Analysis	▪ Findings from the baselining research of the UK CAM market were used to establish the baseline view of the perceptions of the UK CAM market (as presented in Section 2). ▪ Findings from the quantitative survey and qualitative market engagement were brought together to establish an aggregated view of the perceptions of the UK CAM sector as an investment and sourcing destination by senior decision-makers from the territories in scope for this study (as presented in Section 3 and Section 4.

Activity	Approach
	■ A SWOT analysis was conducted based on the findings against the four thematic areas identified in the Autonomous Vehicles Readiness Index[4] which is a comprehensive analytical tool accepted by industry – Technology and Innovation, Policy, Infrastructure, and Consumer Acceptance (as presented in Section 5).
	■ Findings on the UK CAM sector's engagement with the international market were aggregated from the survey and interviews alongside an 'engagement efficacy framework' to inform future engagement (as presented in Section 6).
	■ Views obtained from the market were compared and contrasted against those from UK stakeholders throughout the report, to identify areas of consistency and divergence (as presented in Sections 3, 4, 5, and 6).
	■ Key considerations for the future based on the analysis of the findings were set out throughout the report (Sections 3, 4, 5, and 6) and brought together in the Conclusion in Section 7.

1.3   Key terminology

Key terminology used throughout this report are defined below:

■ **Connected and Automated Mobility (CAM)**: The 'Connected and Automated Mobility' sector is defined as the total ecosystem surrounding CAM – including vehicles, individual parts, software, services, and infrastructure – which enables vehicles to (1) connect with each other and the infrastructure <u>and</u> (2) drive with minimal or no need for human intervention.

■ **Sourcing:** Procurement of goods, systems, and services from the UK.

■ **Investment:** Investment refers to direct investment including opening of a subsidiary or associate company in the UK; acquiring a controlling interest in an existing UK company; entering into a merger or joint venture with a UK company; and indirect portfolio investment.

■ **Survey respondents/survey participants:** Refers to those who participated in the quantitative market engagement of 203 individuals from Germany, Japan, South Korea, and the United States as described.

■ **Interviewees/interview respondents/interview participants:** Refers to those who participated in the qualitative interviews.

■ **Location or country:** When referring to respondents from specific countries, the country name has been used interchangeably in noun or adjective form (e.g. Germany respondents or German CEO). This alludes to the country that the respondent is primarily based in for work, and not the nationality of any respondent.

■ **Full software stack:** A full software stack references the ability for a company to provide all of the core components to deliver an automated vehicle, including on-board and off-board software, and hardware, in an integrated product. This contrasts with a company that may make one, or a number of discrete components that fit into the whole product.

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[4] KPMG (2020) *2020 Autonomous Vehicles Readiness Index*

- **Research and Development (R&D):** Work conducted by organisations and individuals directed towards the innovation, introduction, and improvement of products and processes.

- **Original Equipment Manufacturers (OEM):** In the automotive industry, this typically refers to vehicle manufacturers.

- **Automated Lane Keeping System:** a system allowing a driver to delegate the driving task to their vehicle for an extended period of time, provided that the driver is prepared to resume control when prompted.

- **Infrastructure:** This refers to assets such as testbeds which allow vehicles to be trialled in controlled environments, but it can also refer to the underpinning digital systems on public roads such as 5G communications networks, as well as physical assets such as road signs and lines. However, for the purpose of the survey, 'infrastructure' and 'testbeds' were separated as options for respondents to select as drivers/future drivers of investment and sourcing destinations. 'Infrastructure' was defined as physical infrastructure like roads and communications infrastructure like 5G.

- **End user/customer/consumer:** These terms are used interchangeably to describe those who would use Connected and Automated Vehicles. 'End user acceptance' is therefore used interchangeably with 'public acceptance'.

- **Innovation potential:** Throughout the report the 'UK's innovation potential' is cited as a key driver for investment and/or sourcing. This refers to the UK's future attractiveness as a developer and innovator of CAM offerings, and could be due to factors like its R&D ecosystem, skills base, or companies.

- **Growth potential:** Throughout the report, the 'growth potential of the UK's CAM sector' is cited as a key driver for investment and/or sourcing. This refers to an expectation of the UK's CAM sector to grow in value and size.

1.4 Key caveats

While this study has provided valuable insights into how a subset of the international market may view the UK CAM sector, it is important to consider the following when using the findings to inform policy and market strategy:

- **Perceptions-based bias:** The findings in this report are based on what certain international decision-makers perceive about the UK CAM sector. However, their perceptions might be different from reality – for example, someone who thinks they know a particular market might be basing their assumptions on incomplete information. Perceptions may also vary widely by culture and individual – for example, the definition of knowing something well may mean different things to different people. This can make it challenging to draw broad conclusions.

- **Internal validity and sample size:** This study has been relatively robust in that it uses both qualitative and quantitative research methods, and for the latter has a relatively large sample size. However, for some questions, the sample size of relevant respondents is relatively low (e.g. the number of individuals from a specific country who do not source CAM products internationally) and therefore it is difficult to draw broader insights. Where applicable, these caveats have been mentioned in the analysis.

- **External validity and applicability to other contexts:** This study has focused on certain target markets, and as such the insights may not be as relevant for other markets or the world at large, although the cross-section of countries is fairly wide.

■ **Divergence between survey and interview findings:** On some occasions, there is a divergence between interview and survey findings. This is likely to be due to the anonymous nature of the survey vis-à-vis the interviews. Where the divergence is significant (i.e. a large proportion of interviewees had a different view from a large proportion of survey respondents) or interesting (i.e. when one or more interviewees had a divergent view worth noting despite this not being the overwhelming view), these have been clearly stated in the report.

1.5   Report structure

This report sets out the results, analysis, key findings, and future considerations emerging from the study. It is structured as follows:

■ Section 1 – Introduction

■ Section 2 – Baselining: The UK CAM Sector's Self-Perspective

■ Section 3 – The UK as an Investment Destination

■ Section 4 – The UK as a Source of CAM Products

■ Section 5 – Perceptions of the UK's Comparative Position

■ Section 6 – Engagement Efficacy of the UK CAM Sector

■ Section 7 – Conclusion: Summary of Considerations

■ Appendix A – UK Stakeholder Engagement

■ Appendix B – International Survey

■ Appendix C – International Interviews

2 Baselining: The UK CAM Sector's Self-Perspective

2.1 Overview

To define in-going hypothesis for the study's research, a baseline view of the UK CAM sector was developed by conducting interviews with key UK CAM stakeholders. This section of the reports presents the results of the UK stakeholder engagement, which is also supplemented by data gathered through a review of key UK CAM publications in the public domain.

The objectives of the UK stakeholder engagement activity were to:

- Understand internal perceptions of the UK CAM market, which would serve as hypotheses to be validated through the international market research.
- Collect any existing data or insights that could be of value to the study.

The engagement was designed to help gather perceptions of the UK as an investment destination; the UK as a sourcing destination; and the efficacy of the UK CAM sector's engagement with the international CAM business community.

Appendix A provides further detail on the stakeholders engaged and the research approach adopted.

The following sections detail the findings of the UK stakeholder engagement and further analysis, structured as follows:

- Section 2.2 – which provides stakeholder views of the strengths of the UK CAM sector for investment global competitors; territories investing into the UK; barriers to investment; and expected areas of growth in investment. These are compared with the international market's perspective in Section 3.8.
- Section 2.3 – which provides stakeholder views of the strengths of the UK CAM sector for sourcing; territories sourcing from the UK; global competitors; barriers to sourcing; and expected areas of growth in sourcing. These are compared with the international market's perspective in Section 4.8
- Section 2.4 – policy and regulation came up extensively as cross-cutting factors that influenced both sourcing and investment, and have therefore been considered separately.
- Section 2.5 – which provides stakeholder views of how the UK engages with the international CAM business community. These are compared with the international market's perspective in Section 6.6.
- Section 2.6 – which summarises stakeholders views on how the UK CAM sector could become more attractive for sourcing and investment.
- Section 2.7 – which summarises the findings from the engagement with UK stakeholders.

Additionally, as part of the baselining research, a **comparison of UK CAM marketing materials against key territories is presented in 2.8**, informing later analysis of the UK's engagement efficacy.

2.2 Snapshot of UK stakeholder interview results

Figure 1 - UK stakeholder interview results

Key strengths and weaknesses of UK CAM for investment

Top strengths as perceived by the UK	Top barriers as perceived by the UK
1. Human capital and links to world class universities	1. Policy is not keeping up to allow for larger-scale trialling
2. The role of CAM Testbed UK in promoting investment	2. Lack of domestic large-scale automotive manufacturing capacity
3. The UK's environment for business and investment	3. Lack of institutional and government investment into CAM

Key strengths and weaknesses of UK CAM for sourcing

Top strengths as perceived by the UK	Top barriers as perceived by the UK
1. Niche technologies such as sensors, cybersecurity, software and AI	1. Lack of domestic large-scale automotive manufacturing capacity
2. R&D Capabilities including CAM Testbed UK	2. The global market for sourcing CAM is not yet mature
3. Policy activity shows that the UK is open to CAM	3. Uncertainty around the UK's exit from the EU and future trading regulations

Strategic opportunities for the UK CAM sector

The UK should seek to develop its full software stack and CAM products to offer a full solution to the market, perhaps sold as clusters

The UK's withdrawal from the EU creates an opportunity to get ahead of our European counterparts on regulation and type approval

A cross-stakeholder effort lead by a single actor could engage with industry to promote and develop a clear roadmap for CAM adoption

Key threats for the UK CAM sector

Automotive investment has shifted from CAM to electrification and zero emission mobility in recent years, limiting R&D availability

A lack of funding and investment is making it difficult for UK start-ups to grow from proof of concept stage to widespread trialling

The UK has a strong CAM ecosystem and testbed but a lack of resources to sell it; there is a risk of the sector contracting if investment is not made.

2.3 The UK as an investment destination

2.3.1 Investment strengths

When discussing the UK's strengths as an investment destination, a majority of stakeholders identified the **UK's human capital as the key strength that would likely encourage investment**. Areas noted in particular were the UK's capabilities and skills in engineering, software development and human factors. As an extension of this, the UK's universities and general R&D capability were perceived by stakeholders as world leading, and are a key contributor to investment into R&D facilities and business in the UK, for example Waymo's acquisition of Latent Logic.

The UK's CAM testbed infrastructure was also generally recognised as a key strength, having benefited from significant investment in recent years. One stakeholder had a strong opposing view, arguing that the testbeds have had little effect on investment into the UK CAM sector as OEMs prefer testing infrastructure that is closer to their R&D and production facilities.

Other perceived strengths that position the UK well for investment noted by stakeholders include:

- The general UK CAM eco-system, which UK stakeholders represented as being highly collaborative across the panacea of industry, academia, and government; and,

- The general environment for business and investment in the UK, that is broadly seen as positive compared to other territories (although the UK's withdrawal from the European Union was articulated as creating short term uncertainty). In particular, the UK's historic activity in the automotive sector was seen as a strength.

A historical strength noted by some stakeholders was the **level of R&D funding provided by government through Innovate UK**. Stakeholders felt the funding had helped to develop the CAM eco-system in the UK and support SMEs/start-ups in particular. However, the lack of ongoing funding was raised as a barrier, as discussed further in Section 2.3.2.

Specific UK CAM sectors referenced by stakeholders as likely to see investment by the international market in the coming years are detailed in the table below.

Table 2 - Stakeholder perspective of UK CAM sectors likely to receive investment

Technology
Software development, including components (e.g. visualisation and Simultaneous Localization and Mapping (SLAM)) and the full software stack
AI/ML
Simulation

2.3.2 Barriers to investment

Stakeholders identified a range of potential barriers to investment in the UK CAM sector. A frequently cited barrier is the general position of the automotive market, with some stakeholders stating that there has been a notable decrease in developments and investment in CAM since the market is focusing instead on electrification and alternative fuels. This is seeing **OEM R&D spend/investment being re-directed to zero emission technologies**. Stakeholders felt this was a global issue, rather than being specific to the UK, and that this would shift in the future as CAM becomes a higher priority agenda item.

Another barrier raised by a number of stakeholders is the **UK's limited production capability in the automotive sector** (despite ranking 5th in Europe and 16th globally for number of vehicles produced[5]), potentially due to the strength of the countries in this study. Stakeholders do not expect significant investment in production in the UK CAM sector, instead expecting targeted investment into niche sectors, and/or through the opening of R&D centres, drawing on the UK's human capital.

A final barrier that was a recurring theme with stakeholders was the **limited investment by the UK government and industry into the UK CAM sector**. Two interlinked factors were noted as a combined deterrent for international investment – that UK government R&D funding for CAM has ceased, and that UK financial institutions are not investing into the UK CAM sector. The perception is that if UK government and financial institutions were investing in UK companies, this would attract market interest and would aid UK start-ups in particular in scaling from proof of concept, to production scale. One stakeholder noted that there was a risk that many UK CAM start-ups would fail without further innovation funding support, whilst another noted that lack of UK financial institution investment in UK companies was an industry wide issue, rather than specific to CAM only.

Other barriers to investment referenced by individual stakeholders include:

- The UK and Europe's relatively small markets and financial institution investment pots, as compared to Asia and North America.

- The UK being a left hand drive country, limiting the potential market for sales.

- High energy prices in the UK and the limited amount of land for new factories, which could be a commercial barrier for companies looking to set up larger scale manufacturing facilities.

Whilst not seen as a current barrier, one stakeholder referenced the National Security and Investment Act, which could be a blocker in future to acquisition of UK companies in the CAM technology sector. The Act allows Government to scrutinise and intervene in investment to protect national security and covers several sectors related to CAM, including AI and robotics, that overlap with the defence sector.

Additionally, one stakeholder noted that acquisition of UK companies by foreign companies is not actively encouraged by Government, due to the risk of human capital and IP being taken out of the UK; rather, other forms of investment are preferred.

2.4 Expected investment

Whilst stakeholders identified a number of UK CAM offerings in which they expect to see potential investment in coming years, a number of stakeholders stated that development and investment activity in CAM market as a whole has slowed recently. As such, **there was a view amongst multiple stakeholders that whilst investment may continue, it would be highly targeted on niche services required to deliver early CAM use cases (such as freight and logistics)**. It was also raised that younger OEMs, with more agile approaches than legacy vehicle manufacturers may be more likely to invest in the short term, particularly where they are able to draw on substantial financing.

UK CAM technology offerings referenced as potential targets for investment include:

- Companies, such as Five and Oxbotica, who offer full stack capabilities. However, one stakeholder believed there would be limited investment in this area due to market saturation.

- Simulation software companies, such as AB Dynamics and rFpro.

- Sensor companies, including Fusion Processing.

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[5]SMMT Motor Industry Facts 2020: https://www.smmt.co.uk/wp-content/uploads/sites/2/SMMT-Motor-Industry-Facts-Nov-2020.pdf

- Cyber security.

- Companies offering full CAM solutions in the freight and logistics space, such as Starship.

When discussing future investment potential, several stakeholders expected that investment would focus on **R&D capability in the above sectors, as opposed to large scale production and manufacturing**. This is due to a historical lack of scaled production in the automotive sector in the UK.

2.4.1 Territories investing into the UK CAM sector

Stakeholders referenced five territories as sources of investment into the UK CAM sector: China, Germany, Israel, Japan, and the United States. International perceptions from three of these countries – Germany, Japan and the United States – have been examined through the quantitative survey and qualitative interviews of senior decision-makers. Decision-makers from CAM companies in Israel were also included in the qualitative interviews. Beyond these four countries, South Korea was included in the quantitative survey and qualitative interviews.

An investment example repeatedly referenced by stakeholders was Waymo's acquisition of Latent Logic.

2.4.2 Global competition for investment

Stakeholders referenced a number of territories that are competing with the UK for CAM investment, although there was no consensus or frequently cited territory. Territories referenced include:

- The Netherlands – recognised as having a strong policy and tax regime for encouraging investment

- Singapore – recognised as having a strong policy position and benefiting from being an island nation with a compact geography for testing

- Israel – recognised as having a strong start-up environment, particularly in software, AI, cyber security and sensors

- The United States, Japan and South Korea – each recognised as having a strong OEM presence, which aids in developing a CAM sector and investment.

2.5 The UK as a sourcing destination

This section focuses on perceptions of the UK's CAM sector as a sourcing destination by international companies. It is notable that when discussing sourcing, stakeholders consistently identified that the global CAM market was relatively immature and thus sourcing at scale was not yet being seen at a global level. Rather, stakeholder perceptions were that current sourcing in the CAM sector is largely focussed on component software and products by Tier 1s and OEMs in their development of complete CAM solutions.

2.5.1 Sourcing strengths

Stakeholder perspectives of the UK CAM sector as a sourcing destination consistently recognised the strengths of the UK's **R&D, software and service capabilities**, as detailed in the table below. In particular, UK stakeholders referenced niche capabilities in **sensor development, cyber security for CAM, and development of software** to support CAM operation as the UKs strongest technology areas related to CAM that are likely to be of interest to the global market from a sourcing perspective.

Table 3 - Stakeholder perspective of the UK's sourcing strengths by technology

Technology
Sensors, including radar
Cyber security
Software development, including components (e.g. visualisation and SLAM) and the full software stack
Simulation
AI/ML
Testbeds

When discussing specific companies in the UK CAM sector, CAM software companies were frequently cited, including Five and Oxbotica, both of whom are developing a full software stack for automated driving. Aurrigo and Arrival were also noted as UK CAM leaders, in offering a full CAM service including the vehicles themselves.

Beyond specific technologies, the strength of the UK's **universities and human capital** were referenced as key strengths for both sourcing and investment, whilst the UK's policy and regulatory position were also referenced (as further discussed in Section 2.6).

2.5.2 Barriers to sourcing

A number of perceived weaknesses or barriers that could prevent growth of the UK as a sourcing destination for CAM products and services were noted by stakeholders. The most common weaknesses raised related to the **UK's limited production capability**, and the **impact of the UK's withdrawal from the European Union**.

A weakness consistently raised by stakeholders is the UK's limited production capability in the automotive sector, particularly the low number of OEMs and Tier 1 suppliers in the UK. This places the UK in a relatively weak position in the global supply chain for automotive products currently, and limits the potential for growth (as stakeholders assumed that CAM growth is likely to be seen in territories with an existing strong capability in automotive production). One stakeholder also raised that international OEMs are more likely to source from their home territory and/or from existing supply chains, given historic relationships.

The impact of the UK's withdrawal from the European Union was another common response from stakeholders. Although it was largely recognised that the medium to long term impact of the UK's withdrawal from the EU is currently unknown, the uncertainty around trading negotiations and challenges in trading with Europe in particular, were noted as barriers to both sourcing and investment. It was also recognised that this uncertainty could impact UK start-ups and SMEs who may struggle to trade effectively with European nations, and that some level of support/guidance could be beneficial. Rules of Origin were raised as a particular challenge to overcome, and it was noted that this was affecting parallel automotive sectors, at least in the short term, including technologies related to alternative fuels for vehicles.

Other barriers to sourcing raised by stakeholders include:

- The UK CAM sector's marketing capabilities and quality of information produced.

- The cost of production in the UK relative to other territories, which leads to higher prices.

2.5.3 Expected growth in sourcing

UK stakeholders identified a number of key offerings that could see a growth in sourcing as the market for CAM develops further, though there was no consensus on which technology areas pose the greatest opportunities. CAM offerings referenced include:

- Companies, such as Oxbotica, expanding their existing software stack capabilities to deliver a full CAM product, as has been demonstrated by Aurrigo. Expansion into full CAM product delivery, particularly of pod/shuttle type vehicles, was generally expected to gain interest from the international market.

- Sensors and semiconductors, which were both recognised as existing strengths that could grow further.

- Development of specific CAM products for the freight and logistics sector, such as last mile deliveries and airport operations.

- Data services, including data connectivity and communications, to support data flows in the CAM ecosystem. This also extended to harnessing of data for network management.

2.5.4 Territories sourcing from the UK CAM sector

Stakeholders were typically unable to reference territories sourcing from the UK CAM sector with confidence. Japan was the only territory repeatedly referenced as a territory sourcing CAM related goods and services from the UK, with other countries referenced including Australia, Canada, Israel, South Korea and the United States. As mentioned above, four of these countries are examined in this study.

2.5.5 Global competition for sourcing

As previously noted, there was a general view amongst stakeholders that the global market for sourcing of CAM goods and services is relatively immature. As such, the majority of stakeholders chose not to comment on which territories are competing with the UK to be a sourcing destination for CAM. Where stakeholders did postulate which countries the UK is competing against, these countries broadly fall into two categories:

- Territories with a strong automotive sector and OEM presence, with local OEMs driving development of a local CAM sector. This includes China, Germany and the United States.

- Territories which are encouraging R&D and supporting start-ups in the CAM sector. This includes Estonia, Israel and Singapore.

2.6 Policy, regulation and fiscal incentives

Policy, regulation and funding were recognised by stakeholders as critical drivers of sourcing and investment decisions and were discussed at length. The following sections provide further details on the perceived strengths and weaknesses of the UK's policy and fiscal incentives in the CAM sector.

2.6.1 Policy and regulation

There was broad consensus amongst stakeholders that the **UK's early activity developing policy to support trials** of highly automated vehicles on the public highway has successfully helped position the UK as 'open' for CAM trialling; of particular note was the *Code of Practice: Automated Vehicle*

Trialling[6]. The relatively light-touch approach to regulation of trials on the public highway (for example, not requiring bonds) was recognised as a strength that would help to encourage companies to come to the UK to develop and trial CAM technologies.

The **recent government announcement[7] regarding the use of Automated Lane Keeping Systems** (ALKS) on the public highway was also referenced by multiple stakeholders as a positive indication to the market that the UK is open to CAM development and adoption by the public[8]. Such announcements were seen by stakeholders as a clear message to the market that not only can CAM technologies be sourced from the UK, but that the UK has a market to sell CAM technologies into.

Whilst stakeholders felt the UK had worked quickly initially in developing policy related to CAM testing, there was a general consensus that **more needs to be done for the UK to keep up with its international competitors**, and that this needs to be done quickly (without compromising safety). It was noted that a number of countries had looked to replicate the UK's approach to CAM policy, including Singapore – which has developed an AV roadmap, a regulatory sandbox testing environment and national standards for deployment of automated vehicles ('Technical Refence 68', or 'TR68') – and that other countries were now pushing ahead of the UK, including China, the Netherlands, Germany and France, as well as the state of California.

Specific points raised by stakeholders include:

- The **lack of a clear government strategy, roadmap or framework** for further roll out of CAM technologies on the public highway.

- The **absence of a clear strategy** for encouraging sourcing from, or investment into, the UK CAM sector.

- The difficulty in **delivering large-scale trials and/or commercial CAM deployment on the public highway**. The perception shared by stakeholders was that whilst in theory the Code of Practice[9] enables trials on the public highway, in practice the range of permissions and approvals needed when wanting to carry passengers in a vehicle, without a clear process to navigate, creates a significant barrier to actually delivering trials.

- The interpretation of guidance as requirements by authorities was also noted as a blocker to trialling. Stakeholders noted that the market and local authorities had tried to undertake larger-scale trials but were not successful in delivering them. This difficulty, and the subsequent lack of visible large-scale trials, were raised as key deterrents to sourcing and investment by multiple stakeholders.

The work by the **Law Commission on automated vehicles**, and the CAV PASS project were both noted as good initiatives, but need to be accelerated to work quicker to help UK policy and regulation for CAM keep ahead of the international community.

A **risk** was raised that should the UK develop policy, regulation and/or standards that diverge from that of Europe and the international community, this could deter market sourcing from, and investment into, the UK CAM sector.

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[6] Centre for Connected and Autonomous Vehicles (2019) *Code of Practice: Automated vehicle trialling*.
[7] Department for Transport, Centre for Connected and Autonomous Vehicles, and Rachel Maclean MP (2021) *Government paves the way for self-driving vehicles on UK roads*. Available at: https://www.gov.uk/government/news/government-paves-the-way-for-self-driving-vehicles-on-uk-roads [Accessed 21 May 2021]
[8] The announcement regarding ALKS was made during the period UK stakeholder interviews were conducted; the timing of this may have influenced stakeholder views.
[9] Centre for Connected and Autonomous Vehicles (2019) *Code of Practice: Automated vehicle trialling*.

2.6.2 Fiscal incentives

Similar to policy and regulation, stakeholders largely felt that the UK had made a strong start in supporting CAM development in the UK. Of particular note was the **R&D funding made available through Innovate UK**, which had helped to build the UK's CAM ecosystem and helped start-ups to demonstrate their capability and thereby attract investment. However, **stakeholders shared the view that the drop-off in government R&D funding for CAM meant the UK is now falling behind its competitors**, and that there is a risk that the CAM ecosystem could shrink without further innovation funding support.

2.7 Engagement efficacy

In terms of engagement efficacy, stakeholders were consulted on the UK's approach to engaging with the international CAM market. Several stakeholders noted that there had **historically been effective work** to promote the UK CAM sector internationally; of particular note was the 'Britain Is Great' campaign which included UK CAM pods. Stakeholders felt that, where the main actors in the UK CAM sector had worked together to engage with market, this has been highly effective – for example in taking a **'team effort' approach at international trade shows and conferences**.

However, it was felt that whilst there was early success with engaging the international market, this has **diminished in recent years, largely due to a lack of funding and a re-prioritisation of effort**. It was recognised that the international CAM community is increasingly growing, and that it is increasingly difficult to stand out in the market. UK stakeholders articulated that:

- At this critical stage of the CAM market maturing, with UK companies emerging from the proof of concept stage into production, much **more work is needed to promote UK CAM and engage the international market**.

- The **lack of recent funding and focus by Zenzic to promote the testbeds** and the wider UK CAM ecosystem is a significant limitation, with more work needed to promote the UK CAM sector.

- There is a **lack of a coherent strategy and leaders to co-ordinate and drive engagement with the market**. It was felt that whilst key actors such as CCAV, the DIT and Zenzic are undertaking their own initiatives, this is not joined-up and thus an opportunity is being missed. UK stakeholders also represented that government should work more closely with industry and academia to help promote UK CAM.

In terms of messaging and materials, stakeholders felt that there is a **lack of clear messaging on the UK's strengths** and that existing communication materials are overly focussed on projects and companies, rather than the eco-system as a whole – thus failing to tell the story of 'why source from/invest into the UK?'.

Finally, several stakeholders noted the **lack of guidance and support given to international companies looking to source from, or invest into, the UK CAM sector**. Personal support to companies, to help them navigate the market and understand the UK's processes and regulations was felt to be missing, with other countries, such as Germany, doing this well.

2.8 Improving the attractiveness of the UK CAM sector

UK stakeholders were consulted on what they believed should be done to improve the attractiveness of the UK CAM sector for sourcing by, and/or investment from, the international market. Responses are detailed below under the themes of policy and regulation, fiscal incentives and engagement.

2.8.1 Policy and regulation

There was general consensus amongst stakeholders that the UK should **work more quickly to develop policy and regulation that enables larger-scale testing and commercial deployment** of automated vehicles on the public highway, including providing clear guidance on the process of gaining type approval (and in a quicker timeframe). This would have multiple benefits, including making a clear message that the UK is open to CAM testing and deployment; and in stimulating large scale trials by UK companies that would help promote them internationally for sourcing and/or investment. Such policy and regulation should be supported by a credible roadmap/strategy and political support, to maximise market interest.

Several stakeholders noted that following the UK's withdrawal from the European Union, there is an **opportunity for the UK to develop policy and regulation CAM at a faster pace than European counterparts**. This could aid in gaining market interest in the UK, as the UK market would be 'open' ahead of Europe. Additionally, the opportunity for the UK to develop free trade agreements was raised by one stakeholder as an opportunity to support sourcing.

An opportunity was noted for the UK to also push ahead of international competitors by placing a focus on CAM now, whilst other territories remain focused on electrification and alternative fuels.

2.8.2 Fiscal incentives

Stakeholders generally felt there is no need for direct fiscal incentives to support sourcing; however **fiscal incentives were thought to be required to support investment into the UK's CAM market**.

As previously noted, UK government R&D funding for CAM has ceased, and UK financial institutions are not investing into the UK CAM sector. Stakeholders generally held a view that **UK government funding and investment should be used to support UK CAM start-ups, and to deliver larger scale trials** in order to aid UK CAM companies to demonstrate their functionality, capability and maturity, which would thereby help attract international investment. An example of an investor partnership model was raised, which could help bring together government and financial institution investment to support sector growth.

Other points regarding fiscal incentives raised by individual stakeholders include:

- If further government R&D funding becomes available, it should be directed at a **smaller number of larger demonstration projects, rather than a large number of smaller projects**. Larger demonstration projects were felt to be more effective in gaining market interest.

- Government R&D funding or investment should focus on **supporting the transition from proof-of-concept to commercialisation**.

- The potential, in the long term, for **government to stimulate CAM adoption by businesses and the public through grants for premium CAM features** (such as ALKS), which could help reduce fatalities on the public road. This would have the benefit of supporting demand for CAMs, in a similar approach to the low emission vehicle plug-in car grant that currently operates.

Finally, stakeholders commented that Government and Treasury should take a **longer-term approach to investing in the UK CAM sector**, noting that investment into zero emission mobility by Government has been ongoing for over 10 years, and that similar levels of investment may be required to simulate the UK CAM sector.

2.8.3 Engagement

In terms of engagement with the international market, stakeholders generally felt there is need for **a fresh communications, marketing and engagement approach to help sell UK CAM abroad**,

focusing on the ecosystem as a whole and key sector strengths, rather than specific projects or companies. This should be developed in collaboration by the main UK stakeholders responsible for CAM, including CCAV and Zenzic, as well as BEIS and DIT, amongst others. This would help show that the UK CAM sector is open for business, whether for sourcing or investment.

Additionally, there was general consensus that **tailored support to UK companies to engage with the international market**, and support to the international market to engage with UK companies, could be of significant benefit. This would include giving direct guidance and support to international companies to understand the market opportunities, and in navigating rules and regulations.

It was noted, however, that currently the global automotive market is focussed on electrification and alternative fuels, and therefore there may be less interest at this point in time in CAM.

2.9 SWOT

A SWOT analysis was conducted and is presented on the following page, summarising UK stakeholder perspectives regarding sourcing from and investment into the UK CAM sector, as well as perspectives of the UK's engagement efficacy. Additionally, the SWOT draws on findings of a review of key Government and industry publications, providing further insights which inform the UK's self-perspective. Documents reviewed were:

- HM Government (2020) *Innovation Is Great Connected And Automated Vehicles*
- KPMG (2020) *2020 Autonomous Vehicles Readiness Index*
- SMMT (2019) *Connected and Autonomous Vehicles 2019 Report / Winning the Global Race To Market*
- Zenzic (2020) *UK Connected and Automated Mobility Roadmap to 2030 CAM Creators Update*

This SWOT analysis serves as this research study's in-going hypotheses, to be compared against views of the international market.

Table 4 - SWOT: UK Perspectives

	UK as a sourcing destination	UK as an investment destination	Engagement efficacy
Strengths/Drivers	- The sector has strengths in **niche technologies** that are of interest from a sourcing perspective, including **sensors, cyber security, software, simulation and AI/ML.** - Wider CAM ecosystem offerings, including **R&D capabilities and Testbed UK** are seen as strengths. - Early government **policy activity has shown the UK as open to CAM**, including the recent ALKS announcement. £440 million of government and industry investment in CAM R&D, involving over 200 organisations. - Strong cross-sector collaboration between government, industry and academia for CAM development and regulation, supported by an excellent research base and world-class innovators, shows the UK as open to CAM sourcing and investment.	- The UK's key strength in the CAM sector is its **human capital and R&D capability**; **investment is expected in R&D centres/capabilities** to draw on our human capital. **CAM Testbed UK** is seen as a strength for encouraging investment, whilst Zenzic's Safety Case Framework provides direction for safety testing and trialling of CAM in the UK by providing a clear approach to safety case development. - The 2020 Autonomous Vehicles Readiness Index[10] places the UK second only to Singapore for having a supportive policy regime for CAM. - The **general environment for business** and investment in the UK. - Strong cross-sector collaboration between government, industry and academia for CAM development and regulation, supported by an excellent research base and world class innovators, shows the UK as open to CAM sourcing and investment.	**Historically, the UK has been strong in selling its CAM capability globally**; however, this has diminished in recent years.
Weaknesses	**The lack of large-scale automotive and component production in the UK** is a key barrier to producing goods for large scale sourcing. **The global market for sourcing CAM products and services is not yet developed**, as the technology has not reached maturity for widespread deployment.	- Historically, policy, regulation and innovation funding have put the UK in a strong global position for testing; however, **we are starting to fall behind with a need for larger scale public highway testing**, which is very difficult to do under current policy and regulation. - The **lack of large-scale automotive and component production** in the UK limits potential for investment into production. - The **lack of UK financial institution and government investment** into the UK CAM sector, which creates challenges in scaling up CAM innovation and trials.	- Engagement has reduced in recent years; and there is **no clear body responsible for selling UK CAM abroad**, with a **disjointed approach** across key actors. - Marketing **materials need to be refreshed** to develop a stronger investment story. - There is a **lack of tailored support** to help international stakeholders **navigate the UK CAM** market to source and invest.

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[10] KPMG (2020) *2020 Autonomous Vehicles Readiness Index*

Opportunities	- There is an opportunity for the UK CAM industry to nurture its capabilities in **full software stack and CAM products** (e.g. Pods), to offer a full solution to the market. - Other opportunity areas include **sensors, semiconductors, data services and CAM products for the freight and logistics sector**. - The UK is well positioned to take a leadership role in CAM data sharing, interoperability and cyber security	- Key areas expected to see investment in the future include **software development, AI and simulation**. - Having withdrawn from the European Union, there is an **opportunity for the UK to get ahead of its European counterparts on policy**, regulation and type approval, which would capture the interest of industry investment. - Development of a **clear roadmap** for CAM adoption. - Government is working to ensure that CAM can be deployed at scale, including regulation on insurance for CAM, the CAV PASS (Connected and Automated Vehicle Process for Assuring Safety and Security) project and undertaking a review of legislation.	- There is an opportunity to sell the UK's key CAM strengths as **clusters**, such as cyber security, simulation and full software stack. - A cross-government/actor effort, led by one team, could re-engage with international industry to promote UK CAM.
Threats	- The UK's **withdrawal from the European Union has created uncertainty**, which is bad for trade. **Acquisition of UK companies by foreign companies**, which is not encouraged due to the risk of human capital and IP being taken out of the UK.	- Globally, **automotive investment has shifted from CAM to electrification** and zero emission mobility, meaning there is less R&D and investment funding available in an increasingly competitive market. - A lack of government and financial institution investment means it is **very difficult for UK start-ups to grow from proof of concept stage**, to scaled delivery. 4G connectivity on motorways is strong at 90%, however coverage on A and B roads is relatively weak at 58%, and other markets are pushing ahead with 5G delivery faster than the UK[11].	- The UK has a strong CAM ecosystem but a **lack of resources to sell** it; there is a **risk of the sector contracting** if investment is not made. - Significant funding was spent on developing UK CAM Testbed, with little funding to now sell it abroad. There is a risk that the opportunity to sell the testbeds is missed.

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[11] Ofcom (2017) *Connected Nations Report,* as reported in SMMT (2019) *Connected And Autonomous Vehicles 2019 Report / Winning The Global Race To Market*

2.10   UK CAM marketing materials international comparison

As part of the baselining activity, a high-level assessment of UK CAM capability marketing material has been undertaken. This has assessed UK CAM marketing materials with those of other leading territories, providing an evaluation of the comprehensiveness, quality, differentiation and availability of the materials. This high-level snapshot, present on the following pages, provides context to the engagement efficacy analysis presented later in this report.

The assessment found that UK CAM marketing materials are:

- Generally freely available and easy to find online.

- Comprehensive in the range of information provided at a UK level, but limited sector or geographical detail is provided.

- Generally produced to a high quality, though imagery is repeated, and the investment storytelling component of the market materials is lacking. This latter point was also identified for materials produced by the other key territories.

Table 5 - Baselining: The UK CAM Sector's Marketing Material vis-à-vis other Countries'

Territory	Comprehensiveness	Quality	Differentiation	Availability
UK	▪ Comprehensive range of information provided at a UK level; content is aimed at marketing key strengths, with limited detailed information of the CAM ecosystem provided. ▪ Little information at a disaggregated level (e.g. UK cities). Scotland is the only national with separate marketing materials.	▪ Quality is to a relatively high standard, using graphics/infographics to engage the reader. ▪ The same images/photos are often repeated. ▪ The investment storytelling component is weaker.	▪ Government R&D funding is heavily emphasised, as is CAM Testbed UK.	▪ Key marketing materials are open for free access, although in some cases an email address/contact details are required (for example, to access Zenzic's Roadmap). ▪ Materials are easy to find, and available in English.
Germany	▪ Moderate level of information provided at a national level, with little disaggregated (e.g. state level) information found.	▪ Visually engaging brochures are available with high quality, though the investment storytelling component is weaker.	▪ Strong focus on promoting technologies, rather than the ecosystem, use cases, etc.	▪ Key marketing materials are open for free access. ▪ Only a limited number of documents are in English, with the majority in German.
Japan	▪ Moderate level of information provided at a national level.	▪ Materials are generally text heavy, and do not appeal to a more visual audience. The quality of the content and investment storytelling is weak.	▪ Industry appears to lead marketing, rather than government.	▪ Key marketing materials are open for free access, but are very difficult to find in the English language. ▪ Only a limited number of documents are in English, with the majority in Japanese.
South Korea	▪ A very limited amount of marketing information is available; what can be found is in Government press releases, rather than detailed marketing materials.	▪ Publications are generally visually appealing, but the investment storytelling component is weaker.	▪ Strong emphasis on CAM ecosystem services, such as testing, and on promoting use cases.	▪ Key marketing materials are open for free access, but are very difficult to find in the English language. ▪ Only a limited number of documents are in English, with the majority in Korean.
United States	▪ Comprehensive level of information provided at national level, with several states also publishing more details local materials.	▪ Large amount of detailed, high quality information on the CAM sector through text heavy reports; however, there are not overly engaging and there is a minimal amount of more engaging marketing content. The investment storytelling component is lacking.	▪ Strong emphasis on use cases when promoting technologies / capabilities.	▪ Key marketing materials are open for free access. ▪ Materials are easy to find, and available in English.

3 The UK as an Investment Destination

3.1 Introduction

As described in the Introduction, two of the key objectives of this study are to:

- Understand intentions for organisations to invest in UK CAM, and
- Understand the drivers and barriers of investment facing these organisations

This section sets out the insights and information drawn from the international surveys and interviews to examine perceptions of the UK as an investment destination. Since section 5 on the SWOT analysis focuses more on the UK in comparative perspective, this section does not draw out comparisons with other countries.

The section is structured into the following sub-topics:

- Section 3.2: Snapshot of survey results
- Section 3.3: Country snapshot (Germany, Japan, South Korea, and the United States
- Section 3.4: Current interest in the UK as an investment destination
- Section 3.5: Redacted
- Section 3.6: Investment drivers and barriers
- Section 3.7: Future interest in the UK CAM sector
- Section 3.8: International market perceptions vs. UK stakeholders' self-perception of the UK as an investment destination

3.2 Snapshot of survey results

Figure 2 - Survey snapshot: Investment into the UK

**67% of those investing internationally are investing in the UK CAM market.
59% who are not currently investing in the UK would consider it within 10 years.**

Those investing internationally

Those not investing in the UK yet

38% / 62% / 67% / 33% / 27% / 32% / 10% / 24% / 7%

- Investing internationally
- Not investing internationally
- Investing in the UK
- Not investing in the UK
- Yes within 5 years
- Yes, in 5-10 years
- Perhaps after 10 years
- No, but we might collaborate
- No, I don't see us investing
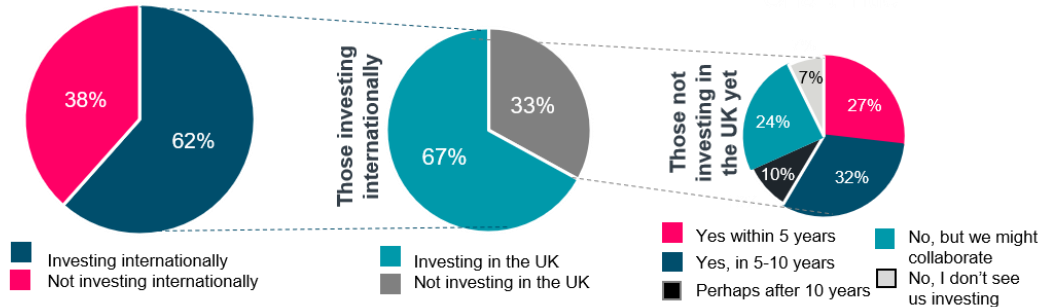
**Investors are currently investing in AI/ML software R&D capabilities, OEMs, and Pods.
They think the UK's future strengths lie in R&D, engineering, AI/ML, and sensors.**

Top 5 offerings respondents are investing in

1. Artificial Intelligence/ Machine Learning software
2. R&D capabilities
3. Autonomous control systems
3. CAM Pods
4. Original Equipment Manufacturers (OEMs)

Note: The highest proportion of respondents selected each of these. Other options were university capabilities, testbed services, and cybersecurity.
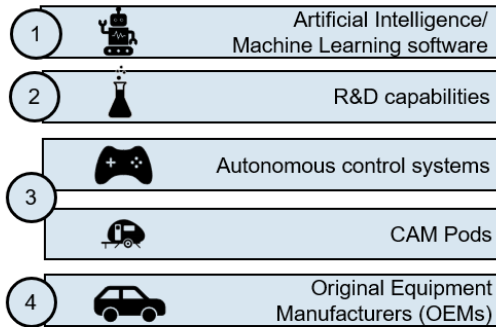
Top 5 investment USPs for the UK in the future

1. R&D capabilities
2. Engineering capabilities
3. Autonomous control systems
4. Sensors
4. Artificial Intelligence/ Machine Learning softwars

Passenger vehicles / Robo taxis and Public transport are believed to be the top two future use cases 62% 51%

What's attracting current investors to the UK CAM market?

Innovation potential of UK CAM sector

Expectations of UK CAM growth

Expectations of high end user acceptance
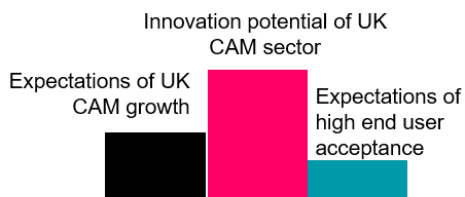
What would make the UK more attractive as an investment destination?

1. More or better CAM-related infrastructure (e.g. 5G, quality of roads)
2. More or better CAM-related innovation (e.g. research, patent registration)
3. More government funding in CAM to attract innovation

What's holding back those who aren't investing in CAM internationally?

More focused on Zero Emission Vehicles

Still recovering from the pandemic

Have the domestic capabilities required

What's holding back those who aren't investing in UK CAM?

A belief that high costs will hold UK CAM back

The high cost of establishing new relationships

Lack of understanding/ insight into UK CAM

Analysis based on quantitative survey results of 203 senior decision-makers from automotive and CAM companies in Germany, Japan, South Korea and the US.

3.3 Country snapshot

Figure 3 - Country snapshot: Investment into the UK

	United States	Germany	South Korea	Japan
Profile of investment and % that is FDI*	• 72% have invested internationally, 64% of these in the UK. • The investments of 74% of the UK-investors is FDI	• 57% have invested internationally, 62% of these in the UK. • The investments of 78% of the UK-investors is FDI	• 60% have invested internationally, 74% of these in the UK. • The investments of 61% of the UK-investors is FDI	• 58% have invested internationally, 69% of these in the UK. • The investments of 75% of the UK-investors is FDI
Top 3 products	• AI/ML software • R&D capabilities • Automotive OEMs	• Sensors • R&D capabilities • CAM pods	• AI/ML software • Autonomous control systems	• Sensors • R&D capabilities • CAM pods
Main investment driver	• Strong CAM testing environment	• Expectations of high growth of UK CAM	• High innovation potential of UK CAM	• High innovation potential of UK CAM
Main barrier for those who do not invest internationally	• Have the domestic capabilities required	• Have the domestic capabilities required	• Have the domestic capabilities required	• They don't see a significant return on timeframes
Products that the UK could have a USP in	• R&D capabilities • University capabilities • Engineering capabilities	• Sensors • CAM Pods • R&D capabilities / Engineering capabilities	• Engineering capabilities • Autonomous control systems	• R&D capabilities
What the UK could do to attract more investment 1	• More or better CAM infrastructure	• More government funding of innovation	• More or better CAM innovation	• More or better CAM infrastructure
2	• More or better CAM innovation	• More or better CAM innovation	• More or better CAM infrastructure	• More or better CAM innovation
3	• Improvements in the automotive skills base	• More or better CAM testbeds	• Improvements in the digital skills base	• A clearer policy regime for CAM

Analysis based on quantitative survey results of 203 senior decision-makers from automotive and CAM companies in Germany, Japan, South Korea and the US.
*Foreign Direct Investment includes opening of a subsidiary or associate company, acquiring a controlling interest in an existing UK company, or entering a merger/joint venture with a foreign company.

3.4   Current interest in the UK as an investment destination

Broadly, for the UK CAM sector, the international market for investment can be segmented into three categories:

- Those who are investing internationally, including in the UK

- Those who are investing internationally, but not in the UK

- Those who are not investing internationally at all

The general findings on investment interest are described in the following sub-section while the barriers and drivers for these are outlined in Section 3.6.

Among those who are investing internationally, there appears to be a **high degree of interest in the UK CAM sector as an investment destination,** with over two-thirds of those respondents whose companies are investing internationally having some form of investment in the UK. This was mirrored in interviews with a good portion of stakeholders noting that they were either investing in the UK market or were considering it.

Among international investors of individual countries, 74% of South Korean respondents and 69% of Japanese respondents who are investing internationally are investing in the UK. This proportion is lower for the US and German markets at 64% and 62% respectively. It is worth noting that of the whole sample for each country, less than half of the respondents are investing in the UK (35% for Germany, 40% for Japan, 44% for South Korea, and 46% for the US).

Over 70% of the respondents who are investing in the UK said that their investment is in the form of foreign direct investment, which includes the opening of subsidiaries or associate companies, acquisition of a controlling interest in an existing company, or entry into a merger or joint venture with a UK company. Only 25% said that their investment was in the form of indirect investment or purchases of securities that represent claims on other indirect securities. It was noted in interviews that, given the relatively immature nature of the CAM sector and the significant upfront investment required to develop suitable technologies, many organisations are looking at joint ventures to help distribute some of the capital risk associated with developing CAM innovation.

Another route to investment highlighted by some interviewees was through the establishment of sales centres. These sales centres tend to be established by B2C companies to enable the respective organisations to directly sell their products more effectively into the UK market.

Redacted

Examining the type of investment from individual countries, respondents from Germany, Japan, and the US indicated a high proportion of direct investment (74-78%), though this was lower for South Korea at 61%. One interviewee from a South Korean OEM noted that when evaluating pitch decks for European companies seeking investment, the first point they check is whether the target companies have already received investment from any of the European OEMs, as the OEM cannot invest in such targets due to

conflict of interest concerns. Given the CAM sector is still fairly immature with a small number of innovative, high value companies, the particular stakeholder noted that it is rare for their organisation to identify a company of interest that has not had some form of competitor investment previously. Whilst this insight was not directly noted by others interviewed, other OEMs may face similar concerns around competitors.

3.4.1 International investors who do not invest in the UK

A third of those who are investing internationally do not currently invest in the UK. Split by market, this proportion is highest for Germany and the US at 38% and 36% respectively, indicating that **international investment from those countries is favouring other destinations over the UK**.

Some interviewees noted that in general, the UK was not perceived as a top investment destination and is not on the initial list of markets to explore for investment prospects. The rationale behind this for these organisations was a perceived lack of CAM organisations worth investing in in the UK.

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Redacted *Redacted*

Redacted *Redacted*

3.4.2 Respondents who do not yet invest internationally

38% of the total sample of respondents are not yet investing internationally, indicating that there is an **opportunity to attract investment into the UK CAM sector from those not yet investing internationally.** Among the individual countries in the survey sample, this opportunity seems to be particularly large for Germany and Japan where only 57% and 58% of respondents (respectively) are investing internationally.

Given the relatively immature nature of the CAM sector, this number is perhaps not surprising, with many interviewees noting that there are many smaller companies (including some in the panel) who are trying to establish themselves in the CAM sector rather than looking to invest internationally. This was particularly evident in the Israeli market where interviewees often noted that there are several start-ups (predominantly focussing on cyber technologies). Separately, Israel was noted by multiple other interviewees as a destination for cyber security, and AI/ML investment. This was partly driven by perceived expertise in digital R&D as well as perceived lower R&D costs, making it more attractive to establish start-ups.

One US stakeholder noted that there are several US companies that are exclusively focused on the US market despite having business models that could be applied elsewhere. There is, therefore, an opportunity to attract these companies to the UK by highlighting the value and ease of investing in and expanding to the UK. The stakeholder noted that these companies should be pitched on "cost, access to talent in the UK, access to Europe, ability to diversify testing and commercial base, access to legitimate commercial markets, and a clear and understandable regulatory environment in the UK." Furthermore, the interviewee noted that this "US-centric" approach could also be leveraged by highlighting that some US companies may derive benefit from investing in the UK as a way to gain experience in a favourable and more advanced regulatory environment.

These companies could subsequently take these experiences back to the US to spur regulatory development there. This approach provides US companies with a way to effectively work with US regulation and allows them to attempt to accelerate regulatory development in the US. Kittyhawk[12] is seen to be a successful example of a company taking this approach through its investment into the New Zealand market, which it has then used to leverage discussions around policy in the US.

3.5 ███████████████████████████████

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[12] https://techcrunch.com/2018/03/13/kitty-hawk-begins-certifying-its-self-flying-taxis-for-service-in-new-zealand/

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3.6 Investment drivers and barriers

In this section, the investment drivers and barriers are split into the three segments described in Section 3.4: international investors who invest in the UK; international investors who do not invest in the UK; and, respondents who do not invest internationally at all.

3.6.1 International investors who invest in the UK

As summarised in the survey snapshot, the top three factors that are currently driving respondents' investment into the UK are:

- A perception of the country's high **innovation potential** (i.e. the factors that make it a strong innovator of CAM products, such as the R&D and skills ecosystem);

- An **expectation of high growth in the UK CAM sector** (i.e. in size and value); and

- An expectation of a **high degree of end user acceptance** of CAM among the UK population.

Among individual countries, whilst the data is not statistically significant (fewer than 30 UK investors per market), the UK's innovation potential is a particularly strong driver for investors from Japan and South

Korea. US-based investors rate the UK's CAM testing environment as an important factor (and do source testbed services from the UK, as covered in Section 4).

Factors that investors into the UK did not rate as very important drivers of investment relative to other factors that were presented as options are the availability of funding from UK government, the attractiveness of the software/IT market, and the overall growth potential of the UK economy. This finding contradicts a later finding (in Section 3.7.3) in which survey respondents highlighted government funding of innovation as an important driver of future investment. As reiterated in that section as well, this is potentially because investors tend to undervalue the importance of funding post facto.

Key considerations emerging from this section

Based on the above, to retain existing investors, it will be important for the UK CAM sector to:

- Continue investing in and highlighting the UK market's innovation potential

- Continue demonstrating the potential for the sector's growth

- Continue demonstrating the likelihood of end user acceptance of CAM

For US investors specifically, there may already be a relatively strong interest in Testbed UK but this may have to be advertised to other markets (as well as further advertised within the US market).

3.6.2 International investors who are not investing in the UK

Among those respondents who are investing internationally but not in the UK, the **top barriers to investing in the UK** are:

- A lack of understanding or insight into the UK CAM sector,

- A perception that growth will be held back by high costs (for example, of engineering and research capabilities),

- A view that it is too expensive to establish new relationships within the UK CAM sector; and,

The factors that were rated the lowest as barriers were an insufficient automotive skills base, an insufficient digital skills base, and low end-user acceptance. The lack of a testing environment was also not a barrier.

It is worth noting that since the sample size of those who invest internationally but not in the UK, is less than 15, insights by individual country cannot be disaggregated.

One international stakeholder noted that perceptions on cost may be inaccurate, and that the market could benefit from having a clearer view on key costs, such as land value.

Redacted	*Redacted*

The **top drivers of international investment** according to those who invest internationally are:

- The overall growth potential of the country's CAM sector,

- The strength of the country's CAM-related infrastructure; and,

- The strength of the country's CAM-related innovation.

Among individual countries, the overall growth potential of a country's CAM sector was investors' top reason for investing internationally.

> *Redacted*

It is important to note that for the purpose of the survey, 'infrastructure' and 'testbeds'/'testing environment' were separated as options for respondents to select as drivers/barriers/future drivers of investment and sourcing destinations. 'Infrastructure' was defined as physical infrastructure like roads and communications infrastructure like 5G. While 'infrastructure' was rated as a key driver of international investment, 'testing environment' was not considered as important.

Key considerations emerging from this section

Based on the above, there is clearly a **strong role for marketing and international engagement to boost investment into the UK**. The international market needs a better and deeper understanding of the UK CAM sector.

Specifically, some of the **information that will be important to attract existing international investors to the UK market** are:

- The UK CAM sector's growth potential,

- A reassurance that growth will not be impeded by high costs,

- The UK's CAM-related physical and communications infrastructure (both available and planned), and

- The UK's CAM-related innovation (both available and planned).

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The factors that international investors in general considered the least important were the level of government funding in the sector, the overall growth potential of the economy, and the attractiveness and stability of CAM policy and regulation. Interestingly, the first of these does not correlate with what all participants want to see from the market going forward. One international stakeholder noted that they had looked at Government R&D funding opportunities in the CAM sector, but that funding was only open to UK based companies and they had therefore chosen not to invest in the UK. Potential reasons for this discrepancy are discussed in Section 3.7.3.

3.6.3 Respondents who are not investing internationally

As stated in Section 3.4, 38% of the sample are not investing internationally at all. The predominant reason for not investing internationally is that all of the **capabilities required for the companies' CAM ambitions are available domestically**. This is not surprising given that the four countries in the survey sample have strong automotive and technology sectors. Respondents cited their companies' **strong focus on zero emission vehicles** and the **COVID-19 pandemic** as other reasons for not investing internationally in CAM.

When asked what improvements would drive them to invest internationally, these respondents cited the following as the top three factors:

- Stronger CAM-related physical or communications infrastructure,

- Stronger CAM-related innovation; and,

- Greater likelihood of end user acceptance.

Respondents that don't invest are less concerned about the overall growth potential of the economy, the strength of the wider automotive market, and the attractiveness and stability of the policy environment.

Key considerations emerging from this section

Based on the above, to attract those who are not investing internationally at all, the UK CAM sector should:

- Consider what its Unique Selling Proposition as an investment destination is for potential investors from Germany, South Korea, USA and Japan, which already have strong domestic CAM markets;

- Demonstrate the strong linkages and interdependencies between CAM and Zero Emission Vehicles through the lenses of policy, technology, infrastructure, and so on;

- Emphasise the strength of its CAM-related infrastructure and innovations (both existing as well as planned); and,

- Highlight the strong consumer market that it expects for CAM in the future.

3.7 Future interest in the UK CAM sector

3.7.1 Level of interest

Of the survey 41 respondents who invest internationally but not in the UK, 27% would consider investing within 5 years and 32% in 5-10 years. Only 7% do not see themselves investing in the UK at all.

Although the numbers of non-UK investors are too small per country for the results to be statistically significant, it is noteworthy that almost all of the non-investors from US and Germany said they might invest in the UK in the next 10 years. On the other hand, almost all of the Japanese non-investors said they would not invest within the next 10 years.

3.7.2 Future areas of interest

Over a third of participants believe that the UK can have a USP in:

- R&D capabilities (45%)

- Engineering capabilities (34%)

- AI/ML software, Sensors, and Autonomous Control Systems (33%).

Interestingly, while R&D capabilities emerged as one of the Top 5 areas that investors are currently investing in, Sensors did not. This indicates that, while Sensors are seen as a future USP for the UK, there is limited current interest in investing in this area.

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In respect of future use cases in which respondents believe the UK has a strength from a deployment perspective, application of CAM technologies to **passenger vehicles and robo-taxis** emerged as the overwhelming winner with over 62% of participants stating that the UK could have a USP in this. This finding correlates with the importance that respondents gave to end user acceptance as a driver of investment. 54% also voted for **autonomous public transport** as a potential use case, again not surprising because of the UK's strong public transport networks. 41% of participants see the UK's value in first and last mile delivery. Fewer than 30% however see long-haul logistics or demand-responsive transport as strong areas for the UK. These findings hold across the four individual countries in the survey.

> **Key considerations emerging from this section**
> - Based on the above the UK CAM sector should develop and market its:
>   - R&D capabilities
>   - Engineering capabilities
>   - AI/ML software
>   - Sensors
>   - Autonomous Control Systems
> - A **greater focus might be required on developing and marketing Sensors** given that these have emerged as a future USP but not as a current investment product.
> - Given that **OEMs and CAM Pods** are current investment strengths (as discussed in Section 4.5), some level of investment and development of these products may be necessary to retain current investment even if these are not viewed as future USPs.
> - If **Testbeds** and **Cybersecurity** are focus areas of the UK CAM sector's current industrial strategy, the perceptions of these among investors and potential investors will have to be improved.
> - In respect to use cases, **focusing on the UK's strength in testing and deploying CAM technologies in passenger vehicles/robo-taxis and public transport vehicles** would help reinforce existing perceptions of these use cases as UK strengths.
> - On the other hand, should the UK want to position itself as a strong contender for use cases in long-haul delivery or demand-responsive transport, existing perceptions would have to be changed.

3.7.3 Perceptions of what would make the UK a more attractive investment destination

Across the entire sample and all segments of respondents, at least 40% of participants believe that the following factors would make the UK a more attractive investment destination:

- More or better CAM-related infrastructure (51%)

- More CAM-related innovation (48%)

- More government funding in CAM to attract innovation (40%)

The first two factors align with the drivers of investment that different segments noted above. Interestingly, however, while 40& of respondents said that more government funding in CAM would encourage them to invest more in the UK, as described above in the analysis of current drivers of investment (Section 3.6), **availability of government funding and incentives in CAM** emerged as one of the least important drivers for international investment into the UK specifically. This could be because those who have already invested in the UK undervalue the importance of government funding post facto. Among interview respondents, there were mixed views on the importance of funding from stakeholders interviewed with some citing it as not important, whereas others emphasised that it was extremely important. Several interviewees noted that there appears to be a funding gap between scaling R&D projects into large scale demonstrations, and they see less evidence and intent from the UK on this.

When interpreting the finding that 'level of government funding' was not rated as a particularly important driver of investment in general, it is important to note that several of the other drivers that survey and interview respondents consider important could or would be achieved through greater government funding. Therefore, the conclusion from previous sections should not be that government funding is not important.

Again, it is worth clarifying that 'infrastructure' was interpreted as physical infrastructure like roads and communications infrastructure and 'Testbeds' were presented as a separate option. 51% of survey respondents rated the former as a key future driver, while 33% considered 'Testbeds' to be important.

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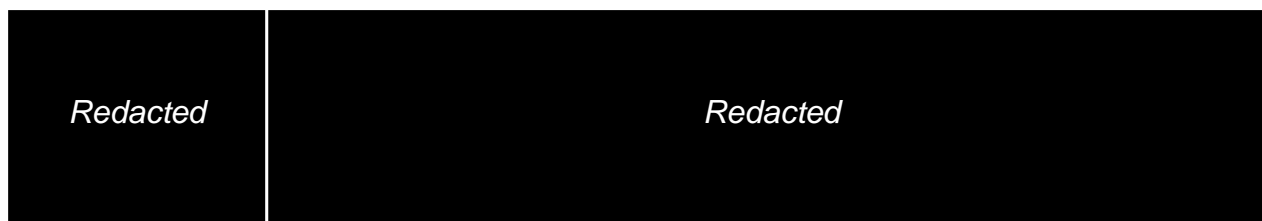
It is also worth noting that the fewest proportion of respondents considered a more stable trade and regulatory environment (20%) as important in making the UK an attractive investment destination. This is a possible indication that, from an investment perspective, respondents do not consider the UK's exit from the EU to be a major deterrent.

A recurring factor through interviews, which was not captured in the survey data, is the power of large OEMs to attract wider ecosystem investment. Several interviewees noted that the UK has a relatively small number of large OEMs when compared to other key markets (such as the US and Germany). Furthermore, with JLR being owned by Tata, an Indian company, there is a risk that significant innovations may spill over into the Indian market. However, multiple interviewees noted there is perhaps an opportunity to leverage this link with India to help attract desirable skills from the Indian market (e.g. software). More broadly, many stakeholders noted that if the UK were to attract a large Chinese or US OEM, this would likely trigger wider investment into the CAM ecosystem as a large number of the broader companies rely on B2B models where large OEMs are the end client.

> **Key considerations emerging from this section**
>
> In addition to the considerations in Section 3.6 on attracting investment from the three segments of the international market, the **UK Government should also consider greater funding to CAM innovation** to attract investors across the board and fund larger-scale deployment of CAM, since the international market felt strongly that this would attract investment into the UK.

3.8 International market perceptions vs. UK stakeholders' self-perception of the UK as an investment destination

This sub-section briefly compares the perception of the international market (as revealed by the survey and interviews) with the UK stakeholders' perspective of the UK as a CAM investment destination.

Table 6 - Comparison of perceptions

UK self-perception	International perception
CAM offerings in which the UK already has a strength	
Full software stack	**While the survey questions did not explicitly ask about the Full software stack, interviewees generally did not highlight it as a particular strength or weakness of the UK's.**
Simulation software	Modelling and Simulation services were not a highly-rated product among survey respondents (with only 18% of investors into the UK saying they invest in it). Similarly, in interviews, Modelling / simulation services and products were not identified as particular strengths.
AI/ML	AI and ML software emerged as the 'most invested in' CAM offering with 39% of investors into the UK saying that they currently invest in it. There were mixed views on the UK's AI / ML capabilities, with some individuals citing organisations such as Deep Mind as market leaders globally (thus positioning the UK well), whereas others noted that AI / ML were not relative strengths of the UK (with Israel, China and the US cited as stronger players).
Offerings not cited explicitly by UK stakeholders as a current investment strength	In addition to the above, international survey respondents noted Autonomous Control Systems, CAM Pods and OEMs as the products they were currently investing in. Interview participants noted computer chip architecture, functional safety, and high-end products (like internal vehicle trim) as current investment areas.

CAM offerings in which the UK could have a USP

Full software stack	Whilst the survey questions did not explicitly ask about the full software stack, interviewees generally did not highlight it as a future strength.
Simulation software	There was average interest in Modelling and Simulation services among survey respondents as a future USP with 25% saying they would consider it as such. Interviewees generally did not identify Simulation software as a potential USP.
Sensors	Both survey respondents (31%) and interview participants felt that the UK had a strong future USP in Sensors. Interview respondents also generally felt that the UK was strong for Sensor technology, however some cited the risk that other markets (e.g. China) will likely adopt similar technology which could risk impacting on the level of USP.
Cybersecurity	Among survey respondents, Cybersecurity was rated the lowest among different CAM offerings as a future USP (only 11% of all survey respondents). Interview respondents also consistently noted that they did not see Cybersecurity as a strength for the UK, especially in light of the capabilities of the US and Israel markets.
Offerings not cited explicitly by UK stakeholders as a current investment strength	In addition to the above, survey respondents recorded Engineering Capabilities and Autonomous Control Systems as a USP for the future. R&D capabilities also emerged as a top USP (UK stakeholders covered this as a driver for investment.)

Future CAM use cases for the UK

Freight and logistics could provide an early use case for CAM within the UK.	Among survey respondents, passenger vehicles and public transport were the overwhelmingly popular future use cases for the UK. While some (41%) also saw the value of first and last mile logistics, only 29% rated long-haul logistics as a future strength for the UK.

Drivers of investment

Human capital and R&D capabilities in the UK	A large proportion (~40%) of survey respondents are already investing in the UK's R&D capabilities and an even higher proportion believe that this is the UK's top USP going forward. This view was borne out by interviews as well, with most interviewees emphasising their perception of the UK's R&D capabilities being very strong, due to a large extent because of its strong university system.
The UK's testbed infrastructure	Redacted Testbed infrastructure did not emerge as a current strength from an investment target perspective. None of the four markets rated it highly as a future strength, with only 12% of all respondents rating it as a future USP.
The Government's R&D funding into CAM innovation, particularly in early years	The Government's funding of CAM innovation did not emerge as an important determinant for current investment among existing investors into the UK (potentially because those who have already invested undervalue this as a factor). Respondents, however, rated it as one of their top three future drivers. Similarly, several interviewees noted that government funding certainly would attract more investment, particularly given that markets such as China are subsiding their sectors so significantly.

Barriers to investment

The recent focus on zero emission vehicles by OEMs in line with international and UK policy (at a global level)	Among survey respondents who are not investing internationally, a focus on zero emission vehicles was the second most predominant reason. This was highlighted throughout interviews as the electrification agenda has been perceived to become a higher priority for OEMs and therefore has reallocated a certain portion of the funding that had previously been allocated towards CAM initiatives.
The UK's limited production capabilities in the automotive sector	Many interviewees noted that whilst the UK had strength in R&D, due to higher production costs, this was not translating to larger scale production capabilities. Similarly, several interview respondents cited the relatively fewer large-scale OEM companies in the UK when compared to competing markets (e.g. Germany and the US) as being a barrier to investment (It is worth noting that OEMs emerged as the fifth most invested-in product among survey respondents, albeit these might be the smaller niche OEMs).
Limited investment by the UK Government and industry in recent times	Survey respondents cited 'more government funding of CAM innovation' as the third-most important factor in making the UK a more attractive investment destination. A small number of interviewees noted that they would have in the past looked at the UK more seriously as an investment destination if the government had made attractive funding, or tax incentives available.

4   The UK as a Source of CAM Products

4.1   Introduction

As described in the Introduction, two of the key objectives of this study are to:

- Understand intentions for organisations to procure UK CAM, and

- Understand the drivers and barriers facing these organisations from a sourcing perspective.

This section summarises the insights and information drawn from the international surveys and interviews to examine perceptions of the UK as a source of UK CAM products. Section 5 on the SWOT analysis focuses more on the UK in comparative perspective, this section does not draw out comparisons with other countries.

The section is structured into the following sub-topics:

- Section 4.2: Snapshot of survey results

- Section 4.3: Country snapshot

- Section 4.4: Current interest in the UK as a source for CAM products

- Section 4.5: Products of interest

- Section 4.6: Sourcing drivers and barriers

- Section 4.7: Future interest in the UK as a source of CAM goods and services

- Section 4.8: International market perceptions vs. UK stakeholders' self-perception of the UK as a source of CAM goods and services

4.2 Snapshot of survey results

Figure 4 - Survey snapshot: UK as a sourcing destination

69% of those sourcing internationally are sourcing from the UK CAM market.
67% who are not currently sourcing internationally would consider it in within 10 years.

Entire sample:
- 82% Sourcing internationally
- 18% Not sourcing internationally

Those sourcing internationally:
- 69% Sourcing from the UK
- 31% Not sourcing from the UK

Those not sourcing internationally:
- 51% Yes within 5 years
- 16% Yes, in 5-10 years
- 22% Perhaps after 10 years
- 11% Not interested in sourcing
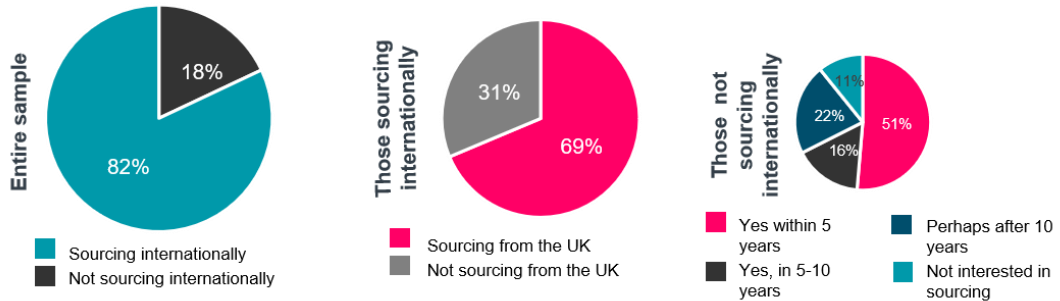
R&D capabilities, Sensors, Autonomous Control Systems, and AI/ML software appear to be the UK's strongest products – both in the present and for the future.

Top 5 products currently being sourced
1. R&D capabilities
2. Sensors
3. Autonomous Control Systems
4. CAM Pods
5. Artificial Intelligence/ Machine Learning software
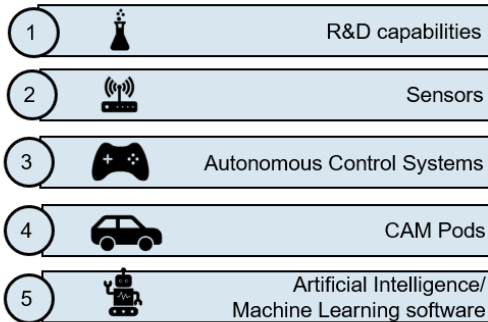
Top 5 'sourcing USPs' for the UK in the future
1. R&D capabilities
2. Artificial Intelligence/ Machine Learning software
3. Sensors
4. Engineering capabilities
5. Autonomous Control Systems
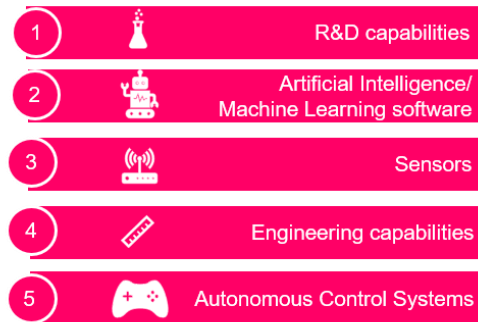
Note: The highest proportion of respondents (>33%) selected each of these. Other options were university capabilities, testbed services, whole vehicles, Human Machine Interface technologies, Modelling and Simulation services, and Cybersecurity.

What's attracting current procurers to the UK CAM market?

- Products are only available from a UK supplier
- Products are of a high quality
- Clear and flexible policy environment

What drives procurers' choice of global markets in general?
1. Availability of the product
2. Relative quality of the product
3. Relative unit cost of the product

What's holding back those who aren't sourcing CAM products from the UK?

- We don't understand the UK's CAM offering
- We don't have strong existing supplier relationships
- The UK doesn't yet provide what we need
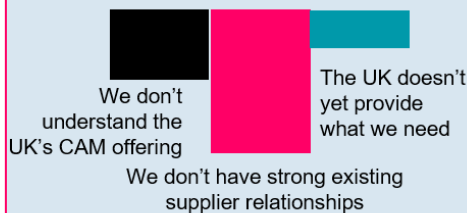
Notes:
- *Factors that were not as important for respondents in the sample as determinants of global markets for sourcing were – Geographic or cultural proximity, Clarity and flexibility of policy, and Trade regulations*
- *Factors that did not appear to determine respondents' choice of the UK as a source were the Strength of geographical and cultural ties, Ease of trading with the UK, and unit cost effectiveness of goods and services*

Analysis based on quantitative survey results of 203 senior decision-makers from automotive and CAM companies in Germany, Japan, South Korea and the US.

4.3 Country snapshot

Figure 5 - Country snapshot: UK as a sourcing destination

Profile of procurers

• 94% have sourced internationally • 53% of these procurers have procured from the UK	• 84% have sourced internationally • 79% of these procurers have procured from the UK	• 73% have sourced internationally • 82% of these procurers have procured from the UK	• 76% have sourced internationally • 63% of these procurers have procured from the UK

Redacted

Main products sourced from the UK

• R&D capabilities • Sensors • Testbed services	• R&D capabilities • CAM pods • Testbed services	• Sensors • Autonomous Control Systems • R&D capabilities	• R&D capabilities • Testbed services

Products that the UK could have a USP in

• R&D capabilities • AI/ML software • Engineering capabilities	• Sensors • R&D capabilities • CAM Pods	• R&D capabilities • Engineering capabilities • AI/ML software	• R&D capabilities • AI/ML software

Main reasons for sourcing from the UK

1 Clear and stable policy and regulatory environment	1 The product is only available in the UK	1 The product is only available in the UK	1 The product is only available in the UK
2 High quality of UK products	• Landed cost effectiveness 2 Digital/Automotive skills base	2 Landed cost effectiveness	2 High quality of UK products
3 Digital/automotive skills base	Clear and stable policy and regulation	3 High quality of UK products	3 Digital/automotive skills base

Analysis based on quantitative survey results of 203 senior decision-makers from automotive and CAM companies in Germany, Japan, South Korea and the US.

4.4 Current interest in the UK as a source for CAM products

Broadly, for the UK CAM sector, the international market for sourcing – i.e. the export market – can be segmented into three categories:

- International procurers who procure from the UK
- International procurers who do not procure from the UK
- Participants who do not yet procure internationally

The general level of interest from survey respondents is summarised in the sub-sections below – the drivers and barriers of their interest are in Section 4.6.

4.4.1 International procurers who procure from the UK

Among those who are procuring internationally, there appears to be a **high degree of interest in the UK CAM sector as a sourcing destination** with over two-thirds of those respondents whose companies are procuring CAM products internationally, also procuring from the UK.

Disaggregated by country, the UK appears to be strongest as a source of CAM products for South Korea and Germany where 82% and 79% (respectively) of all respondents who are sourcing internationally also source from the UK. On the other hand, respondents from the US indicated the lowest demand for UK products with only 53% of those respondents who do source products from other countries saying that they source from the UK.

4.4.2 International procurers who do not procure from the UK

A third of those who are sourcing CAM products from international markets are not procuring from the UK. As described above, the proportion of international procurers who are not sourcing from the UK is highest for the US (47%) and Japan (37%), indicating that a large proportion of CAM companies in these **countries may be favouring other countries over the UK**. Reasons for this are set out in Section 4.6.2.

4.4.3 Participants who do not yet procure internationally

Overall, the survey responses indicate that most CAM companies in Germany, Japan, South Korea, and the US are sourcing products internationally. Only 18% of respondents said that they do not source any CAM products from outside the country in which they are based. Therefore, the opportunity in the untapped export market appears to be smaller than the untapped investment market, although this study does not explore the total exploitable market size, and the UK's share of this, either for investment or sourcing.

4.5 Products of interest

As illustrated in the survey data snapshot, the highest proportion (over 33%) of respondents are currently sourcing the following from the UK:

- R&D capabilities
- Sensors
- Autonomous Control Systems
- CAM Pods
- AI/ML software

Interestingly, CAM pods did not emerge through interviews as a recurring product of interest, however more broadly the following did:

- Functional safety
- High end product design (e.g. internal trim)
- Chip manufacturing.

While the disaggregated results for the four individual countries are not statistically significant (because the number of procurers from the UK per country is less than 30 for the US and Japan, and just over 30 for South Korea and Germany), some of the key take-aways that may warrant further examination are as follows:%

- **Testbed services** are procured by a large proportion of US and Japan respondents (40% and 38% respectively.) However, this did not emerge as a Top 5 product at an overall level because only 10% of South Korean respondents seem to procure testbed services from the UK.
- **South Korea** respondents indicated an almost-uniform interest across all the products in the questionnaire, with no product being a specific preference among even a third of participants.
- **German** respondents showed significant interest (41%) in R&D capabilities but no other product emerged as a specific preference from even a third of participants.

At an overall level, the products in which respondents showed the **least interest** were Cybersecurity and University/Academic Capabilities, with fewer than 20% of respondents saying that their companies procure these. Given that the UK's university capabilities have emerged as a key strength according to the interviews, it is plausible that the survey respondents did not view university capabilities as a product to be 'imported'.

> **Key considerations emerging from this section**
>
> The analysis of current sourcing interests suggests that, to retain current procurers, the UK should continue to invest in and develop its:
>
> - R&D capabilities
> - Sensors
> - Autonomous Control Systems
> - CAM Pods
> - AI/ML Services
> - Testbed services (particularly for the US and Japan)

4.6 Sourcing drivers and barriers

In this section, the drivers and barriers to international sourcing are split into the three segments described in Section 4.4: international procurers who source from the UK; international procurers who do not source from the UK; and, respondents who do not source internationally at all.

4.6.1 International procurers who source from the UK

As summarised in the survey snapshot, the top three factors that are currently driving respondents' procurement from the UK are:

- The product being available only from a UK supplier,

- Products being of a high quality; and,

- Clarity and flexibility of the policy environment.

The first two points indicate that the UK has been able to create a niche for itself in the global CAM market as a reliable and high-quality provider of products (particularly R&D capabilities and sensors as highlighted in Section 4.5). The third point indicates that, from a trading perspective, international companies find the UK's policy environment quite favourable, indicating in turn that those who are procuring from the UK may not see its exit from the EU as a significant barrier.

Product availability and product quality were also two recurrent factors throughout interviews with many stakeholders citing that, given the immature nature of the CAM sector, many goods are yet to become commoditised, and that there is significant variation between suppliers.
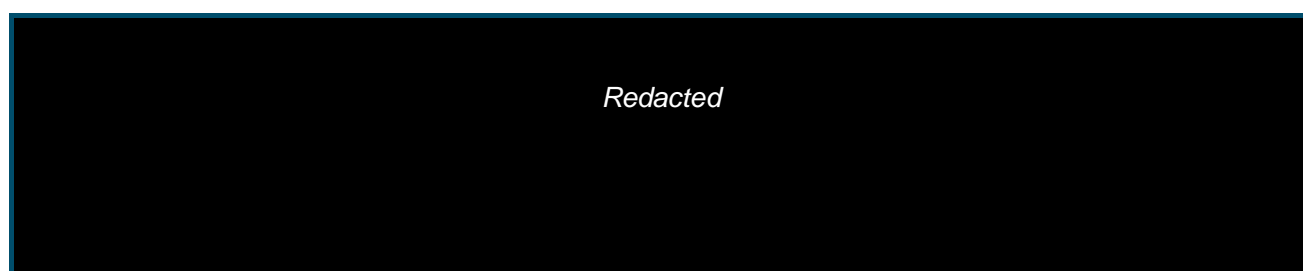
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Among individual countries, while the data is not statistically significant (fewer than 30 UK procurers in two of the four markets), other factors that stood out are the UK's **strong skills base in the automotive and digital sectors** (for Germany, Japan, and the USA), and the **reasonable landed cost of doing business with the UK in respect of customs, duties, brokerage etc**. (for Germany and South Korea).

The factors that respondents did not consider as important were the strength of geographical and cultural ties with the UK, ease of trading with the UK, and the unit cost effectiveness of the goods and services sourced from the UK.

Key considerations emerging from this section

Based on the above, to retain existing procurers, it will be important for the UK CAM sector to:

- Continue investing in and highlighting the UK market's potential to provide high-quality CAM products in which it is already strong (e.g. R&D capabilities, Sensors)

- Continue demonstrating the clarity and flexibility of policy and regulation

- Continue highlighting the country's strong skills base in the automotive and digital sectors

4.6.2 International procurers who are not sourcing from the UK

Among those respondents who are sourcing internationally but not in the UK, the **top barriers are**:

- A lack of strong pre-existing relationships with the UK,

- A lack of information/insight into the UK's CAM offering; and,

- A lack of availability of the product needed.

It is worth noting that since the number of international procurers who are not sourcing from the UK is less than 15 for each country, it is not possible to disaggregate these insights by individual country. It was noted throughout interviews across multiple markets that strong pre-existing relationships helped

secure sourcing. It was noted by both Tier 1 suppliers and OEMs that OEMs in particular have well-established and entrenched supply chains, often choosing to work with a set number of suppliers and then looking to these primary suppliers to source their other goods.

Meanwhile, the **top drivers of international procurement in general** according to those who do source from international markets were largely similar to the drivers for procurement from the UK (barring relative unit cost):

- Availability of the good or service;

- Relative quality of the good or service; and,

- Relative unit cost of the good or service.

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Interviews provided polarising views on the importance of cost. Some interviewees noted that cost was a significant driver, with these stakeholders consequently tending to see the UK less as a sourcing destination ▮▮▮▮▮.

Conversely, some interviewees noted that cost was in fact less important in CAM than in traditional OEM offerings due to the need for quality technology and the fact that the sector is still relatively immature (with a lack of commoditised offerings). Interestingly, one interviewee noted that whilst the UK has a perception of being a high cost ▮▮▮▮▮▮▮▮] due to a higher productivity level, the UK's value for money proposition can be closer to other markets. ▮▮▮▮▮▮▮

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> **Key considerations emerging from this section**
>
> All three barriers to sourcing from the UK indicate that there is a **strong opportunity for focused international engagement detailing the UK CAM market's offering and providing guidance on how to access the market.**
>
> Based on the factors that international procurers in general consider important, the UK should once again focus on **highlighting the availability and high quality of various CAM products**, as well as **providing assurance on the reasonable unit cost of these products** (particularly for the US and Japan).

The factors that international procurers in general considered the least important were geographical or cultural proximity, clarity and flexibility of the policy and regulatory environment, and trade regulations, though policy did emerge as an important driver of procurement for the UK specifically.

4.6.3   Participants who are not sourcing internationally

As stated in Section 4.34.4.3, a relatively small proportion (18%) of the sample is not sourcing internationally at all. While specific insights were not available from the survey responses about what might attract the business of this segment of the international CAM market, it is likely that providing

detailed information about the UK's CAM offering in respect of type, quality, and price, would be an effective strategy for this segment as well.

4.7 Future interest in the UK as a source of CAM goods and services

67% of the 37 participants who are not currently sourcing CAM products internationally would consider it in the next 5-10 years. Whilst the data for those who source internationally but not from the UK is not statistically significant enough to cite a particular percentage, the strategies highlighted above Section 4.6 could be effective for this segment.

Over a third of participants believe that the UK can have a USP in:

- R&D capabilities (49%)

- AI/ML software (43%)

- Sensors (39%)

- Engineering capabilities (37%)

- Autonomous control systems (35%).

Interestingly, these are the same products that respondents highlighted as future strengths from an investment perspective. In respect of the gap between current products sourced and future areas of interest, Engineering capabilities did not appear as a current product so would have to be developed for the future.

Among individual countries, in addition to the above, respondents from Germany rate 'CAM pods' as a significant future USP (39%).

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Key considerations emerging from this section

- Based on the above and depending on its current industrial strategy, **the UK CAM sector should develop and market its:**
    - o R&D capabilities
    - o AI/ML software
    - o Sensors
    - o Engineering capabilities
    - o Autonomous Control Systems

- Of these, a **greater focus might be required on developing and marketing Engineering capabilities** given that these have emerged as a future USP but not as a current product that is sourced.

- Given that **CAM Pods** are noted by survey respondents as a Top 5 product being sourced, some level of investment and development of these products may be necessary to retain current interest even if these are not viewed as future USPs.

- If **Testbeds** and **Cybersecurity** are focus areas of the UK CAM sector's current industrial strategy, the perceptions of these among procurers and potential procurers will have to be improved.

4.8 International market perceptions vs. UK stakeholders' self-perception of the UK as a source of CAM goods and services

This sub-section briefly compares the perception of the international market (as revealed by the survey and interviews) with the UK stakeholders' perspective of the UK as a source of CAM products.

Table 7 - Sourcing: differences in perceptions

UK self-perception	International perception
CAM offerings in which the UK already has a strength	
Sensors	Sensors were the most sourced product among respondents who do source from the UK (44%).
Cybersecurity	Among survey respondents, Cybersecurity was rated the lowest among different CAM products being sourced from the UK (17%). Interview respondents also consistently noted that they did not see cybersecurity as a strength for the UK, especially in light of the capabilities of the US and Israeli markets.
Software development	Interview respondents had mixed views on the UK's strength in Software development, with some citing it as advanced but with others noting it is lagging behind other markets (with the likes of India, China, and Israel being considered leaders). Generally, it was acknowledged however that the UK is an expensive market for software development. 'Software' was not presented as a separate category in the survey.
Simulation	Modelling/Simulation services were a moderately-rated product among survey respondents with 29% noting that they source them from the UK.
AI/ML	AI/ML software is the fifth most sourced product among survey respondents (33%). There were mixed views on the UK's AI/ML capabilities, with some individuals citing organisations such as Deep Mind as market leaders globally (thus positioning the UK well), whereas others noted that AI/ML were not relative strengths of the UK ████████████
Testbeds	Testbed services were a relatively highly-sourced product for the US and Japan, and moderate for Germany, but not sourced much by South Korea respondents.
Offerings not cited explicitly by UK stakeholders as a current strength	In addition to the above, at least a third of survey participants noted Autonomous Control Systems and CAM Pods as products they currently source from the UK.

CAM offerings in which the UK could have a USP

Sensors	**Sensors were the third-most popular future USP among survey respondents with 39% noting that it could be a strength for the UK.**
Full software stack, semiconductors & data services	The survey questions did not explicitly ask about the Full software stack, Semiconductors or Data services. These could be examined as discrete capabilities in future studies. Of these capabilities, Semiconductors recurred as a key strength for the UK in interviews, with a number of interviewees referring to ARM Ltd as a core strategic asset.
Offerings not cited explicitly by UK stakeholders as a future strength	As discussed earlier in the section, the products that did emerge through the survey as future strengths were Engineering capabilities, Autonomous Control Systems, and AI/ML software.

Drivers of sourcing decisions

R&D capabilities	**Among survey respondents, R&D capabilities were rated as the most-sourced current product as well as the UK's biggest USP for the future. This was also borne out overwhelmingly in interviews.**
Software and service capabilities	AI/ML software emerged as a Top 5 'currently sourced product' as well as a 'future USP, indicating that survey respondents do positively regard the UK's software capabilities. Respondents from Germany, South Korea, and the US, in particular, value the UK's digital skills base as a driver of their sourcing decisions.
University capabilities	Interview respondents emphasised the UK's strong University and academic capabilities as a key driver of their decision to source from the UK. However, this did not emerge as a significant current or future strength in the surveys (potentially because respondents do not view university capabilities as something that needs to be 'procured' separately, and more as a contributing factor to the UK's R&D capabilities more generally).

Barriers to sourcing from the UK

The UK's limited production capabilities in the automotive sector	**Several interview respondents cited the limitations of scale in the UK's automotive market as being a barrier to sourcing though the UK's automotive market did not emerge as a significant barrier among survey respondents.**
The UK's exit from the European Union and the resulting uncertainty in the trading environment	Among survey respondents, the UK's exit from the European Union did not emerge as a barrier. In fact, 'clarity of the UK's policy and regulatory environment' was one of the top three drivers of sourcing decisions from the UK. Among interview respondents, there was a mixed response – while some believe that this has impeded their companies from sourcing from the UK because it is no longer a 'Gateway to Europe', others believe that this could be a key opportunity for the UK to shape a favourable regulatory regime for CAM before Europe does.
Insufficient marketing and international engagement by the UK CAM sector	Among survey respondents who are not currently sourcing from the UK, a lack of information/insight into the UK market and the high perceived cost of establishing new relationships were among the top barriers. Many interview respondents also emphasised opportunities for the UK CAM sector to engage and share more information internationally. These points will be detailed in Section 6.

5 Perceptions of the UK's Comparative Position

5.1 Introduction

As described in the Introduction, a key overarching objective of this study is to:

- Understand perceptions of UK's strengths, weaknesses, opportunities and threats (SWOT) in the CAM sector.

This section summarises the perceived strengths, weaknesses, opportunities and threats for UK CAM by drawing together the insights and information from the international surveys and interviews. Each of these areas has been explored through the following lenses, which are the same as those used in KPMG's Autonomous Vehicle Readiness Index[13]:

- Technology and innovation

- Policy and regulatory landscape

- Infrastructure

- Consumer acceptance

The section is structured into the following sub-topics:

- Section 5.2: ▮▮▮▮▮▮

- Section 5.3: Country-by-country snapshot

- Section 5.4: The UK in comparative perspective

- Section 5.5: International market perceptions vs. UK stakeholders' self-perception of the UK's comparative position on the global stage

It is worth noting in the following section that since UK strengths like Sensors, R&D capabilities and Engineering Capabilities, are also being procured from other markets, the UK needs to continue to invest in them to build its competitive advantage. Similarly, Cybersecurity and Testbeds do not seem to be procured in large proportions from other countries, indicating that they may be immature markets.

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[13] KPMG (2020) *2020 Autonomous Vehicles Readiness Index*

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Table 8 ████████████

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Table 9 – ████████████

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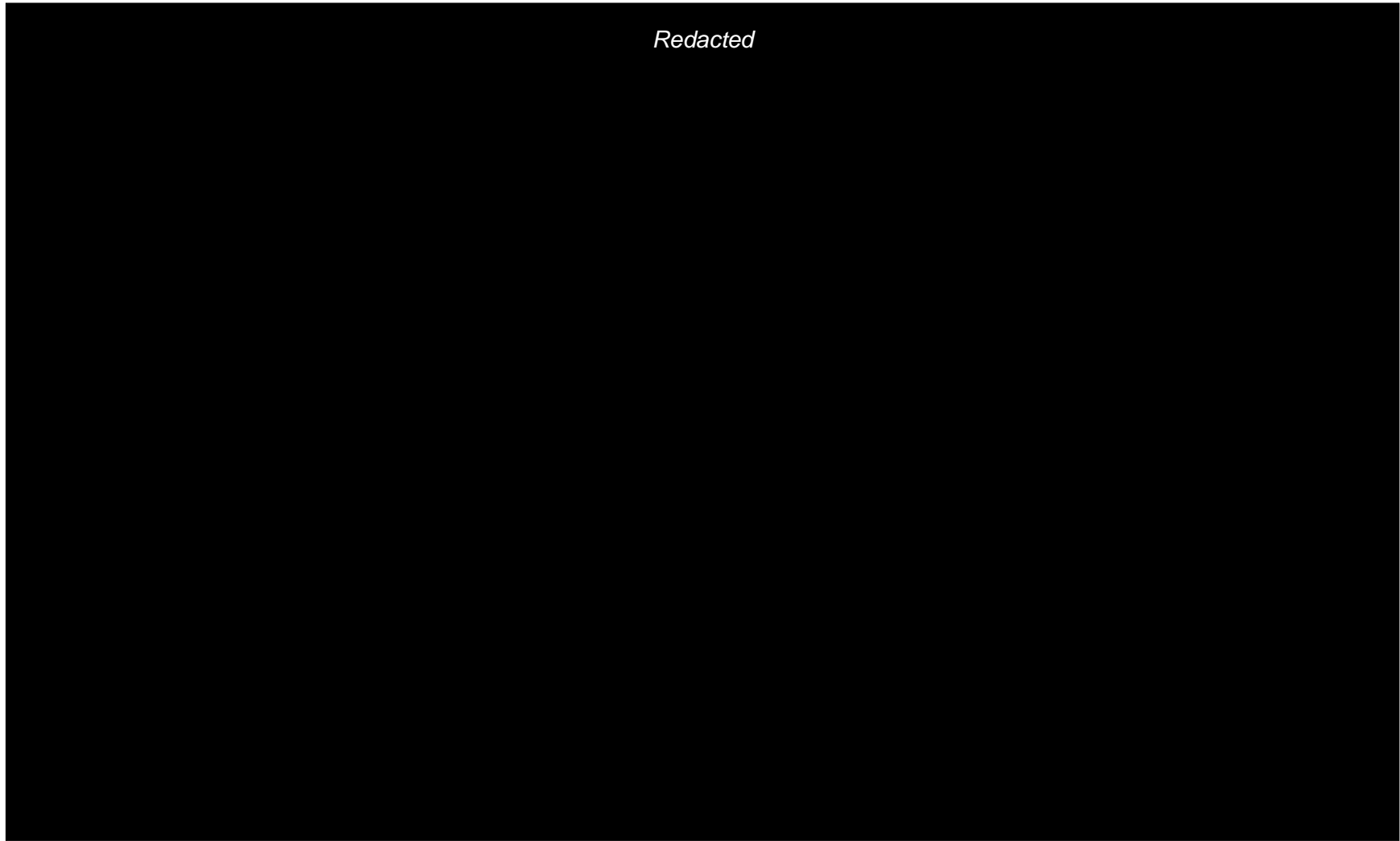
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Table 10 – ████████████

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5.3 Country-by-country snapshot

Figure 6 - Investment and sourcing by country

What factors would make them invest more in the UK?

- More CAM related Infrastructure (64%)
- More CAM-related innovation (e.g. more CAM patents, more CAM research) (46%)
- Improvements in the automotive skills base (46%)

- More government funding in CAM to attract innovation (55%)
- More CAM-related innovation (e.g. more CAM patents, more CAM research) (53%)
- More or better CAM testbeds (45%)

- More CAM-related innovation (e.g. more CAM patents, more CAM research) (40%)
- More CAM related Infrastructure (40%)
- Improvements in the digital skills base (33%)
- Indications of customer acceptance of CAM in the future (33%)

- More CAM related Infrastructure (44%)
- More CAM-related innovation (e.g. more CAM patents, more CAM research) (30%)
- A clearer and more attractive CAM policy and regulatory environment (45%)

Note: This snapshot is based on the survey responses of 203 participants across Germany, Japan, South Korea, and the United States. It does not include insights from the qualitative interviews.

5.4   The UK in comparative perspective

The below table lays out the identified Strengths, Weaknesses, Opportunities and Threats identified through both the international survey and interview engagement exercises. Redacted text

Table 11 - UK CAM: Strengths, weaknesses, opportunities and threats

	Technology and innovation	Policy and regulatory environment	Infrastructure	Customer acceptance
Strengths	**Skills ecosystem:** ■ **R&D capabilities** were seen as the UK market's biggest strength across surveys and interviews, as a product that international CAM businesses currently source and/or invest in. ■ The education sector in the UK is seen as market-leading, with Oxford and Cambridge cited often as world leading institutions. **Offerings:** ■ The following products are seen as **sourcing strengths**: sensors, CAM pods, computer chip architecture (with the presence of ARM Ltd cited as a core strength). ■ The following are seen as **investment strengths**: AI/ML, modelling / simulation. ■ The UK is perceived as a destination for high end goods (e.g. internal trim). This is particularly the case for Japan and South Korea. **Company ecosystem:** ■ The UK has a number of companies that are seen as market leading in their respective fields (e.g. ARM Ltd, Oxbotica and Five) ■ The UK has valuable OEMs that attract investment into the wider ecosystem (e.g. JLR and Rolls-Royce) ■ Arrival's recent IPO in New York has provided a short term boost to UK automotive/ CAM visibility in the US **Other factors:** ■ The UK is seen as being a global leader in the green agenda and decarbonisation. ■ London is perceived as a core strength as both a target market for goods, as well as having a strong financial sector with access to venture capital and private equity capital.	**Single regulatory body:** ■ A **single regulatory driving body** (i.e. the UK Government) is seen as providing a more streamlined regulatory system (in contrast to US and EU markets in particular) ■ It is also viewed as enabling more regulatory agility, which is hugely valuable in a rapidly changing sector such as CAM. **Clarity and flexibility:** ■ Survey participants who are currently sourcing CAM products from the UK noted the clarity and flexibility of the policy environment as a key driver **Quality of regulation:** ■ **UK regulation** is seen as market-leading by many with some other markets basing their own regulation on the UK's. ■ UK **regulation is generally perceived as having a focus on safety** (which is not the case in the US where some feel the sector is under regulated). **Other factors** ■ The UK is seen as having strong public/ private sector collaboration	**Mature infrastructure:** ■ Overall, the UK is seen as having **relatively mature CAM infrastructure** when compared to other markets ■ The UK is seen as being **better positioned to roll-out comprehensive CAM infrastructure** than some other markets (e.g. with infrastructure in the US and China developing in pockets) due to the UK being a smaller geography with more pervasive historic levels of underlying internet infrastructure (led by BT). **Early adopter:** ■ The UK is seen as an **early adopter of CAM/ transport infrastructure** (e.g. being one of the first in the world to successfully implement a congestion zone through installation of innovative infrastructure) ■ The presence of a "**Camera Culture**" in the UK is seen as a key enabler for future infrastructure required for CAM (e.g roadside infrastructure such as speed cameras).	**Overall acceptance:** ■ Overall, the UK is seen as having **high consumer acceptance for CAM services with** end user acceptance of CAM noted as one of the top three drivers of investment into the UK. ■ The UK's population is seen as being **early adopters of new transport infrastructure and technologies** (e.g. congestion zones). **Strong digital capabilities:** ■ The UK is perceived generally as having a **digitally-capable population.** **Existing network:** ■ The UK's existing public transport network is seen as a major strength that can be leveraged as a part of Mobility as a Service (MaaS) and CAM scale-up.

	Technology and innovation	Policy and regulatory environment	Infrastructure	Customer acceptance
	▪ The **English language** is cited as a key strength due to ease of accessibility of information.			
Weaknesses	**Overall perception:** ▪ Whilst there are pockets of expertise (mentioned above), generally the UK is perceived as being 'middle of the pack' for technology and innovation ███████. **Availability:** ▪ Availability of CAM technology goods and services is perceived to be limited in the UK. **Cost:** ▪ Survey respondents cited 'expectations of future growth being impeded by the high cost of engineering and R&D capabilities' as one of the main barriers to investing in the UK. ▪ More broadly, the UK is seen as an expensive market to source technology from, partly driven by high labour costs. **Cybersecurity:** ▪ Cybersecurity offerings in the UK are perceived as weaker than other markets ███████. **Manufacturing:** ▪ Whilst there is a strong R&D sector in the UK, a lack of manufacturing capabilities means that the UK struggles to translate this R&D into large scale production of new technologies. ▪ There is a lack of large OEM's in the UK in comparison to other markets such as Germany and the US. Many CAM organisations operating a B2B model therefore choose to locate themselves in these other markets.	**Impact of the UK's withdrawal from the EU (mixed view):** ▪ Several interviewees noted that the UK's withdrawal from the EU is seen by some as impacting on reliability of supply chains and diminishing the view of UK as gateway to Europe. However, others noted that the UK's withdrawal from the EU will not serve as too much of a deterrent for these factors. **Clarity of CAM policy:** ▪ There is a perceived lack of a clear regulatory roadmap for CAM in the UK. **Government incentives** ▪ The UK Government is not seen as subsidising the sector in the same way as some other markets (most notably China).	**5G infrastructure:** ▪ 5G infrastructure is generally perceived to be less developed than some other markets ███████.	**Driving side:** ▪ The need to adapt software and hardware for left hand side driving to sell into the UK is seen as a weakness for the UK as an investment destination. Similarly, the need to repurpose technology to sell into other right hand side drive markets is seen as a weakness from a sourcing perspective. **Certain use cases:** ▪ Long-haul driving and demand-responsive transport are generally not seen as important use cases for CAM in the UK among survey respondents.
Opportunities	▪ **Continuing to emphasise and promote existing strengths** like R&D, sensors, AI etc. will be critical to maintaining competitiveness as these are also strengths of the international market ▪ Developing a **clear and well publicised technology and innovation roadmap** for	▪ Developing a **clear and well-publicised regulatory roadmap** for the UK CAM sector would help provide confidence to prospective investors around the direction of travel and future areas of strength for the UK market	▪ Developing a **clear and well publicised infrastructure roadmap** for the UK CAM sector would help provide confidence to prospective investors around the direction of travel and future areas of strength for the UK market	▪ Ensuring **clear communications on developments in the CAM space are circulated to the general population** e.g. through formal channels (e.g. BBC News) and informal channels (e.g. shows such as Top Gear). This would continue to build consumer acceptance of CAM technology

	Technology and innovation	Policy and regulatory environment	Infrastructure	Customer acceptance
	the UK CAM sector would help provide confidence to prospective investors around the direction of travel and future areas of strength for the UK market. ■ **Attracting a large OEM from either US / China** would help to bridge the gap between the UK and these markets. The presence of more OEMs would in turn attract broader investment from across the CAM ecosystem and encourage technological innovation. ■ **'Piggy-backing' off large scale investments being made into the electrification and green agenda** more broadly by associating CAM with the latter would help increase investment into CAM. ■ **Increasing government funding** available to the CAM sector to enable successful R&D projects would support early stage technologies to scale more effectively. ■ **Attracting companies based in other markets** (e.g. USA) that are currently focused only on their home market. This could be done by highlighting the value of expanding into the UK, as well as the ease of doing so.	■ Circulating **clearer messaging on the current funding/ investment support available** to international companies for the UK would help improve awareness of current government support. ■ **Attracting businesses from markets with less developed / favourable regulation** (e.g. US which has lagged as the result of litigation fears) who can then take their experiences back to their home markets to spur on regulation (case study – Kittyhawk in New Zealand). This would attract investment into the UK CAM sector. ■ **Acting as a bridge between the Western and Eastern CAM sectors** by seeking investment from Chinese CAM players would increase investment into the UK CAM sector and open up new finance streams to the UK CAM sector.	■ Improving international engagement with, and awareness of, the **UK testbeds** would help attract users to the testbeds, which are currently not an important driver of investment relative to other factors or as an investment target relative to other products. ■ Promoting the benefits that a **large scale uniform infrastructure environment and camera culture** can have for testing vehicles. This is in contrast to the US where infrastructure is not uniform, and to the Singapore which only enables testing on a small scale. This would improve the relative attractiveness of the UK as a testing destination.	which would subsequently make the UK a more attractive target market for CAM technology. ■ **Emphasising developments in end user acceptance** in communications about the UK CAM sector as this is a key driver of investment decisions. ■ **Emphasising development of 'Passenger vehicles / robo-taxis'** and **'Public transport'** is important as these were cited specifically as the two use cases that investors expect the UK's USP to lie in. **Driving side:** ■ Whilst also listed as a weakness, the UK could position itself as the best location to develop right hand drive autonomous control systems. Doing so would allow OEMs better access to key markets such as the UK, Japan, Australia and South Africa.
Threats	■ There is a **risk of key strategic assets being sold** off (e.g. ARM Ltd). ■ With the UK's large OEMs (e.g. JLR) generally not under UK ownership, there is a risk that any innovations they develop in the CAM space could **overspill or be acquired by other markets**. ■ ▮▮▮▮▮▮▮▮ ■ Capital is being reallocated or diverted towards **electrification** (which is being driven by international policy focus). ■ **Countries subsidising their own CAM markets** ▮▮▮▮▮▮ could redirect investment away from the UK due to perceived lower cost of investing elsewhere.	■ ▮▮▮▮▮▮▮▮▮ ■ As a result of **the UK's withdrawal from the EU** the UK could lose its status as 'The Gateway to Europe'. ■ There is a risk of standards and regulation **diverging too far from other markets** (e.g. Europe) to the point that investors are hesitant over investing in the UK in case larger markets head in a different regulatory direction. ■ There is a risk that the UK **loses its pace of regulatory innovation and therefore loses its position as a market leader** without new, permissive, regulation.	■ Some smaller markets ▮▮▮▮▮▮ are seen as leading in Infrastructure due to small geofenced locations and public testing. ■ There is a risk of investing considerably in **roadside infrastructure only for this to become redundant** as the result of technological innovation in the sector (e.g. one stakeholder interviewed noted that their business model aimed to remove the need for significant amounts of roadside infrastructure to enable CAM).	■ Some CAM organisations (particularly in the US due to a less regulated sector) are overpromising on technological capabilities and testing technology on public roads that some perceive to be unsafe. This has a risk of negatively impacting consumer confidence for CAM technology (in particular automated elements of CAM).

Table 12 – ▮▮▮▮▮▮▮▮▮

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5.5 International market perceptions vs. UK stakeholders' self-perception of the UK's comparative position on the global stage

This sub-section briefly compares the perception of the international market (as revealed by the survey and interviews) with the UK stakeholders' perspective of the UK vis-à-vis other countries.

Table 13 - International perceptions vs UK stakeholders

UK self-perception	International perception
Countries investing in the UK CAM sector	
Stakeholders referenced China, Germany, Israel, Japan, and the US **as sources of investment**	■ As demonstrated by the survey, a significant proportion of respondents from Germany, Japan, and the US who are investing internationally are investing in the UK CAM sector (62%, 69%, and 64% respectively. ■ While Israel was not part of the survey sample, interview respondents did not indicate that they are currently investing in the UK CAM market. ■ As demonstrated by the survey, South Korea is a significant source of investment, with 74% of international investors also investing in the UK.
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Countries sourcing from the UK CAM sector	
UK stakeholders generally felt that the global CAM sector is immature and were typically unable to reference specific **territories** with confidence.	■ The international procurement market seems relatively mature, with 82% of survey respondents saying that they do procure CAM products internationally.
Japan was the only territory repeatedly **referenced**, with **Australia, Canada, Israel, South Korea**, and the US occasionally referenced	■ As demonstrated by the survey, a significant proportion of respondents from **Germany, Japan, South Korea, and the US** who are procuring CAM products internationally are sourcing from the UK CAM sector (79%, 63%, 82%, and 53% respectively.) ■ **Israel** was not part of the survey sample; however, interview respondents did not indicate that they are currently sourcing from the UK.
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6 Engagement Efficacy of the UK CAM Sector

6.1 Introduction

This section focuses on the engagement-related objectives of the study described in the Introduction

- Understand how individuals and organisations form their opinion of the UK CAM sector

- Understand how individuals and organisations source their information and assess opportunities

- Understand how organisations would like to be engaged by the UK CAM sector going forward

The amount and quality of information that international companies have about the UK CAM market is a critical determinant of their sourcing and investment decisions. This was borne out by the survey responses. Of those not sourcing from the UK, the two reasons cited as most influential were:

- The **companies do not have strong pre-existing relationships** with suppliers in the UK; and,

- They **don't understand or have insight into the UK's CAM offerings**.

Similarly, of those not investing in the UK, two of the three biggest barriers to investment were cited as:

- A **lack of information or insight into the UK's CAM offerings**; and,

- The **high cost of establishing new relationships** in the UK.

These findings were mirrored in the stakeholder interviews where respondents often cited that despite the universal nature of the English language, they did not have sufficient access to information on the UK CAM sector. Many stakeholders throughout the engagement exercise noted that they would welcome increased engagement from the UK CAM sector, and that this is a pre-requisite to sourcing from or investing in the UK.

The section is structured into the following sections:

- Section 6.2: Snapshot of survey data

- Section 6.3: Country snapshot

- Section 6.4: Level of familiarity and engagement with the UK CAM market

- Section 6.5: Information preferences and choices

- Section 6.6: International perceptions vs. UK stakeholders' self-perception of the engagement efficacy of the UK CAM sector

- Section 6.7: Considerations for decision makers on engagement efficacy

- Section 6.8: Engagement efficacy framework

6.2 Snapshot of survey data

Figure 7 - Survey snapshot: Engagement efficacy

39% of individuals have never directly received information on the UK CAM sector. 74% would like more information on the UK CAM sector.

Have you received information on UK CAM directly?

Yes, from CCAV (34%)

Yes, from DIT (29%)

Yes, but I'm not sure from whom (13%)

No, never (39%)

Would you like more information on UK CAM?

26%

74%

- Yes
- No
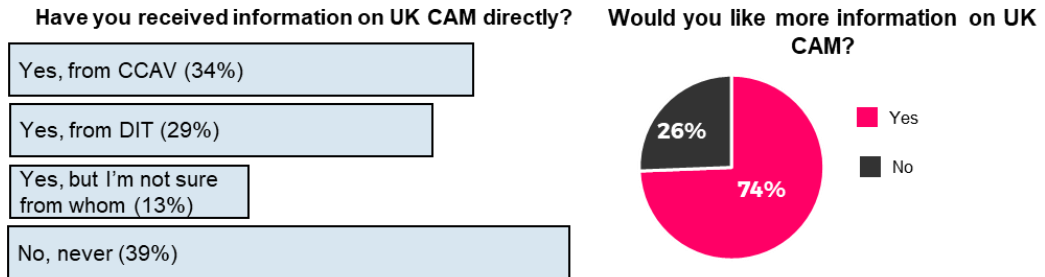
Overall, people said they were most familiar and knowledgeable about CCAV and UK trade shows; and less familiar and knowledgeable about Zenzic, gov.uk and UK policy initiatives.

	Know it well	Aware	Not aware at all
CCAV	31%	51%	18%
Zenzic	19%	53%	28%
gov.uk	19%	55%	26%
UK policy initiatives	17%	59%	25%
UK trade shows	22%	61%	17%

How would you rate the quality of information that you have consumed on UK CAM?

22% 29% 5% 45%

- Very informative and insightful
- Somewhat informative and insightful
- Not informative or insightful
- Haven't come across any
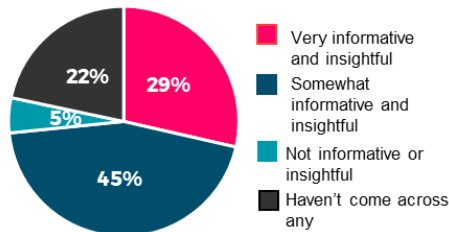
What information would people most like to see?

1 Details on CAM-related infrastructure

2 Information on the skills base

3 Comparisons with other countries

4 Data on the size and growth of the sector

5 Details on available government funding

For information on UK CAM, official reports would be respondents' preferred channel, though for other markets, they prefer industry/consulting reports, in-house research, or trade shows.
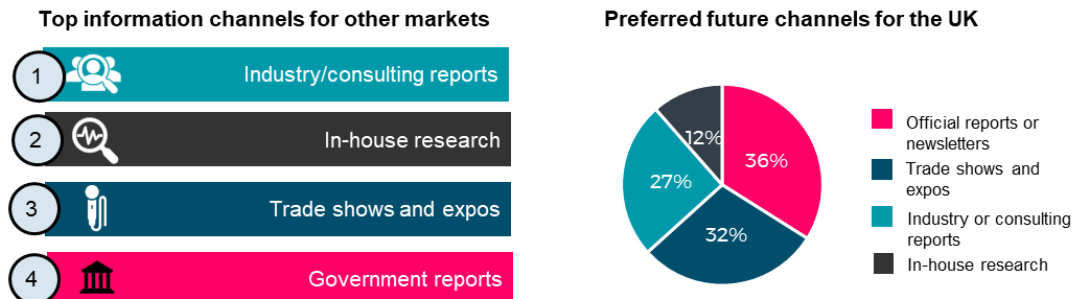
Top information channels for other markets

1 Industry/consulting reports

2 In-house research

3 Trade shows and expos

4 Government reports

Preferred future channels for the UK

12% 36% 27% 32%

- Official reports or newsletters
- Trade shows and expos
- Industry or consulting reports
- In-house research

Analysis based on quantitative survey results of 203 senior decision-makers from automotive and CAM companies in Germany, Japan, South Korea and the US.

6.3   Country snapshot

Figure 8 - Country snapshot: Engagement efficacy

	United States	Germany	South Korea	Japan
Respondents who claim to know these sources well				
CCAV	34%	49%	25%	16%
Zenzic	20%	29%	10%	16%
uk.gov	26%	24%	13%	14%
UK policy	16%	22%	14%	14%
UK trade shows	16%	31%	27%	14%
Respondents who have received information directly				
DIT/CCAV/other	54%	82%	65%	40%
Respondents who find the quality at least 'somewhat insightful and informative'				
Very	32%	33%	25%	24%
Somewhat	38%	53%	54%	34%
Respondents who want more information about the UK				
Want more info	72%	59%	90%	70%
Preferred channel from the UK				
1	Official reports	Official reports	Trade shows	Official reports
2	Industry/consulting reports	Trade shows	Official reports	Trade shows
3	Trade shows	Industry/consulting reports	Industry/consulting reports	Industry/consulting reports
Type of information respondents want to see				
1	Industry and growth data	Skills base	Details on infrastructure	Details on infrastructure
2	Details on infrastructure	Details on infrastructure	Skills base	Skills base
3	Market comparisons	Government funding	Market comparisons	Industry and growth data

Note: This snapshot is based on the survey responses of 203 participants across Germany, Japan, South Korea, and the United States. It does not include insights from the qualitative interviews.

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6.4 Level of familiarity and engagement with the UK CAM market

6.4.1 Overall awareness of UK engagement sources

Across the total survey sample, **awareness was relatively consistent for all the sources that respondents were asked about** (CCAV, Zenzic and CAM testbeds, 'CAV in the UK' information booklet[14], Zenzic CAM Roadmap[15], the gov.uk website, UK trade shows, UK Automated and Electric Vehicles Act 2018, UK Code of Practice *[16]* on trialling and the Law Commissions' review of safety regulation), with 70-85% of the sample at least partially aware of each of these sources. However, awareness varied between markets, with the following overall figures for 'at least partial awareness' across all sources:

Table 14 - Awareness of UK engagement

Market	Average score for 'At least partially aware' across all sources
South Korea	88%
Germany	86%
USA	72%
Japan	58%

Across Germany, South Korea and the US, respondents indicated that they had the highest level of knowledge about CCAV, the CAV information booklet and trade shows. Respondents in Germany appeared to be the most knowledgeable about the sources, with more respondents saying they knew the sources well than those from other countries. **Respondents in Japan had the least familiarity with the sources**, with over 40% indicating that they had no awareness of CCAV, the CAV booklet, Zenzic, the CAM roadmap, or any of the three policy initiatives. A vast majority of respondents in South Korea said that they were aware or partially aware of the sources, but very few indicated that they knew the sources well or that they did not know the sources at all. **Respondents from the US had a relatively low level of familiarity with Zenzic, the CAM roadmap and CAM information on the gov.uk website** (around 40% of respondents having no awareness of any of these)**.** This is perhaps surprising in light of the previous finding that 40% of US respondents source testbed services from the UK.

Interestingly, whilst survey results suggest a relatively good awareness of the highlighted communication channels and UK organisations, throughout interviews it was rare for individuals to proactively identify these as sources of information for the UK CAM sector. This suggests that this awareness of the organisations might be surface-level and triggered by seeing their name in the survey.

6.4.2 Direct engagement

Of the survey sample, 34% of respondents said they had received information about the UK CAM sector from CCAV directly with 29% saying they had received information from DIT directly. Interviewees noted that there was mixed engagement with these bodies. One interviewee noted that the DIT ran very

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[14]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/929352/innovation-is-great-connected-and-automated-vehicles-booklet.pdf
[15] Zenzic (2020) UK Connected and Automated Mobility Roadmap to 2030 CAM Creators Update
[16] Centre for Connected and Autonomous Vehicles (2019) *Code of Practice: Automated vehicle trialling*.

successful networking events through embassies, including events that had been sponsored by Scotch whiskey companies and had tended to attract more senior individuals than trade shows tended to.

Germany had the highest number of respondents who have been engaged by CCAV or DIT – approximately 40%. 37% of South Korea respondents have also been engaged by CCAV. 39% of overall survey respondents said that they had never received information directly about the UK CAM sector, with Japan and the US having the highest number of individuals who have never received information directly from CCAV, at 60% and 46% respectively.

6.4.3 Centre for Connected and Autonomous Vehicles

Overall, 82% of respondents had some knowledge of CCAV, with 31% saying they knew it very well. **Survey respondents were generally more aware of CCAV than most other sources of information**, with CCAV ranking in the top two sources that respondents "knew very well" for every market. This was echoed in interviews where respondents were generally aware of CCAV. Furthermore, 34% of survey respondents had received information on the UK CAM sector through CCAV, the most of any of the listed sources.

As illustrated in the table below, 77% of respondents had some awareness of the 'CAV in the UK' information booklet released by CCAV in 2020, with 23% saying they knew it very well. Among individual countries, respondents from Germany had the best knowledge of the CAV information booklet with 35% claiming to 'know it very well'. Respondents from Japan had the least knowledge, with 40% claiming that they 'don't know it at all'. Across interviews, the CAM booklet was not mentioned as a significant source of information.
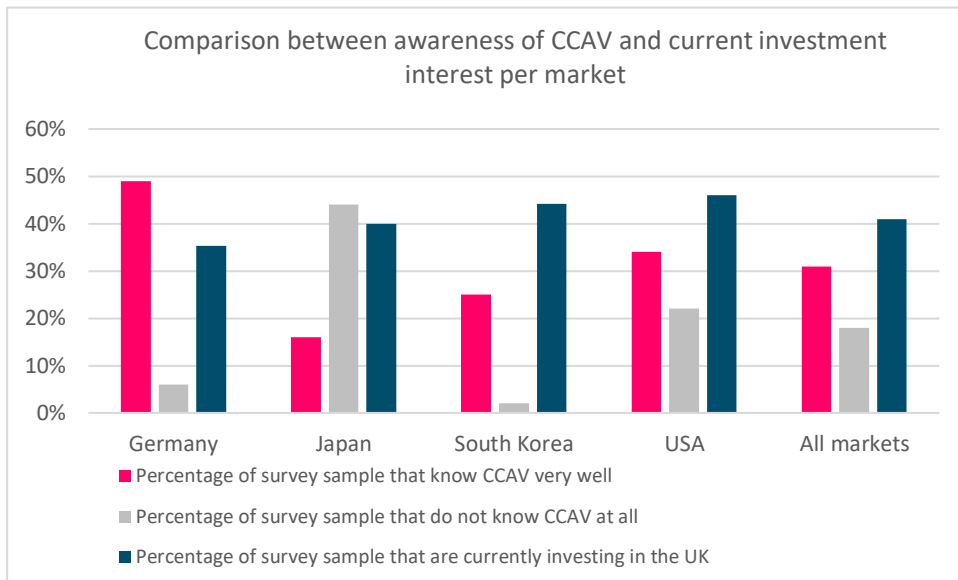
Table 15 - Awareness of CCAV

	CCAV – I know it well	CAV information booklet – I know it well	CCAV – I don't know it at all	CAV information booklet – I don't know it at all
Germany	49%	35%	6%	16%
Japan	16%	16%	44%	40%
South Korea	25%	19%	2%	13%
USA	34%	22%	22%	24%
All markets	31%	23%	18%	23%

Of those who do invest in the UK, 97% were at least partially aware of CCAV with 45% saying they know it well and only 2% saying they did not know it at all. Of those who invest internationally but not in the UK, 76% were at least partially aware of CCAV with only 22% saying they knew it well and 24% saying they did not know it at all. This indicates at a high level that there is a role for CCAV to play in boosting investment, though more advanced statistical analysis would be required to establish a definitive link between the two.

The below graphic provides a visual snapshot of the relationship between knowledge/awareness of CCAV compared with the level of interest in the UK as an investment destination across countries. Whilst from this high level analysis there is no clear link between investment and CCAV awareness, it does highlight the discrepancy in awareness across the four markets.

Figure 9 - Comparison CCAV awareness and investment interest

Comparison between awareness of CCAV and current investment interest per market

Legend:
- Percentage of survey sample that know CCAV very well
- Percentage of survey sample that do not know CCAV at all
- Percentage of survey sample that are currently investing in the UK

### 6.4.4 Zenzic and CAM Testbed UK

Of the survey respondents, 72% had some knowledge of Zenzic and CAM Testbed UK. However, only 19% said they knew it very well and 28% said they did not know it at all. This was echoed in interviews where the majority of those interviewed were either unaware of Zenzic or were aware but not familiar with what they do.

Table 16 - Awareness of Zenzic and CAM Testbed UK

	Zenzic and CAM testbed UK – I know it well	CAM Roadmap – I know it well	Zenzic and CAM testbed UK – I don't know it at all	CAM Roadmap- – I don't know it at all
Germany	29%	25%	20%	20%
Japan	16%	16%	44%	44%
South Korea	10%	17%	10%	13%
USA	20%	20%	40%	38%
Total	19%	20%	28%	29%

Several stakeholders (without knowledge of the existence of Zenzic) coincidentally described the current role of Zenzic as something that would be extremely valuable to the UK ecosystem, and were surprised to hear that an organisation with this role already existed in the UK. Once informed of the presence of Zenzic and the testbeds in the UK CAM ecosystem, several stakeholders noted that these sounded like

valuable services. These individuals often subsequently noted that there was a clear case for the UK to improve its marketing around Zenzic and the UK testbeds.
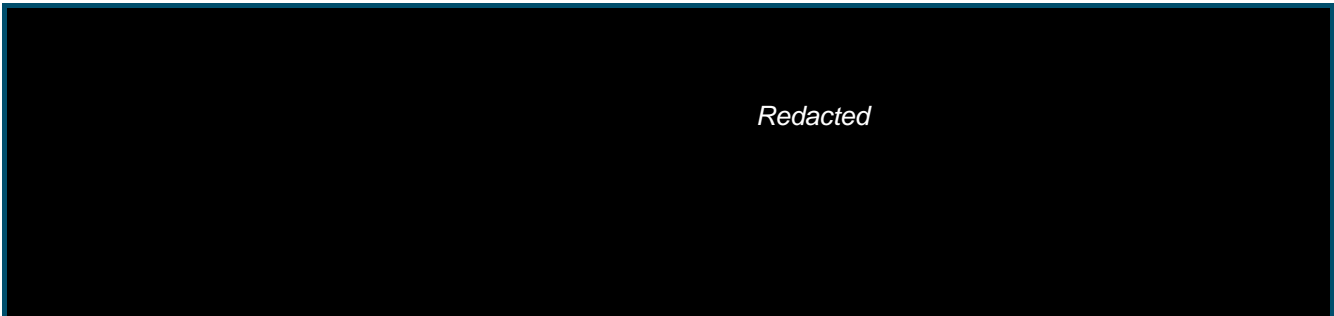

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Overall, 71% of respondents had some awareness of the 'CAM Roadmap' released by Zenzic in 2019[17]. However, only 20% said they knew it very well and 29% said they did not know it at all. Across the interviews conducted, the CAM roadmap was not identified as a resource they were overly aware of or utilised. Across the four markets, respondents from Germany and the US had less 'good knowledge' about Zenzic and CAM Testbed UK than they did about CCAV and the CAV information booklet. Interestingly, a large proportion (~40%) of US and Japan respondents had no knowledge of Zenzic, the UK testbeds or the UK Roadmap.

This represents a significant portion of potential investors / procurers that to date have not been engaged with for these services. As highlighted below, there appears to be a significant opportunity to stimulate investment / procurement through the UK Testbed services across these markets by better communicating their presence to the portions of the markets that are currently unaware of their existence. With such significant portions of the market still unaware of these services it appears premature to conclude that the testbeds are not / would not be potential drivers for broader investment.

Figure 10 - Comparison: Awareness of Zenzic and sourcing figures
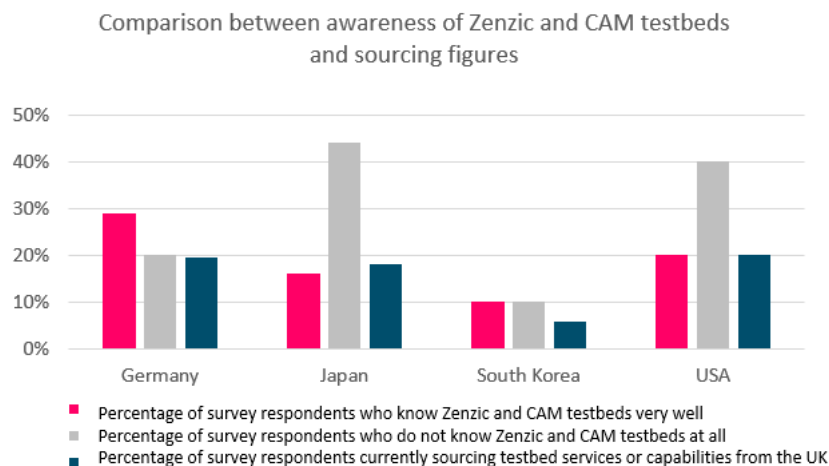
Whilst not statistically significant, anecdotally stakeholders interviewed from the Israeli market also had limited awareness of Zenzic. Several of the organisations interviewed as a part of the Israeli market noted that the CAM testbeds sounded of interest. One stakeholder also noted that it would be worth

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[17] Zenzic (2020) UK Connected and Automated Mobility Roadmap to 2030 CAM Creators Update

Zenzic engaging with CAM focussed incubators such as EcoMotion and Drive TLV as a good way of disseminating information to the Israeli CAM start-up organisations.

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> *Case study:* *One interviewee noted that he was aware of Zenzic and the testbeds but that he felt the marketing around these could be improved. He noted that Zenzic should make information around the testbeds more transparent and accessible. The information should also inform end users of the following points:*
>
> - *A description of the available infrastructure*
> - *Information on the best way to get in touch with the testbeds*
> - *A description of what funding is possible / available*
> - *Information on the previous performance of the testbeds*
> - *Some references / feedback from users who have used the testbeds*
> - *A breakdown of the partners who are currently using it as well as identifying which are open to using partners*

6.4.5 CAM information on the gov.uk website

Almost two-thirds of the market had some awareness or good knowledge of the gov.uk website; however, the rest did not know it at all. Several interviewees noted that the UK Government websites tended to have the information they needed but often this is hard to find as it is 'buried' on the Government website.

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Overall, the US was the strongest segment for individuals that "know it very well". However, among individual countries, respondents from Germany and South Korea had a better general awareness of the website than respondents from Japan and the US (with the US also containing the largest portion of respondents who "did not know it at all").

Table 17 - Awareness of gov.uk website

	I know it very well	Aware/partially aware	I don't know it at all
Germany	24%	61%	16%
Japan	14%	42%	44%
South Korea	13%	79%	8%
USA	26%	36%	38%
All markets	19%	55%	26%

6.4.6 UK presence at trade shows

Trade shows/ bodies noted in interviews

- OESA.org
- 5GAA
- TRB
- ITS World Congress
- CES
- Computer Vision Conference
- CCV
- CVPR
- Autosense

A large proportion (83%) of overall respondents said that they had some awareness of the UK CAM sector's presence at trade shows, indicating that this channel has high rates of penetration. Trade shows were also a recurring theme throughout interviews across all markets as a key source of information for individuals and organisations, and as a source of new relationships.

Among individual countries, respondents from Japan had the least awareness, with 36% saying they were not aware of the sector's presence at trade shows. Interestingly, one individual in Japan who declined to be interviewed for the study instead suggested that CCAV would be better placed to join their annual catch up in Tokyo for other government departments and agencies.

Table 18 - Awareness of UK presence at trade shows

	Very aware	Aware/partially aware	Not at all
Germany	31%	65%	4%
Japan	14%	50%	36%
South Korea	27%	62%	12%
USA	16%	68%	16%
All markets	22%	61%	17%

6.4.7 UK policy and regulation

Approximately 75-80% of respondents said they had at least some basic awareness of the Automated and Electric Vehicles Act 2018, UK Code of Practice[18], and Law Commissions' Review of Connected and Automated Vehicles. More people knew about the Automated and Electric Vehicles Act than the Code of Practice or Law Commission Review. Among individual countries, more respondents from Germany said they knew these regulations well than those from any other country. Approximately 40% of respondents from Japan said they did not know any of the three.

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[18] Centre for Connected and Autonomous Vehicles (2019) *Code of Practice: Automated vehicle trialling*.
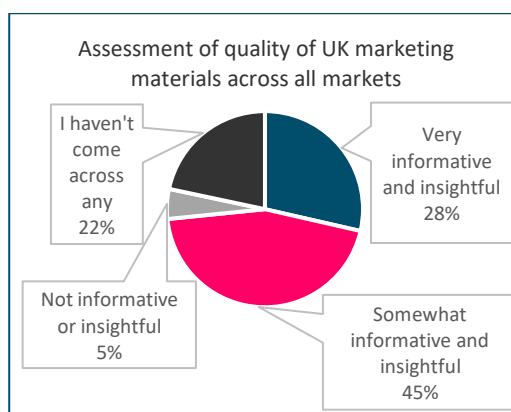
Throughout interviews, specific advancements in regulation were not particularly well known; however, interviewees had the perception that the UK is 'a leader' in regulation more broadly. One regulatory development that was highlighted in multiple interviews was the (at the time the interviews took place) recent announcement that the UK has become the first country to regulate the use of self-driving vehicles at slow speeds on motorways. Multiple stakeholders noted that this had been well-circulated, and they had consumed this through news reports such as Bloomberg and the BBC. It is worth noting that this awareness of the initiative will have been distorted given the timing overlapped with interviews, however the channels through which it was circulated through clearly reached high-value target individuals.

Table 19 - Awareness of UK policy and regulation

I know it very well				**I don't know it at all**		
	Automated and Electric Vehicles Act	Code of Practice	Law Commission Review	Automated and Electric Vehicles Act	Code of Practice	Law Commission Review
Germany	25%	22%	20%	12%	16%	20%
Japan	14%	16%	12%	42%	44%	40%
South Korea	19%	12%	12%	12%	19%	19%
USA	14%	16%	14%	28%	28%	26%
All markets	19%	16%	14%	21%	27%	27%

6.4.8 Assessment of quality

Overall, 45% of respondents believe that the information they have read about the UK CAM sector is somewhat informative and insightful while 28% believe that it is very informative and insightful. This is roughly consistent across markets, although a large proportion of Japanese respondents have not come across any information at all, as described in the previous section. Several interviewees noted that Singapore was a good example of a country that had effective and efficient information dissemination strategies. Multiple interviewees felt that the advancements being made in the Singapore CAM market were similar to others being made elsewhere around the world, however the Singaporean government was simply more effective at circulating these advancements which has given a broad perception of general advancement for the Singaporean market. Similarly, some interviewees noted that the US and China has produced good marketing material around "Lighthouse" projects.

Assessment of quality of UK marketing materials across all markets

I haven't come across any 22%

Very informative and insightful 28%

Not informative or insightful 5%

Somewhat informative and insightful 45%

6.5 Information preferences and choices

6.5.1 Desired information about the UK CAM market

74% of the total survey respondents said they wanted more information on the UK CAM market. This was particularly true of the South Korean and Japanese markets where 90% and 70% respectively wanted more information. This was mirrored in interviews where nearly all interviewees noted that they do not have access to sufficient information on the UK CAM market. Whilst the interview sample size was smaller for South Korea, one South Korean OEM noted that whilst they did desire information on the UK CAM market, they currently receive quarterly reports from a market intelligence agency which contain limited information on the UK CAM sector. The interviewee noted that they have a sales office based in the UK which likely has individuals focussing on CAM. This could thereby act as a channel for information.

Interviewees from the Japanese market, however, noted that they tend to prefer receiving information through existing suppliers.

The numbers of those who want more information about UK CAM were slightly lower for the US and Germany, possibly because their current levels of engagement and familiarity are higher. 32% of all respondents cited that they want to receive information at trade shows and expositions ('expos') (virtually or in person). This is particularly high for South Korea (52%) but lower for Japan (28%).

6.5.2 Type of information accessed on the CAM sector in other countries

The top three sources of information consumed are:

- Industry or consulting reports (67%)
- In-house research (49%)
- Trade shows and expos (44%)

This is in line with interview findings where industry and consulting reports were often cited as important channels. Many interviewees noted that these sources of information were preferred over information directly obtained from a government or company marketing material. This is perhaps due to a perceived objectivity in these reports. Interestingly, industry or consulting reports were the highest ranked source of information across all markets (notably with around 80% of German and US respondents receiving their information through industry or consulting reports), underscoring their importance across the sector. Interestingly, one interviewee noted that as the result of the UK's withdrawal from the EU they have noticed that several such **reports have not included the UK market as they tend to be focussed on China, the US and EU, with the UK now being included as a secondary or additional market**.

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In-house research is particularly important for Japanese and South Korean respondents. Some interviewees noted that a potential way to inform these organisations would be to access their in-house

research teams by connecting through any UK based subsidiaries/ offices (if present). Trade shows do not appear to be a very significant source for Japanese respondents.

Only 1% of survey respondents said that they access information on the CAM sector directly from the media. However, this finding was somewhat contradicted among some interviewees who noted that they often consumed information through reputable news sources such as Reuters, the BBC and others, even if this was simply through headlines or brief stories.

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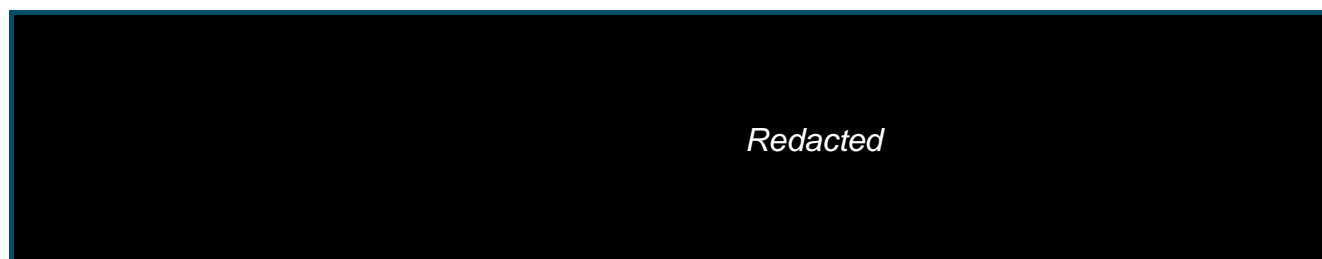
### 6.5.3 Desired channels for receiving information about the UK CAM market

Table 20 - Desired information channels

How would survey respondents like to receive information on the UK's CAM sector?	Percentage of sample
Official reports or newsletters issued by the UK CAM market directly to my company	36%
Trade shows and expos (virtual or in-person) organised by the UK Government	32%
Publicly available industry or consulting reports directly to my company	27%
We can research it ourselves when we need to	12%
Other	0%

Overall, survey respondents indicated that they would primarily like to receive information through official reports or newsletters. This is particularly high for the US (46%) and slightly lower for Japan (28%). Several interview respondents also echoed this feeling but emphasised that any newsletters or communication should be at a high level, with links to further detailed information that could be explored by individuals if they wanted to.

Trade shows also were identified as a significant channel that respondents would like to receive information through. This is particularly high for South Korea (52%) but lower for Japan (28%). Interestingly, there is a gap between how people consume information about global CAM (mostly industry or consulting reports) and how they want to consume information about UK CAM (mostly through government reports or trade shows). Among the different trade shows listed, the AV Technology Expo appears to be the most popular with 66% saying that the UK CAM sector should attend and present information there. The CES and ITS World Congress were other popular choices (~45%). Many interview respondents noted that whilst there are the large well-known expos e.g. CES, there are also smaller expos that are market specific that the UK could benefit from attending.

Overall, interview respondents generally were willing to receive information on the CAM sector, as long as it was concise with clear messaging and updates. However, given that it was not a market of focus for many stakeholders, any material would likely have to be 'pushed' marketing rather than 'pull' marketing (given that they are not likely to proactively seek out the information). An example raised by several interviewees was that they would find a monthly or quarterly CAM newsletter interesting to receive. Social medias such as Twitter and LinkedIn also recurred through multiple interviews as possible sources of information.

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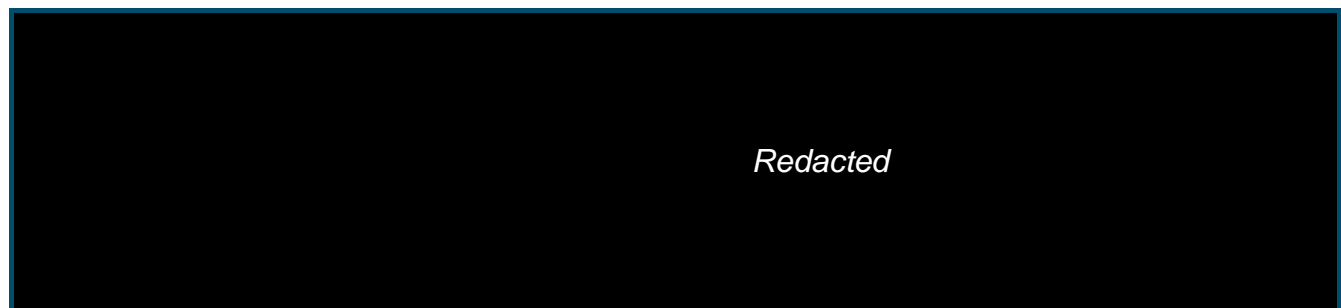
6.5.4   Type of information that the international market wants

Through the surveys, the top three pieces of information identified that individuals look for (~50%) are:

- Details about CAM-related infrastructure,

- Information on the skills base of the market; and,

- Clear comparisons with other markets.

Overall, this varied from market to market as shown in the below table.

Table 21 - Type of information wanted by market

	Clear data on the size and growth of the sector	Information on the skills base in the market	Clear comparisons with other markets	Details about CAM-related infrastructure	Information about available government funding	Information about CAM policy and regulation	Information about CAM innovations
Germany	35%	65%	53%	61%	57%	33%	29%
Japan	36%	38%	22%	42%	32%	32%	30%
South Korea	23%	52%	44%	54%	17%	35%	23%
USA	62%	46%	48%	50%	44%	38%	40%

Of particular note in the above, German respondents cited the importance of information on available Government funding, whilst US respondents noted that 'clear data on size and growth of the sector' is key.
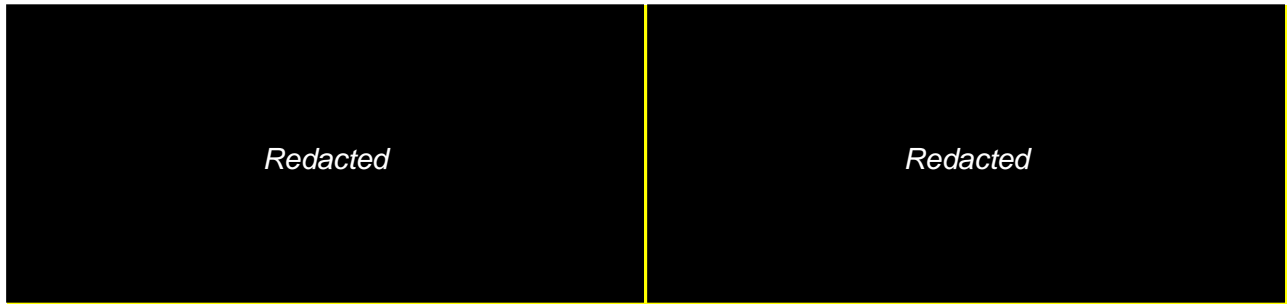
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6.6 International perceptions vs. UK stakeholders' self-perception of the engagement efficacy of the UK CAM sector

Table 22 - International vs UK stakeholder perceptions

UK self-perception	Similarities or variations of international perceptions
At this critical stage of the CAM market maturing, with UK companies emerging from the proof of concept stage into production, much more work is needed to promote UK CAM and engage the international market.	39% of survey respondents had not received any information on the UK CAM sector, with many interviewees noting that they would like to be kept up to date with developments in the UK but are unaware of how to do so. There is therefore a significant pool of potential investors or procurers for UK goods that is currently untapped.
The lack of recent funding and focus by Zenzic to promote the testbeds – and the wider UK CAM ecosystem – is a significant limitation, with more work needed to promote the UK CAM sector.	28% of survey respondents were not aware of Zenzic or CAM Testbed UK and 29% noted that they were unaware of the CAM Roadmap. These were the highest two scores out of all the sources of information identified indicating that **international stakeholders are the least aware of Zenzic / the UK testbeds and the CAM roadmap out of all UK sources identified**. Several interviewees echoed UK stakeholders' feelings – those who were familiar with Zenzic often believe that it plays a valuable role in the UK CAM ecosystem but that there is significant scope to improve the international engagement outreach and marketing. There is therefore an opportunity to maximise the sunk investment in the UK testbeds by improving marketing around them to potential users of the services.
UK stakeholders conveyed that the UK lacks a coherent strategy and leader to co-ordinate and drive engagement with the market. It was felt that whilst key actors such as CCAV, DIT and Zenzic, were undertaking their own initiatives, this was not joined up and thus an opportunity was being missed. It was also raised that government should work more	Several stakeholders identified the need for clear concise marketing material which sets out the UK's future strategy for development of the CAM sector. Separately, several stakeholders noted that they would find condensed marketing material such as newsletters or condensed emails showing significant updates in the UK CAM sector (e.g. new regulatory updates, new technology breakthroughs, new testing sites) valuable.

UK self-perception	Similarities or variations of international perceptions
closely with industry and academia to help promote UK CAM.	With many stakeholders noting the UK's ability to function as a single entity as a strength (especially when compared to other markets such as the US with the state system and the EU), there is therefore a risk that this perceived strength could be tarnished by multiple disjointed marketing channels and communication from multiple UK Government / industry sources.

6.7   Considerations for decision makers on engagement efficacy

Table 23 - Engagement considerations for decision-makers

	Channels	**Focus areas / products or services**	**Messaging and framing**
All markets	▪ Expand level of engagement with all markets, focusing on **official Government releases** as a key channel to shift the level of engagement in the international market from 'awareness' to 'good knowledge'. ▪ Review the **CAM marketing material available through the gov.uk websites** to ensure the highest-value content is easily accessible. ▪ Improve the UK's presence at targeted **trade events**. ▪ Evaluate the opportunities to host **events at UK embassies** targeting senior stakeholders. ▪ Feed relevant and up to date information to **industry and consulting firms** to ensure that messages about UK CAM are included in their reports. ▪ Ensure that any regulatory, technology or infrastructure developments are circulated to and through **reputable news sources** such as Reuters, the BBC, The Wall Street Journal etc. ▪ Engage with international market research companies to identify the sources of data they utilise and then ensure that these are maintained with up to date relevant data for the UK market (e.g. Statista). ▪ Conduct a mapping exercise to identify the relevant internal research teams at large OEMs and, if possible, engage with them to identify and inform/supplement their sources of data.	▪ From an investment and sourcing perspective, emphasise **AI/ML software, R&D and engineering capabilities, Autonomous Control Systems, and Sensors**, while retaining current interest in CAM pods and OEMs among procurers. ▪ Improve the **marketing of Zenzic and Testbed UK** by developing and disseminating information about the value proposition. ▪ Ensure that UK priority areas (e.g. demand-responsive transport) are effectively communicated to help narrow the gap between international perceptions and reality	▪ Develop and release a clear 'CAM strategy' for the UK, setting out future plans and milestones for regulation, technology and innovation, acceptance, and use cases. ▪ Work closely with other UK stakeholders in the ecosystem to ensure that **communications and marketing materials and release strategies are aligned** (e.g. CCAV, DfT, Zenzic, private sector). ▪ Improve transparency and communication around **investment support incentives** that are available to foreign investors. ▪ Continue to **circulate communications to mitigate fears around the UK's withdrawal from the EU** (specifically around supply chains, tariffs and losing the status as 'the gateway to Europe'). ▪ Ensure that where cost of goods / services is detailed for the UK, material should also refer to the **efficiency gains to be made due to the UK workforce**, noting that this may improve value for money overall. ▪ **For current and potential investors,** provide information on themes noted in section 3 – innovation strengths and potential, availability of infrastructure, details on projected growth, details on end user acceptance of CAM within the UK, linkages with the offering on Zero Emission Vehicles, a 'how-to' guide on establishing new relationships in the UK, and details of government funding available to attract innovation. ▪ **For current and potential procurers,** include detailed information on themes noted in Section 4 – suite of available CAM offerings, information about quality, reassurance about costs, clarity of policy, and a how-to guide for establishing new supplier relationships.
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	▪		▪

Channels	Focus areas / products or services	Messaging and framing
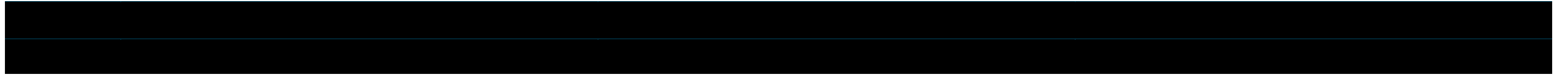
6.8   Engagement efficacy framework

'Engagement efficacy' in the context of this study refers to the relationship between engagement with the international market and investment and trade flows, the principle being that the engagement of the UK CAM sector with the international market should lead to an increase in trade and investment flows.

There are three potential ways, each with multiple channels, to do this:

1) Conducting a **quantitative regression analysis** to predict the impact of engagement on trade and investment flows

2) **Directly asking the international market** about whether changes in engagement have led them to trade more with, and invest in the UK by:

- UK Government-to-International Industry meetings

- UK Business-to-International Business meetings

- UK Government-to-International Government meetings

- Independent perceptions analysis

3) **Indirectly inferring from the international market**'s responses to engagement if they are accessing different engagement methods, under the assumption that increased awareness and engagement leads to more trade and investment.

- International industry's response to UK government releases

- International industry's response to consulting reports about UK CAM

- International industry's response to media/social media coverage about UK CAM

- International industry's response to UK government and industry at trade shows

Each of these methods comes with its advantages and disadvantages.

Table 24 - Engagement methodologies

	Advantages	**Disadvantages**	**Potential way forward**
Regression analysis	■ Potentially the most rigorous type of analysis possible ■ Technically-sound analysis can be more persuasive than qualitative methods	■ Extremely challenging because of the time and analytical rigour required to separate from the 'engagement variable' the many other variables that also have an impact on trade and investment flows (e.g. policy, level of private sector investment, international competition etc.) ■ Data collection and analysis would likely be costly ■ Could be difficult to communicate widely among people without a technical background	■ Data on trade and investment flows should be collected to check for a positive correlation with engagement metrics; however, regression may be too expensive and time-consuming to conduct
Directly asking the market	■ Requires less inference so reduces the potential for bias ■ Cost-effective because multiple objectives can be served simultaneously – e.g. using the same interviews to also raise awareness or create the positive perception about the sector ■ Could be persuasive because it is a good way to 'tell a story'	■ Perceptions can be misleading (e.g. when asked whether Engagement Method X has led them to invest more, respondents may give this too much weight) ■ Inconsistency of perceptions can make the analysis challenging (e.g. different cultures have different perceptions) ■ Anonymity requirements make it difficult to collect and report many types of data that would strengthen the analysis ■ Bias could arise if interviews are conducted by the UK Government or businesses whom interviewees are trying to	■ The challenges and shortcomings of perception-based analysis should be clearly presented as caveats (as in this report) ■ An objective of assessing 'engagement efficacy' could be added to all types of engagement that the UK CAM sector has with international stakeholders. ■ Independent quantitative surveys and qualitative interviews can be conducted at regular intervals to de-bias the analysis.

	Advantages	Disadvantages	Potential way forward
		develop a positive relationship with	
Inferring from the market	▪ Arguably the most cost-effective because it is an add-on to existing efforts – e.g. a government press release on UK CAM which is being used to promote the sector can be tracked at minimal cost	▪ The relationship between these channels and trade and investment are likely to be more tenuous in principle so results could be less helpful (e.g. fewer responses to a government press release may not necessarily indicate that the press release has not been effective) ▪ Requires more inference so increases the potential for bias.	▪ The benefits of these channels should be tracked given that they would be used anyway. ▪ Potential biases and inaccuracies should be clearly caveated

The following is a visual summary of this analysis, comparing the various methods mentioned above against two criteria – the effectiveness of the analysis and the ease of implementation. Based on the survey and interview findings of this study, each method is given a RAG rating of its ability to increase engagement in and of itself.

Figure 11 - Comparison of analytical methods
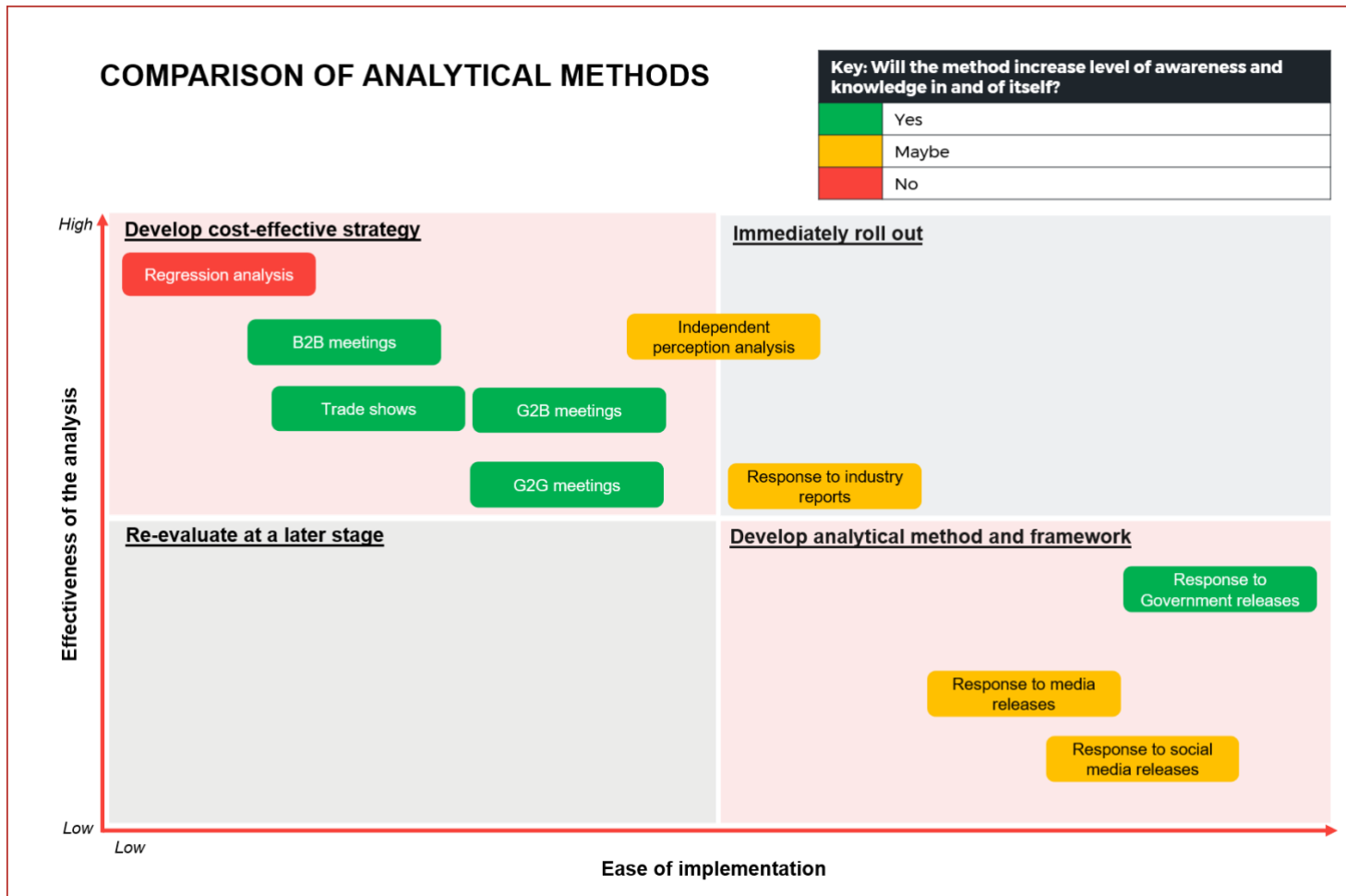
6.8.1 Engagement metrics, measurement tools, and ease of measurement

Potential engagement metrics and measurement tools for each of the above methods (excluding the regression analysis) are described below:

Table 25 - Engagement methods assessment

Directly asking the market

Engagement Channels	Engagement metrics	Measurement tools
UK Government to International Business meetings	■ Expression of interest in UK CAM offerings ■ Level of awareness of various engagement methodologies ■ Perceptions of various engagement methodologies (including on their perceived impact on trade and investment) ■ Follow-up meetings suggested ■ Connections recommended within the global CAM community	■ Records and minutes of the meetings ■ Contacts databases of UK CAM stakeholders (e.g. Zenzic/CPC/DIT/DfT)
UK Business to International Business meetings	■ Expression of interest in UK CAM offerings ■ Level of awareness of various engagement methodologies ■ Perceptions of various engagement methodologies (including on their perceived impact on trade and investment) ■ Follow-up meetings suggested ■ Connections recommended within the global CAM industry	■ Records and minutes of the meetings (challenge: commercial sensitivity) ■ Contacts databases of UK CAM stakeholders (e.g. Zenzic/CPC/DIT/DfT)
UK Government to International Government meetings	■ Knowledge of UK CAM policy and strategy ■ Perceptions of UK CAM policy and strategy ■ Level of awareness of various engagement methodologies ■ Perceptions of various engagement methodologies (including on their perceived impact on trade and investment) ■ Number of interested companies within the international country ■ Follow-up meetings suggested	■ Records and minutes of the meetings ■ Contacts databases of UK CAM stakeholders (e.g. Zenzic/CPC/DIT/DfT)

Engagement Channels	Engagement metrics	Measurement tools
	■ Connections recommended within the country's CAM sector	
Independent perceptions analysis of international business	■ Expression of interest in UK CAM offerings ■ Knowledge and perceptions of UK CAM policy, industry, innovation, infrastructure, use cases, etc. ■ Level of awareness of various engagement methodologies ■ Perceptions of various engagement methodologies (including on their perceived impact on trade and investment) ■ For interviews: follow-up meetings suggested ■ For interviews: Connections recommended within the country's CAM sector	■ Quantitative surveys ■ Qualitative interviews

Indirectly inferring from the market

Responses to Government releases	■ Number of downloads or 'reads' ■ Comments ■ Reshares (including in international media)	■ Website tracking ■ Media/social media tracking ■ Search engine results
Responses to consulting reports	■ Number of downloads ■ Comments ■ Reshares (including in international media)	■ Commissioned research ■ Media/social media tracking
Responses to media/social media coverage	■ Views ■ Likes ■ Comments ■ Reshares (including in international media)	■ Media/social media tracking ■ Sentiment analysis
Responses to UK presence at trade shows	■ Expression of interest in UK CAM offerings ■ Knowledge and perceptions of UK CAM policy, industry, innovation, infrastructure, use cases, etc. ■ Level of awareness of various engagement methodologies ■ Perceptions of various engagement methodologies (including on their perceived impact on trade and investment) ■ Number of participants at expos/UK Plc events ■ Number of enquiries/follow-up meetings after trade shows and expos	■ Meeting records and minutes

7 Conclusion: Summary of Considerations

7.1 Overview

This study has addressed the objectives as highlighted in the introduction, namely to:

- Understand perceptions of UK's strengths, weaknesses, opportunities and threats (SWOT) in the CAM sector.

- Understand intentions for organisations to invest into the UK CAM sector, or procure goods and services from the UK CAM sector.

- Understand the drivers and barriers of investment and/or sourcing decisions facing such organisations.

- Understand how individuals and organisations form their opinion of the UK CAM sector.

- Understand how individuals and organisations source their information and assess opportunities in relation to CAM investment and sourcing.

- Understand how organisations would like to be engaged by the UK CAM sector going forward.

- Develop an efficacy framework for CCAV to use to assess the efficacy of the UK's engagement with the international market going forward.

Through stakeholder engagement (comprising quantitative and qualitative inputs), a number of considerations and potential actions have been identified which could be used to:

- Inform how to improve the UK as a destination for investment.

- Inform how to improve the UK as a sourcing destination of goods and services.

- Inform how to improve the engagement efficacy of the UK Government and the UK CAM sector on the international stage.

- Inform how to best track ongoing engagement efficacy of communications on an ongoing basis.

7.2 The UK as an investment destination

7.2.1 Current and future interest

Among those who are investing internationally, there appears to be a **high degree of interest in the UK CAM sector as an investment destination,** with over two-thirds of those respondents whose companies are investing internationally having some form of investment in the UK. Among international investors of individual countries, 74% of South Korea respondents and 69% of Japan respondents who are investing internationally are investing in the UK. This proportion is lower for the US and German markets at 64% and 62% respectively. Albeit it is worth noting that, overall, fewer than half of the whole population of respondents from each country are currently investing in the UK (35% for Germany, 40% for Japan, 44% for South Korea, and 46% for the US).

A third of those who are investing internationally currently have no investments in the UK but have invested in other markets globally. Split by market, this proportion is highest for Germany and the US at 38% and 36% respectively. In total, 27% would consider investing within five years and 32% in 5-10 years. Only 7% do not see themselves investing in the UK at all. Although the numbers of non-UK investors are too small per country for the results to be statistically significant, it is noteworthy that **almost all of the non-investors from US and Germany said they might invest in the UK in the next**

10 years. On the other hand, **almost all of the Japanese non-investors said they would <u>not</u> invest within the next 10 years.**

38% of the total sample of respondents are not yet investing internationally, indicating that there is an **opportunity to attract investment into the UK CAM sector from those not yet investing internationally.** Among the individual countries in the survey sample, this opportunity seems to be particularly large for Germany and Japan where only 57% and 58% of respondents (respectively) are currently investing internationally.

7.2.2 Potential focus areas

Table 26 - Investment focus areas

	Current perceived UK strengths	Future UK USPs	Future use cases
International response	- AI/ML software - R&D capabilities - Original Equipment Manufacturers (OEMs) - CAM Pods - Autonomous Control Systems - Computer chip architecture (with the presence of ARM cited as a core strength) - Functional safety - High-end products such as internal vehicle trim	- R&D capabilities - Engineering capabilities - AI/ML software - Sensors - Autonomous Control Systems	- Passenger vehicles / robo-taxis - Public transport - First and last mile delivery
Considerations for the UK CAM sector	Continuing to develop and market the above strengths could help retain existing investors	Focusing on sensors could help develop it as a future USP since it is not cited as a current product	Focusing on the UK's strength in testing and deploying CAM technologies in these use cases could reinforce existing perceptions

Since Testbeds and Cybersecurity were the lowest-rated offerings as current strengths and future USPs and there is a relatively low awareness of Testbeds (as noted in the Engagement chapter), it will be important to think about the future strategy for these and potentially improve perceptions of them among potential investors.

The main variations between the international market's perception and the UK stakeholders' self-perceptions of the UK as an investment destination are:

- **Simulation software:** Modelling/simulation, which was seen by UK stakeholders as a current strength and future USP, did not emerge as either among international participants.

- **Cybersecurity:** Cybersecurity was noted as a key future USP by UK stakeholders, but survey and interview respondents did not see this as a strength.

- **Freight and logistics:** UK stakeholders perceived this to be an early use case for CAM but among survey respondents, passenger vehicles and public transport were the popular use cases, with long-haul logistics ranking low.

- **UK's testbed infrastructure:** UK stakeholders saw this as a driver of investment, but it did not emerge as a current or future strength as a key investment target among international participants (with the exception of the US survey respondents). As covered in Chapter 6, this may be due to a lack of awareness about the testbed infrastructure.

Additional detail and analysis are in Section 3 on the 'UK as an investment destination'.

7.2.3 Leveraging existing drivers and overcoming barriers

Table 27 - Leveraging existing drivers and overcoming barriers: investment

	International investors who are investing, or considering investing, in the UK	International investors who are not investing in the UK	Potential investors who are not investing anywhere
Drivers or barriers	**Current drivers of UK investment** - A perception of the country's high innovation potential - An expectation of high growth in the UK CAM sector - An expectation of a high degree of end user acceptance of CAM among the UK population. **Future drivers of UK investment** - More or better CAM-related infrastructure (e.g. improved 5G coverage) - More CAM-related innovation (e.g new market leading products)	**Barriers to UK investment** - A lack of insight into UK CAM - A perception that growth will be held back by high costs - A view that it is too expensive to establish new relationships **Drivers of international investment** - Overall growth potential of the country's CAM sector - Strength of the country's CAM-related infrastructure	**Barriers to international investment** - Availability of required capabilities domestically - Strong focus on zero emission vehicles - Strong focus on recovering from the COVID-19 pandemic **Potential drivers of international investment:** - Stronger CAM-related infrastructure (e.g. improved 5G coverage) - Stronger CAM-related innovation (e.g new market leading products) - Greater likelihood of end user acceptance

	▪ More government funding in CAM	▪ Strength of the country's CAM-related innovation	
Considerations for the UK CAM sector	To retain existing investors, consideration should be given to: ▪ Highlighting the UK market's innovation potential ▪ Continuing to demonstrate the potential for the sector's growth ▪ Continuing to demonstrate the likelihood of end user acceptance of CAM	To attract international investors who are not investing in the UK, consideration should be given to: ▪ Boosting marketing and international engagement ▪ Emphasising the UK CAM sector's growth potential ▪ Providing reassurance that growth will not be impeded by high costs ▪ Showcasing the UK's CAM-related infrastructure and innovation	To attract new investors, consideration should be given to: ▪ Considering whether the UK can establish a Unique Selling Proposition as an investment destination ▪ Demonstrating the interdependencies between CAM and Zero Emission Vehicles ▪ Emphasising the strength of CAM-related infrastructure and innovation ▪ Highlighting the strong consumer market

7.3 The UK as a sourcing destination

7.3.1 Current and future interest

Among those who are procuring internationally, there appears to be a **high degree of interest in the UK CAM sector as a sourcing destination** with over two-thirds of those respondents whose companies are procuring CAM products internationally, also procuring from the UK.

Overall, the survey responses indicate that most CAM companies in Germany, Japan, South Korea, and the USA are sourcing products internationally. Only 18% of respondents said that they do not source any CAM products from outside the country in which they are based, and two-thirds of the 37 participants who are not currently sourcing CAM products internationally would consider it in the next 5-10 years.

The opportunity in the untapped export market appears to be smaller than the untapped investment market, although this study does not explore the total exploitable market size, and the UK's share of this, either for investment or sourcing.

7.3.2   Potential focus areas

Table 28 - Potential focus areas

	Current perceived UK strengths	Future UK USPs
International response	- R&D capabilities - Sensors - Autonomous Control Systems - CAM Pods - AI/ML software - Functional safety - High end product design (e.g. internal trim) - Chip manufacturing	- R&D capabilities - AI/ML software - Sensors - Engineering capabilities - Autonomous control systems
Considerations for the UK CAM sector	- Continuing to develop and market the above strengths could help retain existing procurers. - In particular, since CAM pods are seen as existing strength but not a major future USP, it would be worth thinking about the forward strategy for these.	A greater focus may be required on developing and marketing engineering capabilities which have emerged as a future USP but not a current strength.

Like with investment, since Testbeds and Cybersecurity were the lowest-rated offerings as current strengths and future USPs, it will be important to think about the future trade strategy for these and potentially improve perceptions of them among potential procurers.

The main variations between the international market's perception and the UK stakeholders' self-perceptions of the UK as a source of CAM products are:

- *Simulation software:* Modelling/simulation, which was seen by UK stakeholders as a current strength did not emerge as such among international participants.

- *Cybersecurity:* Cybersecurity was noted as a key current strength by UK stakeholders, but survey and interview respondents did not see this as such.

- *UK's exit from the European Union:* Whilst UK stakeholders saw this as a significant barrier to sourcing and investment, among survey respondents it did not emerge as such and 'clarity of the UK's policy and regulatory environment' was one of the top three drivers. Among interview respondents, there was a more mixed response.

Additional detail and analysis are in Section 4 on the 'UK as an CAM source'

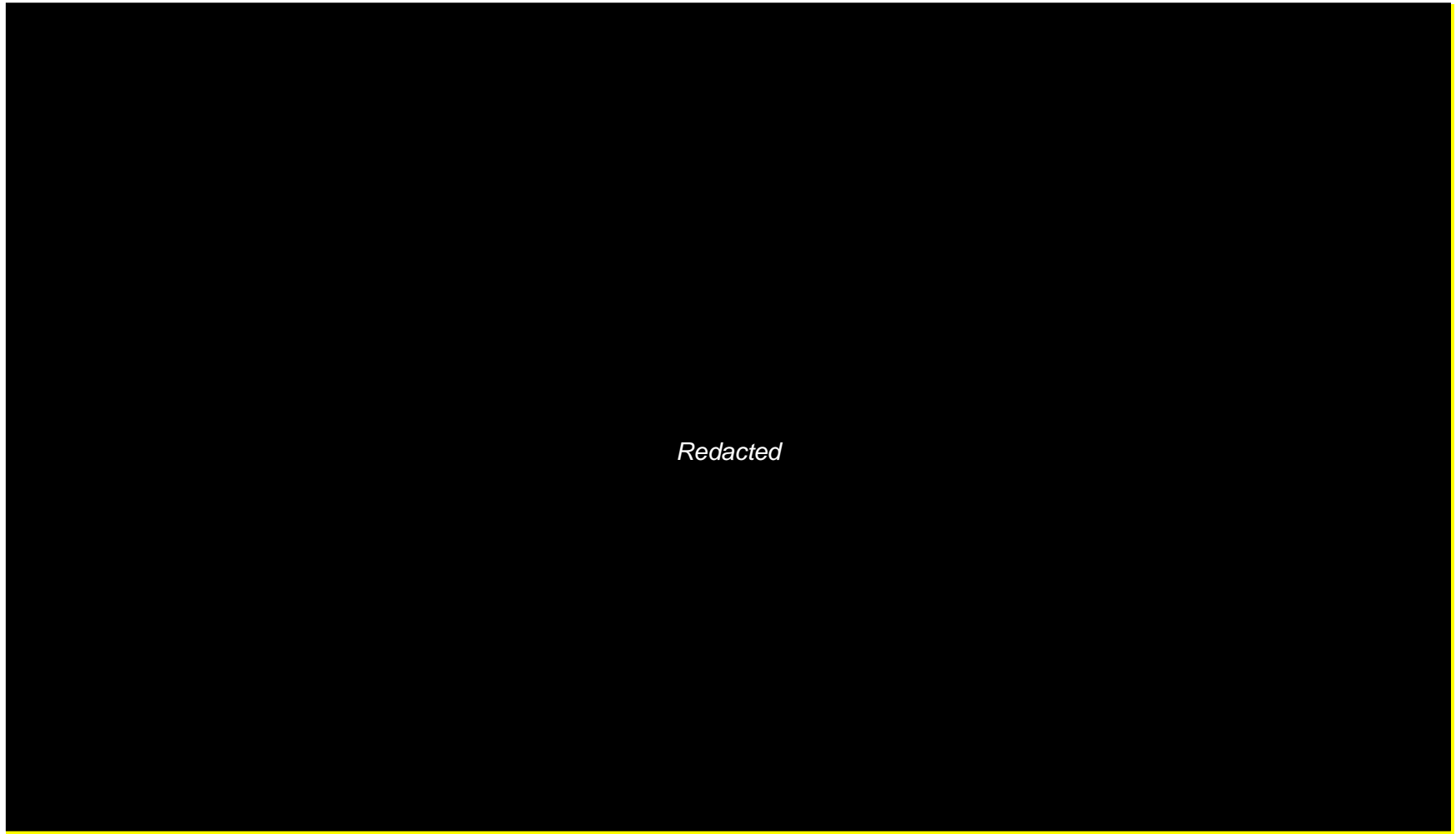### 7.3.3 Leveraging existing drivers and overcoming barriers

Table 29 - Leveraging existing drivers and overcoming barriers: sourcing

|	International procurers who are sourcing from the UK	International procurers who are not sourcing from the UK
Drivers or barriers	**Current drivers of sourcing from the UK** ■ The product being available only from a UK supplier ■ Products being of a high quality ■ Clarity and flexibility of the policy environment	**Barriers to sourcing from the UK** ■ A lack of strong pre-existing relationships with the UK ■ A lack of information/insight into the UK's CAM offering ■ A lack of availability of the product needed **Drivers of international procurement in general** ■ Availability of the good or service ■ Relative quality of the good or service ■ Relative unit cost of the good or service
Considerations for the UK CAM sector	To retain existing procurers, it could be important to: ■ Continue investing in and highlighting the UK market's potential to provide high-quality CAM products ■ Continue demonstrating the clarity and flexibility of policy and regulation	To attract international procurers who are not currently procuring from the UK, it could be important to: ■ Boost marketing and international engagement to detail the UK CAM sector's offering ■ Provide guidance on how to access the market ■ Highlight the availability and high quality of various CAM products ■ Provide assurance on the reasonable unit cost of these products.

7.4 Redacted text

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Table 30 - ▮▮▮▮▮▮▮

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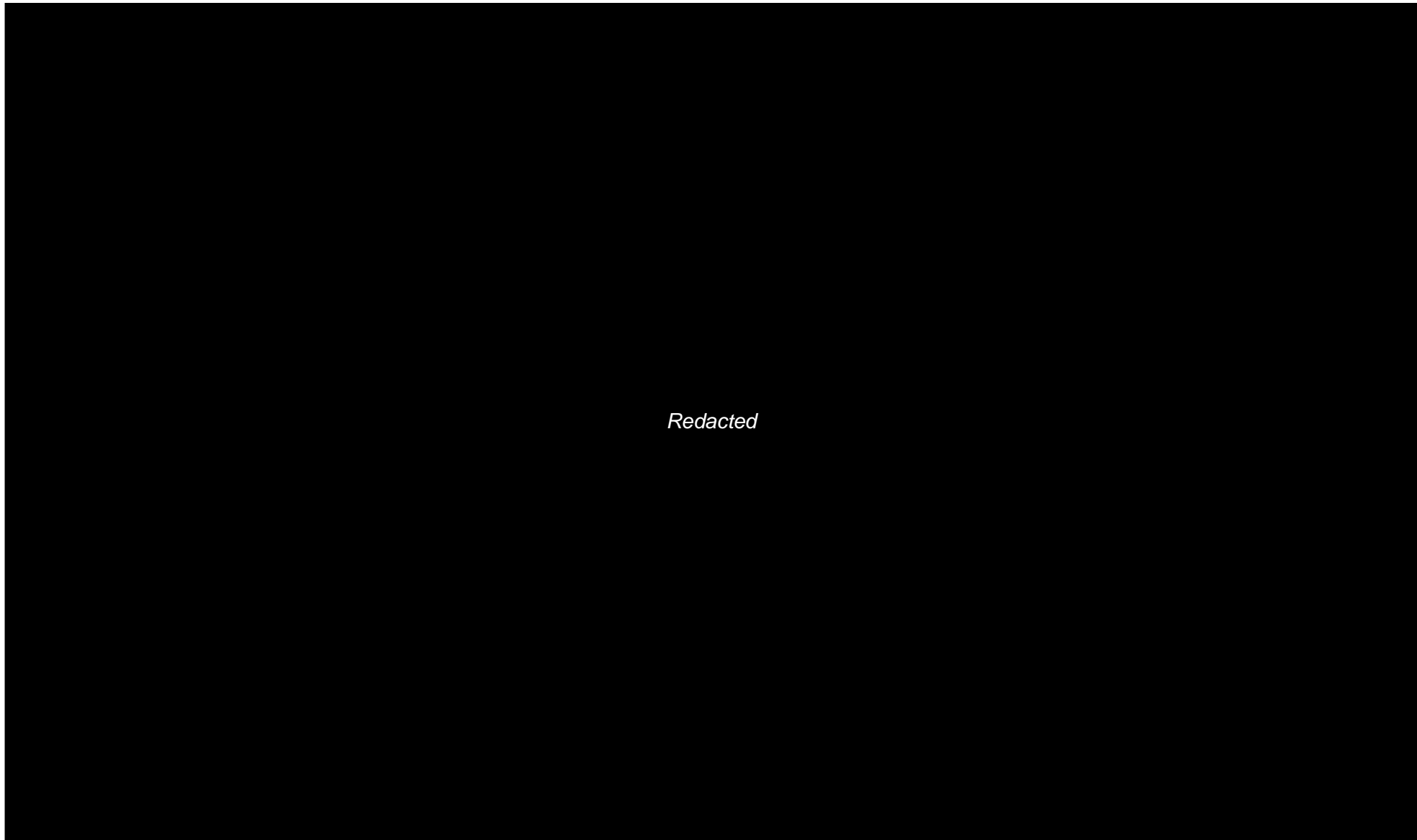
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Figure 12 – ██████████

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7.5   Engagement

Overall, there appears to be **significant appetite for more information on the UK CAM sector with 74% of survey respondents noting that they want more information**. Whilst the perception was that marketing material was of high quality (with 73% of respondents categorising it as very or somewhat informative and insightful), this does not appear to not have translated into significant awareness that is more than 'surface deep' of key organisations and initiatives in the UK market. There is mixed awareness across key organisations and initiatives, with significant scope to increase marketing around key strategic assets such as the UK testbeds.

One key finding that was echoed by both UK stakeholders and international stakeholders was the **need for a clear and concise way forward for the UK CAM sector**. This should identify strategies for technology and innovation, infrastructure, and policy, to help provide perspective investors or sources increased confidence. The following information was cited as what people wanted to see the most:

- **Details on CAM-related infrastructure**

- **Information on the skills base**

- **Clear comparisons with other markets**

- **Data on the size and growth of the sector**

- **Details on available government funding**

A number of **different engagement channels** have been identified throughout this study with recommendations made on a market by market basis to improve the perception of the UK CAM market within these respective markets. Overall, respondents were the most aware of CCAV and UK trade shows; and less familiar and knowledgeable about Zenzic, gov.uk and UK policy initiatives. The following have also been identified as preferred future channels for engagement on the UK CAM sector:
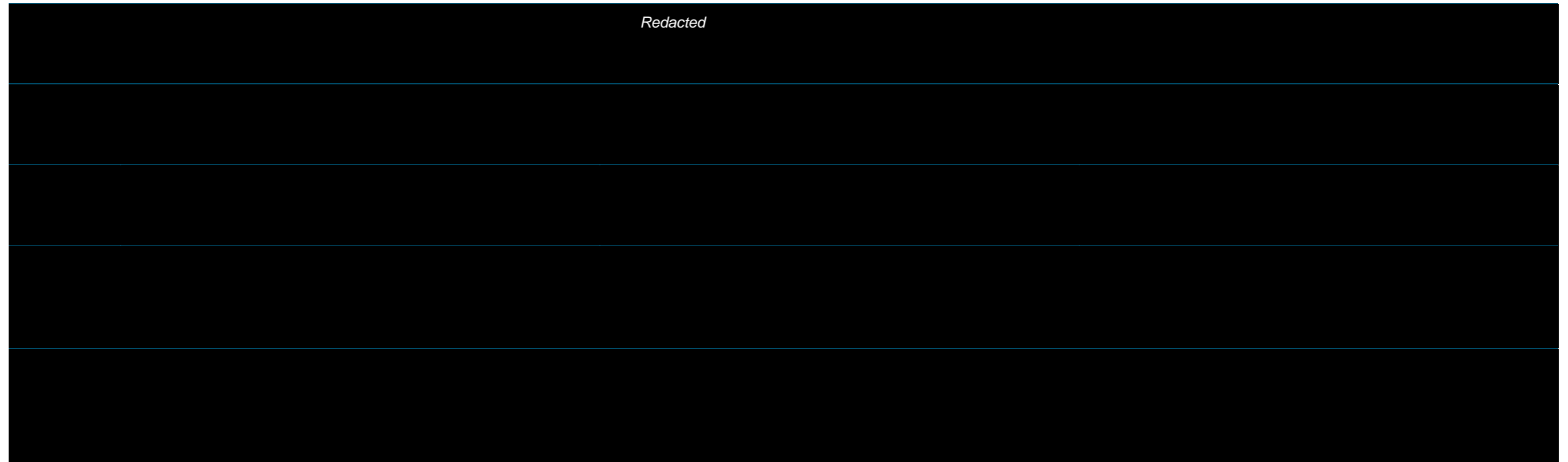
- **Official reports or newsletters**

- **Trade shows and exhibitions**

- **Industry or consulting reports**

- **In-house research**.

The below table sets out considerations for the UK Government and CAM sector in respect of marketing and international engagement to be adopted in the short-term.

Table 31 - Marketing and international engagement considerations

	Channels	Focus areas / products or services	Messaging and framing
All markets	■ Expand level of engagement with all markets through increased communication through Government channels and trade shows. ■ Ensure that industry reports have correct and up to date data on the UK CAM sector. ■ Ensure that any developments in the UK CAM sector are circulated to and through **reputable and widely-read news sources** such as Reuters, the BBC, The Wall Street Journal etc. ■ Engage with UK based sales teams for large international organisations to feed in relevant information to these companies.	■ From an investment and sourcing perspective, emphasise **AI/ML software, R&D and engineering capabilities, Autonomous Control Systems, and Sensors**, continuing to promote CAM pods and OEMs among procurers. ■ Improve the **marketing of Zenzic and Testbed UK** by developing and disseminating information about the value proposition.	■ Develop and release a clear '**CAM strategy**' for the UK, setting out future plans and milestones for regulation, technology and innovation, acceptance, and use cases ■ Ensure marketing materials for the UK CAM sector are aligned, coherent, and consistent across UK stakeholders. ■ Ensure messaging around the UK's departure from the EU, cost of doing business with and in the UK, and investment support initiatives is made available and clear. ■ **For current and potential investors,** provide information on themes noted in Section 3, notably: innovation strengths and potential, availability of infrastructure, details on projected growth, details on end user acceptance of CAM within the UK, linkages with the offering on Zero Emission Vehicles, a 'how-to' guide on establishing new relationships in the UK; and, details of government funding available to attract innovation. ■ **For current and potential procurers,** include detailed information on themes noted in Section 3The UK as an Investment Destination, notably: the suite of available CAM offerings in the UK, information about quality, reassurance about costs, clarity regarding policy; and, a how-to guide for establishing new supplier relationships.
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7.5.1 Engagement efficacy

A key finding of this study has been the importance of international engagement. This study has also served to develop an efficacy framework which could enable the Government to track and measure the benefits of international engagement in order to boost trade and investment flows.

'Engagement efficacy' in the context of this study refers to the relationship between engagement with the international market and investment and trade flows, the principle being that the engagement of the UK CAM sector with the international market should lead to an increase in trade and investment flows. There are three potential ways, each with multiple channels, to do this:

- Conducting a **quantitative regression analysis** to predict the impact of engagement on trade and investment flows (very rigorous but likely to be expensive and time-consuming);

- **Directly asking the international market** about whether changes in engagement have led them to trade more with, and invest in the UK (relatively cost-effective because these meetings are happening anyway but less rigorous because inferences have to be drawn); and,

- **Indirectly inferring from the international market**'s responses to engagement if they are accessing different engagement methods, under the assumption that increased awareness and engagement leads to more trade and investment (relatively cost-effective because these channels have to be used anyway but the least rigorous because inferences have to be drawn).

A potential way forward for each of these methods and different engagement channels are summarised in the table below. Details of metrics, measurement tools and the relative advantages and challenges of these are presented in Section 6.

Table 32 - Next steps for engagement methods

Method	Way forward	Channels
Quantitative regression analysis	- Data on trade and investment flows should be collected to check for a positive correlation with engagement metrics; however, regression may be too expensive and time-consuming	- Data collection - Desktop research
Directly asking the market	- An objective of assessing 'engagement efficacy' could be added to all types of engagement that the UK CAM sector has with international stakeholders. - The challenges and shortcomings of perception-based analysis should be clearly presented as caveats - Independent quantitative surveys and qualitative interviews can be conducted at regular intervals to de-bias the analysis.	- UK Government-to-International Industry meetings - UK Business-to-International Business meetings - UK Government-to-International Government meetings - Independent perceptions analysis
Indirectly inferring from the market	- The benefits of these channels should be tracked given that they would be used anyway. - Potential biases and inaccuracies should be clearly caveated	- International industry's response to UK government releases, consulting reports, media/social media coverage, trade shows

Appendices

Appendix A: UK Stakeholder Engagement

As detailed in Section 2, as part of the study's baselining activity, a number of UK stakeholders were engaged to seek their views on the UK CAM market. The objectives of this engagement activity were to:

- Understand internal perceptions of the UK CAM market, which would serve as hypotheses to be validated through the international market research.
- Leverage any existing data or insights that could be of value to the study.

The engagement was designed to help gather perceptions of the UK as a sourcing destination; the UK as an investment destination; and UK engagement efficacy with the international CAM business community.

The research approach taken was to undertake semi-structured interviews with a group of stakeholders. The stakeholders to be interviewed, and the interview questions, were agreed with CCAV in advance. Interviews were one hour long each, on a 1-1 basis, and conducted by the research team. Stakeholders were provided a list of discussion topics in advance of the interviews. Interviews were held on a confidential basis; none of the discussion points or findings would be attributed to any one individual or organisation.

The stakeholders engaged were:

- Connected Places Catapult (CPC)
- Innovate UK
- The Department for Business, Energy and Industrial Strategy (BEIS)
- The Department for International Trade (DIT)
- The Knowledge Transfer Network
- The Society of Motor Manufactures and Traders (SMMT)
- Zenzic

The questions used in the stakeholder engagement are presented below; as this was a semi-structured interview, additional questions may have been asked during discussions.

Role in the CAM Sector

1. **Can you describe your organisation's role in the UK CAM sector?**
2. What role does your organisation have in promoting the UK CAM sector for procurement or inward investment?

UK CAM Market Offer (Sourcing)

Lead question:

3. **What do you think are the strengths of the UK CAM sector from a sourcing perspective?**

Follow up questions depending on the direction of conversation:

4. What do you think are the UK's CAM USPs?
5. What do you think are the barriers to sourcing goods or services from the UK CAM sector?
6. Which are the key international territories that are procuring UK CAM goods or services?
7. How do you think the UK compares with other countries selling CAM goods or services?
8. Do you have / are you aware of any targets or strategies around increasing international exports related to the UK CAM sector?
9. What do you think could be done to increase international interest in procuring goods and services from the UK CAM sector?

Inward Investment in the UK CAM Sector

Lead question:

10. **What do you think are the strengths of the UK CAM sector as an investment destination?**

Follow up questions depending on the direction of conversation:

11. Do you expect to see further inward investment in the UK CAM sector? – how do you expect this to manifest?
12. If you expect to see further inward investment, in which sectors of the CAM market do you expect to see this in?
13. Where would you like to see more inward investment, and why?
14. What do you think are the barriers to investing in the UK CAM sector?
15. How do you think the UK compares with other countries for inward investment into CAM goods or services, in terms of our USPs/competitive advantage?
16. Do you have / are you aware of any targets or strategies around increasing inward investment into the UK CAM sector?
17. What do you think could be done to increase international interest in investing in the UK CAM sector?

Individual factors

Policy

Lead questions:

18. **What are your opinions on the UK's policy and regulatory environment in respect of encouraging procurement from the CAM sector?**

19. **What are your opinions on the UK's policy and regulatory environment in respect of encouraging investment into the CAM sector?**

Follow up questions depending on the direction of conversation:

20. In respect of attractiveness, how do you think the UK's policy and regulatory environment in respect of CAM compares to that of other countries?
21. Do you think there is enough policy and regulatory certainty in the UK in respect of the CAM sector?

22. What trade policies and regulations, if any, would encourage procurement of goods and services from the UK's CAM sector?
23. What policies and regulations, if any, would encourage investment in the UK's CAM sector?
24. What role do you think there is for government funding/fiscal incentives to support procurement from, or inward investment into, the UK CAM sector?

Technology and innovation

Lead question:

25. How do you think the UK's technology and innovation capabilities compare with those in other markets?

Follow up questions depending on the direction of conversation:

26. What do think are the key innovations in the UK's CAM sector, when compared to other countries?
27. What is your view of the UK's technology and innovation capabilities? (Pointers: Strength, Variety, Agility, Cost Effectiveness)

Infrastructure

Lead question:

28. Do you think the UK has developed the infrastructure required to attract CAM investment?

Follow up questions depending on the direction of conversation:

29. What do you think are the strengths and weaknesses of the UK's CAM-related infrastructure?
30. From an infrastructure perspective, what do you think could be done to see expansion in inward investment in the UK CAM sector?

Marketing & engagement

Lead questions:

31. What approaches to marketing and engagement do you take to promote procurement from, or investment into, the UK CAM sector?

32. How would you characterise the quality of the information produced generally by the UK CAM sector to encourage sales/inward investment?

33. What do you think could be done to further promote procurement from, or investment into, the UK CAM sector?

Appendix B: International Survey

As detailed in Section 1, for this study an online survey was conducted of 203 individuals from the automotive sector to gather their perceptions about three broad areas – investment, sourcing, and engagement efficacy, related specifically to the UK market and more broadly.

Survey sample:

Country	Number of respondents
Germany	50
Japan	51
South Korea	52
United States	50
Total	203

Screening questions about the type of company, role, and knowledge of the CAM sector were included in the survey to ensure a high quality of responses.

Sample composition:

- The participants represented a **range of companies** – the largest proportion being from automotive Original Equipment Manufacturers (OEMs) and automotive parts suppliers, followed by software technology providers, hardware technology providers, service providers, and infrastructure providers.

- The companies represented by the participants were of **varying sizes** – about 45% in smaller companies with less than 1,000 people, 27% in the range of 1,000-20,000 employees, and 28 percent in the range of over 20,000 employees.

- The participants were all **senior decision-makers** – CXOs, Senior Vice Presidents, Vice Presidents, Senior Directors, Directors, and Heads of Departments, primarily representing Research & Development, Manufacturing, Strategy or Operations. 64% claimed to have an in-depth understanding of their company's CAM offering and strategy, while 36% claimed to have some understanding of this.

Privacy and anonymity

- Respondents were not asked any information that could be traced back to a specific company

- Responses were anonymised and aggregated such that there was no way to link responses to specific individuals.

Survey Questionnaire

Introduction

This is an online survey of decision-makers from 200+ companies in the Connected and Automated Mobility sector (including Original Equipment Manufacturers, supply chain companies, and service providers) across the world to gather perceptions of the United Kingdom's Connected and Automated Mobility (CAM) market and capabilities.

Thank you for participating in this survey. It should take approximately 15 minutes to complete. Please answer all questions as completely and honestly as possible. Your input is anonymous and confidential. All your answers will be aggregated with others'.

Context and definitions

- ***Connected and Automated Mobility (CAM)***: For the purpose of this survey, 'Connected and Automated Mobility' sector is defined as the ecosystem – including vehicles, individual parts, software, infrastructure, and services – which enables vehicles to (1) connect with each other and the infrastructure <u>and</u> (2) drive with minimal or no need for human intervention.
- ***Sourcing:*** Procurement of goods, systems, and services
- ***Investment:*** Refers to both direct investment including opening of a subsidiary or associate company, acquiring a controlling interest in an existing foreign company, or entering a merger/JV with a foreign company, and indirect portfolio investment.
- ***Your country of work:*** Refers to the country in which you are primarily based for work.

Permission checkbox

Contextual/Screening questions

1. In which of the following countries are you primarily based for work?
    a. Germany
    b. Japan
    c. South Korea
    d. USA
    e. None of the above – Terminate

2. Which of the following best describes your company? (Tick all that apply.)
    a. Automotive Original Equipment Manufacturer (OEM)
    b. Automotive parts supplier
    c. Other automotive, please specify _____
    d. Hardware technology provider with interest in Connected and Automated Mobility
    e. Software technology provider with interest in Connected and Automated Mobility
    f. Service provider with interest in Connected and Automated Mobility (e.g. logistics or mobility services)
    g. Infrastructure provider with interest in Connected and Automated Mobility
    h. None of the above, but we have an interest in Connected and Automated Mobility, please specify _____
    i. None of the above, please specify _____ (Terminate)

3. How many full-time employees does your company have globally?
   a. Less than 500
   b. 500 – 1,000
   c. 1,000 – 20,000
   d. 20,000 – 50,000
   e. 50,000 – 100,000
   f. 100,000-200,000
   g. Over 200,000
   h. Cannot discuss

4. Which of the following best describes your role in your company?
   a. CXO
   b. Senior Vice President
   c. Vice President
   d. Senior Director
   e. Director
   f. Head of a Department
   g. Other, please specify _____ (Terminate)

5. Which of the following best describes your team or area?
   a. Strategy
   b. Operations
   c. Manufacturing
   d. Finance
   e. Research and Development
   f. Procurement
   g. Supply Chain
   h. Other, please specify _____

6. Which of the following would best describe your understanding of your company's interest and involvement in the connected and automated mobility (CAM) sector?

   a. I have an in-depth understanding of my company's interest or involvement in the connected and automated mobility (CAM) market
   b. I have some understanding of my company's interest or involvement in the connected and automated mobility (CAM) market
   c. I have no knowledge about of my company's interest or involvement in the connected and automated mobility (CAM) market – Terminate

7. In your view, how mature are your connected and automated mobility (CAM) offerings?
   a. Mature for both
   b. Mature for connected, less mature for automated
   c. Mature for automated, less mature for connected
   d. Somewhat mature for both
   e. Not mature for either

8. What areas of CAM do you have capabilities in? (Tick all that apply)
   a. Whole vehicles
   b. CAM Pods
   c. Connected features

d. Autonomous control systems
e. R&D
f. Sensors
g. Artificial intelligence/Machine learning
h. Testbeds and infrastructure provision
i. Modelling/simulation services
j. Connectivity and communications technologies
k. Cybersecurity
l. Other, please specify _____

Sourcing decisions

This section is focused on decisions to procure CAM goods or services internationally, including the UK.

9. Do you currently source goods or services from other markets (beyond your country) for its CAM-related products?
   1. Yes (Go to Question 11)
   2. No (Go to Question 10)

If 9(b) No

10. Do you think you would source goods or services from other markets for its CAM-related products? (Go to Question 19 after)
    1. Yes, within 5 years
    2. Yes, in 5-10 years
    3. Perhaps after 10 years
    4. No

If 9(a) Yes:

11. What factors do you think drive your choice of global market for the sourcing of CAM-related products? (Rate each of the following from 1-5, 1 being "extremely important", 2 being "somewhat important", 3 being "may be a consideration", 4 being "unlikely to be a consideration" and 5 being "definitely not a consideration".)
    1. Availability of the good or service
    2. Relative unit cost of the good or service being sourced
    3. Relative landed cost of the good or service being sourced (including customs, duties, brokerage fees, banking fees etc.)
    4. Relative quality of the good or service being sourced
    5. Strength of existing supplier relationships
    6. Trade regulations
    7. Automotive skills base
    8. Digital skills base
    9. Clarity and flexibility of policy and regulatory environment
    10. Geographical or cultural proximity
    11. Other, please specify _____
    12. Cannot discuss

12. Do you currently source goods or services from the UK for its CAM-related products?

    1. Yes (Go to Question 13)
    2. No (Go to Question 15)

If 12(a) Yes:

13. In broad terms, what do you source from the UK market? (Tick all that apply.)
1. R&D capabilities
2. University/academic capabilities
3. Engineering capabilities
4. Sensors
5. Whole vehicles
6. Autonomous control systems
7. Human Machine Interface (HMI) technologies
8. CAM Pods
9. Artificial intelligence / machine learning software
10. Testbed services or testing capabilities
11. Modelling/simulation services
12. Cybersecurity
13. Other, please specify _____

14. What is your understanding of why source these goods or services from the UK market compared to other markets? (Rate each of the following from 1-5, 1 being "extremely important", 2 being "somewhat important", 3 being "may be a consideration", 4 being "unlikely to be a consideration" and 5 being "definitely not a consideration".) (Go to Question 16 after)
1. The goods or services are only available from a UK supplier
2. Goods or services we source from the UK are higher quality than those available from other markets
3. Unit cost effectiveness of the goods and services we source from the UK
4. Landed cost effectiveness (including customs, duties, brokerage, banking fees etc.) of the goods and services we source from the UK
5. We have strong relationships with suppliers in the UK.
6. It is easy to trade with the UK.
7. We have strong geographical and cultural ties with the UK.
8. The UK's skills base in the automotive and software sectors is well developed.
9. The UK has a clear and flexible policy and regulatory environment.
10. Other, please specify _____
11. Cannot discuss

If 12(b) No:

15. Why do you think you are not sourcing CAM-related goods or services from the UK market? (Rate the following factors from 1-5, 1 being 'I think this is a critical reason', 2 being 'I think this may be an important reason', 3 being 'I think this may be a reason, but not an important one', 4 being 'This is unlikely to be a reason.' and 5 being 'I definitely don't think this is a reason.')
1. The UK doesn't yet provide what we need.
2. We don't understand, or have insight into the UK's CAM offerings

3. Goods and services in the UK are too expensive.
4. The landed cost of doing business in the UK, such as customs, duties, brokerage fees, banking fees etc. is too high.
5. We don't think the UK's goods and services in the CAM market are of a high enough quality.
6. We don't have strong pre-existing relationships with suppliers in the UK.
7. We don't have strong geographical or cultural ties with the UK.
8. Trade regulations aren't conducive or flexible.
9. The UK's skills base in the wider automotive or technology markets isn't as developed as ours or other countries.
10. Other, please specify _____
11. Cannot discuss

16. Which of the following countries do you source CAM-related goods and services from? (Tick all that apply)
1. Canada
2. China
3. Finland
4. France
5. Germany
6. Israel
7. Japan
8. Netherlands
9. Norway
10. Singapore
11. South Korea
12. UK
13. USA
14. Other, please specify _____
15. Cannot discuss

17. How do you think the UK is likely to compare to those international markets on various determinants of sourcing for CAM-related goods and services? (Rank each country from 1 to X, 1 being the best.) Include UK in all; otherwise only display X countries selected in the list above.

Determinants of sourcing decisions	UK	USA	Japan	S. Korea
Availability of CAM-related goods and services				
Cost competitiveness				
Quality of CAM-related goods and services				

Strength of CAM market				
Strength of automotive/software/IT skills base				
Conducive trade regulation				

18. In broad terms, what do you source from these other countries? (Tick all that apply)
1. R&D capabilities
2. University/academic capabilities
3. Engineering capabilities
4. Sensors
5. Whole vehicles
6. Autonomous control systems
7. Human Machine Interface (HMI) technologies
8. CAM Pods
9. Artificial intelligence / machine learning software
10. Testbed services and trialling capabilities
11. Modelling/simulation services
12. Cybersecurity
13. Other, please specify _____

19. In which of the following do you think the UK could build a unique proposition as a sourcing destination? (Tick all that apply)
1. R&D capabilities
2. University/academic capabilities
3. Engineering capabilities
4. Sensors
5. Whole vehicles
6. Autonomous control systems
7. Human Machine Interface (HMI) technologies
8. CAM Pods
9. Artificial intelligence / machine learning software
10. Testbed services and trialling capabilities
11. Modelling/simulation services
12. Cybersecurity
13. Other, please specify _____

Investment decisions

This section is focused on decisions to invest (either directly or indirectly) in CAM related companies internationally, including in the UK.

20. Are you investing in developing capabilities and go-to-market channels in the CAM sector in countries beyond your home country?
1. Yes (Go to Question 23)

2. No (Go to Question 21)

If 20(b) No

21. Why do you think you are not investing in the CAM sector in other markets? (Rate the following factors from 1-5, 1 being 'I think this is a critical reason', 2 being 'I think this may be an important reason', 3 being 'I think this may be a reason, but not an important one', 4 being 'This is unlikely to be a reason.' and 5 being 'I definitely don't think this is a reason.')
    a. We ~~They~~ have the capabilities we ~~they~~ require for our CAM ambitions domestically.
    b. CAM is not an investment priority at the moment because we ~~they~~ are more focused on zero emission vehicles.
    c. CAM is not an investment priority at the moment because we ~~they~~ are still recovering from the pandemic.
    d. CAM is not an investment priority because we ~~they~~ don't see a return on investment in the required time frames.
    e. CAM is not an investment priority because we ~~they~~ don't think the CAM sector will see much growth within the next 10 years.
    f. Other (please specify)_____
    g. Cannot discuss

22. If you did choose to invest in international markets, what factors do you think would drive your choice of investment destinations in the Connected and Automated Mobility market? (Rate each of the following from 1-5, 1 being "extremely important", 2 being "somewhat important", 3 being "may be a consideration", 4 being "unlikely to be a consideration" and 5 being "definitely not a consideration".) (Go to Question 30 after)
    1. Overall growth potential of the country's CAM market
    2. Strength of CAM-related infrastructure
    3. Strength of the CAM testing environment / capabilities (e.g. availability of testbeds)
    4. Strength of CAM-related innovation
    5. Attractiveness and stability of CAM policy and regulation
    6. Level of government funding in the sector
    7. Likelihood of consumer (i.e. end user) acceptance of CAMs
    8. Strength of wider automotive market
    9. Strength of wider software/IT market
    10. Competitiveness of CAM-related capabilities
    11. Overall growth potential of the economy
    12. Strength of existing relationships and investments in the country
    13. Other, please specify _____

If 20(a) Yes

23. What factors do you think ~~drives~~ your choice of investment destinations in the CAM market? (Rate each of the following from 1-5, 1 being "extremely important", 2 being "somewhat important", 3 being "may be a consideration", 4 being "unlikely to be a consideration" and 5 being "definitely not a consideration".)
    1. Overall growth potential of the country's CAM market
    2. Strength of CAM-related infrastructure
    3. Strength of CAM testing environment / capabilities (e.g. availability of testbeds)

4. Strength of CAM-related innovation
5. Attractiveness and stability of CAM policy and regulation
6. Level of government funding in the sector
7. Likelihood of consumer (i.e. end user) acceptance of CAMs
8. Strength of wider automotive market
9. Strength of wider software/IT market
10. Competitiveness of CAM-related capabilities
11. Overall growth potential of the economy
12. Strength of existing relationships and investments in the country
13. Other, please specify _____
14. Cannot discuss

24. Do you currently invest in the UK's CAM market (automotive, Tier 1 supply chain, software products) etc.?
1. Yes (Go to Question 25)
2. No (Go to Question 28)

If 24(a) Yes:

25. Broadly, what kind of investment has your company (or its UK subsidiary) made in the UK's CAM sector? (Tick all that apply.)
1. Foreign Direct Investment (including opening of a subsidiary or associate company, acquiring a controlling interest in an existing UK company, or entering a merger/JV with a foreign company)
2. Indirect Investments (or purchases of securities that represent claims on other underlying securities)
3. Both
4. Other, please specify _____
5. Cannot discuss

26. In broad terms, what kind of CAM-related offerings has your company (or its UK subsidiary) invested in within the UK market? (Tick all that apply.)
1. Automotive OEM
2. CAM Pods
3. Testbeds
4. Artificial intelligence/machine learning
5. Connectivity and communications technology
6. Autonomous control systems
7. Human Machine Interface (HMI) technologies
8. Sensors
9. Modelling/simulation services
10. R&D capabilities
11. University capabilities
12. Engineering capabilities
13. Cybersecurity
14. Other, please specify _____
15. Cannot discuss

27. What do you think makes companies in the UK CAM sector attractive for investment compared to other countries? (Rate the following factors from 1-5, 1 being 'I think this is a critical reason', 2 being 'I think this may be an important reason', 3 being 'I think this may be a reason, but not an important one', 4 being 'This is unlikely to be a reason.' and 5 being 'I definitely don't think this is a reason.')
1. We're expecting high growth in the UK CAM sector.
2. We think the UK's CAM-related infrastructure is strong (e.g. quality of roads, electric vehicle charging infrastructure, 4G coverage, future 5G coverage etc.)
3. We think the UK's CAM testing environment is strong (e.g. availability of testbeds)
4. We think that there is high innovation potential in the UK CAM market (e.g. CAM-related patents, strength of industry partnerships, research capabilities)
5. We think that the policy and regulatory environment for CAM is attractive, clear and stable.
6. We are looking to benefit from, or have already benefited from UK government funding.
7. We believe that the UK's CAM market will grow because of a high degree of consumer (i.e. end user) acceptance of CAVs.
8. We believe that the UK's wider automotive market is attractive.
9. We believe that the UK's wider software and IT market is attractive.
10. We already have strong relationships and stable investments in the UK market.
11. We believe that the economic growth potential of the UK is high.
12. We believe that the UK's overall policy environment for investments is strong.
13. Other, please specify _____

If 24(b) No:

28. What is holding you back from investing in the UK CAM sector vis-à-vis other countries? (Rate the following factors from 1-5, 1 being 'I think this is a critical reason', 2 being 'I think this may be an important reason', 3 being 'I think this may be a reason, but not an important one', 4 being 'This is unlikely to be a reason.' and 5 being 'I definitely don't think this is a reason.')
1. We don't understand, or have insight into the UK's CAM offerings
2. We are not expecting high growth in the UK CAM sector.
3. We think that the UK's CAM sector growth will be held back by high costs, for example of engineering and research capabilities.
4. We don't think the UK's CAM-related infrastructure is sufficient to support near-term adoption of connected and/or automated vehicles (e.g. quality of roads, electric vehicle charging infrastructure, 4G coverage, future 5G coverage etc.)
5. We don't think the UK's CAM testing environment is sufficient for our requirements (e.g. availability of testbeds)
6. We don't think that there is high innovation potential in the UK CAM market (e.g. CAM-related patents, strength of industry partnerships, research capabilities)
7. We don't think that the UK's policy and regulatory environment for CAM is attractive or clear.
8. There are insufficient government funding incentives as compared to other markets.
9. We think consumer (i.e. end user) acceptance in the UK will be a barrier to the growth of UK CAM.
10. The UK's automotive skills base is insufficient to meet our requirements.
11. The UK's digital skills base is insufficient to meet our requirements.

12. It would be too expensive to establish new relationships within the UK CAM sector.
13. The UK market more broadly is not an attractive investment destination at the moment (please specify why) _____.
14. Other, please specify _____
15. Cannot discuss

29. Would you consider investing in the UK CAM sector in the future?
1. Yes, within 5 years
2. Yes, in 5-10 years
3. Perhaps after 10 years
4. No, I don't see us investing in the UK but we could consider other collaborations
5. No, I don't see us investing in the UK.

All:

30. What do you think would make the UK CAM sector more attractive for investment? (Tick all that apply)
1. More or better CAM-related infrastructure (e.g. 5G coverage, quality of roads)
2. More or better CAM testbeds
3. More CAM-related innovation (e.g. more CAM patents, more CAM research)
4. A clearer and more attractive CAM policy and regulatory environment
5. More government funding in CAM to attract innovation
6. Indications of customer acceptance of CAM by end-users in the future
7. Improvements in the automotive skills base
8. Improvements in the digital skills base
9. More cost-effective engineering and research capabilities
10. A more stable economic environment in the UK
11. A more stable trade and regulatory environment in the UK
12. Other, please specify _____

31. In which countries' CAM companies/sectors do you currently invest?
1. Canada
2. China
3. Finland
4. France
5. Germany
6. Israel
7. Japan
8. Netherlands
9. Norway
10. Singapore
11. South Korea
12. USA
13. Other, please specify _____

32. How do you think the UK is likely to compare to those markets on various determinants of investment in the CAM market? (Rank each country from 1 to X, 1 being the best.)
Include UK in all, otherwise only display X countries selected in the list above

Determinants of investment decisions	UK	USA	Japan	S. Korea
Overall growth potential of CAM sector				
Strength of CAM infrastructure				
Strength of CAM testing environment				
Strength of CAM-related innovation				
Attractiveness and clarity of CAM policy and regulation				
Academic and R&D capabilities				
Amount of government funding and support				

33. In which of the following do you think the UK could build a unique proposition as an investment destination? (Tick all that apply)
1. R&D capabilities
2. University/academic capabilities
3. Engineering capabilities
4. Sensors
5. Whole vehicles
6. Autonomous control systems
7. Human Machine Interface (HMI) technologies
8. CAM Pods
9. Artificial intelligence / machine learning software
10. Testbed services
11. Modelling/simulation services
12. Cybersecurity
13. Other, please specify _____

34. What kind of applications and use cases are/ would you be interested in within the UK market?
1. Passenger vehicles/robotaxis
2. Long-haul logistics
3. First and last-mile delivery
4. Autonomous public transport
5. Demand-responsive transport

6. Other, please specify _____
7. None

Engagement efficacy

This section is focused on understanding how effectively the UK CAM sector has engaged with you, and how you would like to be engaged going forward.

35. How familiar are you with the following?

	I know it very well	Aware	Partially aware	Not at all
The Centre for Connected and Autonomous Vehicles				
Zenzic and CAM Testbed UK				
'Connected and Automated Vehicles in the UK 2020' booklet				
Zenzic Connected and Automated Mobility Roadmap to 2030				
CAM information on the uk.gov website				
UK trade shows				
UK Automated and Electric Vehicles Act 2018				
UK Code of Practice: Automated Vehicle trialling				
Law Commissions' review of UK legislation to enable the deployment of CAVs				

36. Have you received information about the UK CAM sector directly from any UK government stakeholders in the past? (Tick all that apply)
1. Yes, the Department for International Trade

2. Yes, the Centre for Connected and Autonomous Vehicles
3. Yes, but I'm not sure from whom
4. No, never
5. Other, please specify _____

37. Do you feel you have access to sufficient sources of data on the UK CAM sector?
1. No
2. Partially
3. Yes
4. There are too many sources of data on the UK CAM sector that I don't know which to utilise

38. If you have accessed the aforementioned materials about the UK CAM sector, how would you assess their quality?
1. Very informative and insightful
2. Somewhat informative and insightful
3. Not informative and insightful
4. I haven't come across any information

39. What sources of data do you access that informs your opinion of the CAM sector in other countries? (Tick all that apply.)
1. Government reports
2. Media, please specify _____
3. Industry or consulting reports
4. In-house research and analysis
5. Trade shows and expos
6. Other, please specify _____
7. None

40. In which trade shows do you think the UK CAM sector should showcase its products and services? (Tick all that apply.)
1. CES (organised by the Consumer Technology Association)
2. ITS European Congress
3. ITS World Congress
4. Autonomous Vehicles Technology Expo
5. Future of Transport Conference
6. Global Symposium on Connected and Automated Vehicles and Infrastructure
7. Other, please specify _____

41. What do/would you look for in information about the CAM sector of any country? (Tick all that apply)
1. Clear data on the size and growth of the sector
2. Information on the skills base in the market
3. Clear comparisons with other markets
4. Details about CAM-related infrastructure
5. Information about available government funding
6. Information about CAM policy and regulation
7. Information about CAM innovations

8. Other, please specify _____

42. Would you be interested in potentially receiving more information about the UK CAM sector?
1. Yes
2. No

If 42(a) Yes: (Note: Questions 42 and 43 to appear on the same page so that the respondent realises that we are looking for insight and not their contact details)

43. How would you like to receive information about the UK CAM sector?
1. Official reports or newsletters issued by the UK CAM market directly to my company
2. Trade shows and expos (virtual or in-person) organised by the UK Government
3. Publicly available industry or consulting reports directly to my company
4. We can research it ourselves when we need to
5. Other, please specify _____

44. How would you characterise this survey? (Tick all that apply)
1. Interesting
2. Relevant
3. Not interesting
4. Irrelevant
5. Too difficult
6. Too long
7. Other, please specify _____

Appendix C: International Interviews

To augment the quantitative market engagement, semi-structured interviews were conducted with an additional set of senior decision-makers from the automotive industry. Interviews focused on obtaining a richer set of insights on the aforementioned topics.

Interview panel

Interviews were conducted with decision-makers from the four territories in scope for this study: Germany, Japan, South Korea and the United States. Additionally, and to provide further insight and value for this study, interviews were conducted with respondents from Israel and one from France.

Country	Number of participants
Germany	10
Japan	10
South Korea	4
United States	10
France	1
Total	45

The participants represented a range of companies – covering Original Equipment Manufacturers (OEMs) and automotive parts suppliers, software technology providers, hardware technology providers, service providers, and infrastructure providers.

Interview methodology

Semi-structured interviews were conducted focused on a few lead questions with additional detailed questions depending on the responses of the participants

Privacy and anonymity

All responses were anonymised and aggregated (at a country level) such that there was no way to link responses to specific individuals.

International Interview Guide

Introduction

We are conducting a set of interviews of 50+ decision-makers from companies interested in the Connected and Automated Mobility sector across the world to gather perceptions of the United Kingdom's Connected and Automated Mobility (CAM) market and capabilities.

WSP and partner have been commissioned by the UK Government's Centre for Connected and Autonomous Vehicles to undertake a market study to (a) assess perceived push and pull factors to investing in, or procuring, UK Connected and Automated Mobility (CAM) products or services, and (b) get input on how organisations such as yourselves would like to be engaged by the UK Government in relation to Connected and Automated Mobility going forward.

We are interviewing ten people from each country. The insights that you share will be completely anonymous and aggregated at a national level. We will not report any company information or details.

Definitions:

- *Connected and Automated Mobility (CAM)*: For the purpose of this interview, 'Connected and Automated Mobility' sector is defined as the ecosystem – including vehicles, individual parts, software, services, and infrastructure – which enables vehicles to (1) connect with each other and the infrastructure and (2) drive with minimal or no need for human intervention.
- *Sourcing:* Procurement of goods, systems, and services
  Investment: Investment refers to both direct investment including opening of a subsidiary or associate company, acquiring a controlling interest in an existing UK company, or entering a merger/JV with a foreign company, and indirect portfolio investment.

Interest in the CAM market

1. **Can you describe your company's interest in the connected and automated mobility sector?**

2. **How has this changed over the years?**

3. **How would you characterise your company's offering in the automated vs. connected sphere?**

Sourcing decisions

4. **What are the key factors that influence your sourcing decisions, and how does the UK compare to other markets for these factors?**

   Supplemental questions

   a. Does your company currently source goods or services from the UK CAM market?
   b. If so, what do you source from the UK CAM market?
   c. If not, would your company consider sourcing goods or services from the UK CAM market?

d. What do you think are the strengths of the UK CAM market from a sourcing perspective?

e. What do you think are the barriers to sourcing goods or services from the UK CAM market?

f. Which international markets do you source CAM-related goods and services from?

g. How do you think the UK compares to these?

h. What would have to change about the UK market for you to procure goods and services from there?

Investment decisions

5. What are the key factors that influence your investment decisions, and how does the UK compare to other markets for these factors?

Supplemental questions

a. Does your company currently invest in any companies in the UK CAM market?

b. Are these direct or portfolio investments?

c. If so, what kind of companies are you investing in?

d. If not, would your company consider investing in the UK CAM market?

e. What do you think are the strengths of the UK CAM market as an investment destination?

f. What do you think are the barriers to investing in the UK CAM market?

g. Which international markets is your company currently investing in?

h. How do you think the UK compares to these?

i. What would have to change about the UK market for you to invest in it?

Individual factors

Note: These questions should be asked earlier if they have been mentioned by interviewees. Some questions may not be necessary depending on previous responses.

Policy

6. What are your opinions on the UK's policy and regulatory environment in respect of the CAM sector?

Supplemental questions

a. In respect of attractiveness, how do you think the UK's policy and regulatory environment in respect of CAM compares to that of other countries?

b. Do you think there is enough policy and regulatory certainty in the UK in respect of the CAM sector?

c. Would your company be encouraged to invest in the UK CAM sector if there was more government funding available?

d. What policies and regulations, if any, would encourage you to invest in the UK's CAM sector?

e. What trade policies and regulations, if any, would encourage you to source goods and services from the UK's CAM sector?

f. Given the UK's new trading relationship with your country, what do you think are the opportunities for trade policy to support your UK investment decisions?

Technology and innovation

7. What are your opinions on the technology and innovation environment in the UK in respect of the CAM sector?

Supplemental questions

a. Are you aware of the innovations in the UK's CAM sector? (Refer to CCAV list)
b. What is your view of the UK's technology and innovation capabilities?
c. How do you think the UK's technology and innovation capabilities compare with those in other markets?
d. What drives your decision to source CAM technologies from other markets?
e. How does the UK stack up against these?

Infrastructure

8. Do you think the UK has developed the infrastructure required to attract CAM investment and support adoption of connected and automated vehicles?

Supplemental questions

a. What do you think are the strengths and weaknesses of the UK's CAM-related infrastructure?
b. From an infrastructure perspective, what would you need to see to expand your investment in the UK CAM sector?

Customer acceptance

9. Do levels of customer acceptance influence your decisions regarding investment destinations?

Supplemental questions

a. How do you see the current levels of consumer acceptance in the UK compared to other countries?

Engagement with the UK CAM sector

10. Do you feel like you have access to sufficient information and data on the UK CAM market?

Supplemental questions

a) What sources of data do you or your organisation access that informs your opinion of the UK CAM sector?
b) What sources of data do you or your organisation access that informs your opinion of the global CAM sector?
c) How would you characterise the quality of the information that you have received/consumed about the UK CAM sector?
d) How would you like to be informed about key developments in the UK CAM market?
e) Would you prefer more targeted engagement of your organisation?

Additional contacts to interview

Thank you for your time today. Do you know of anyone else that you think we should be engaging with as a part of this work?

If yes – then: "Please could you introduce us to X"

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