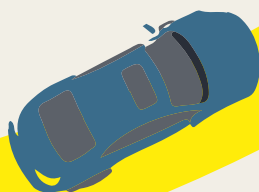


Accelerating Innovation

Investing in the UK
Automotive Sector

2020



Beauhurst

PROSPEDIACAPITAL
INVESTING IN AUTOMOTIVE TECHNOLOGIES

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Foreword

Rob Palmer

FOUNDER AND CEO
OF PROSPEDIA CAPITAL

This report says **we can, and must, accelerate innovation in future mobility by investing in SMEs** serving the UK automotive sector, an industry that every year spends £4 billion in R&D. In 2019, automotive SMEs received £277 million. Pundits often consider SMEs the backbone of the economy and the means of recovery. But not if **they only receive 7 per cent of R&D funding.**

Since 2011, more than half of the seed and venture stage companies studied for this report have raised an aggregate £504 million. They need another £891 million to scale up to full commercial viability. Moreover, **it will take £2 billion of private investment to encourage growth in all early-stage companies.** But with £1.9 trillion of uninvested funds available globally, funding is not the problem.

Our report reveals that **automotive SMEs are receiving almost £5 for every £1 grant.** So, it's good news the government plans to more than double public investment. It augurs well for the automotive sector as **innovation grants help SMEs to secure private funding.** UKBAA efforts to strengthen the angel ecosystem is another vital part of the strategy for economic recovery.

“
The need to plug the
£1 billion funding gap
was the inspiration for
Prospedia Capital.”

Understanding the need to plug **this £1 billion funding gap was the inspiration for Prospedia Capital**, bringing together companies, angel investors, fund managers and industry experts. We have been encouraged by the support we've received from government, industry and academia.

Being prepared makes the difference between success and failure, including governments preparing for the next financial crisis or global pandemic. The same applies to startups. Some do and succeed; many do not and fail. Ditto investors. Due diligence does not guarantee that ten times return, but it does help to mitigate the risk. Beauhurst research informs us that **71 per cent of the most successful companies, including every UK unicorn, attends an accelerator.** It is why we have invested heavily in our Investment Readiness Programme.

All too often, companies fail to receive the grant they have been awarded not realising that private investment cannot be accessed overnight. Frankly, it is naïve not to understand that it takes at least six months to prepare for investment. Bottom line: **private funding not only precedes the work necessary to validate innovative ideas but also government grants!**

We intend this financial report to be the first of many focused on the automotive sector. Next time it would be interesting to deepen our understanding of why so many startups do not receive either the grants or the private investment they deserve. We also know that **around half of all automotive SMEs seem content with organic growth.** The question is, why? Mostly, we welcome your ideas of what to include - other than whether we've recovered from the coronavirus.

I'm indebted to many industry colleagues. I must also thank Henry Whorwood and Ava Scott for their unstinting support as well as Steve Sapsford and everyone at Prospedia. Hopefully, you, the reader, will find something of interest, in this report designed to **inform crucial stakeholders, government policymakers and Automotive Council.**



Executive Summary

Henry Whorwood

HEAD OF RESEARCH AND CONSULTANCY
AT BEAUHURST

This report has been years in the making and the need for it has grown more urgent day by day. The automotive sector is a heavily monitored sector but the industry and its **coverage has typically been dominated by large, traditional car manufacturers** and the stories of where they site their factories. This focus by the media belies the innovation that is taking place in the sector and obscures the **smaller businesses that are growing and transforming the industry.**

The future of mobility is broad and relies on innovation across multiple other sectors. **This report divides the sector into four sub-sectors**, looking at Connected and Autonomous technologies; Propulsion, Energy Recovery and Storage Systems; Fuels and Energy Carrier technologies; and Composite Materials and Lightweighting Technologies. Each of these sub-sectors **overlap with some of the UK's most active sectors for high-growth and innovation activity**, such as Artificial Intelligence, Big Data, and Clean Energy.

It is not surprising then that the sector is already receiving a reasonable amount of investment. But **the numbers have a taken a hit in 2020**, with investment falling by 38% compared to the same period last year. We project that COVID-19 and the Government's response to it **could create a funding deficit for the sector of up to £142m.** And that's before we include the future funding requirements of these businesses. Over £1bn is needed to ensure the sector achieves its full potential.

If this can be achieved the benefits for the economy and society will be huge. It is particularly pleasing to see that **this innovative sector breaks the mould of London dominance.** While innovative automotive companies can be found across the country, there is a particular network of activity between Birmingham, Bristol, Cambridge, and Oxford. With the right investment and support, the companies in **this sector could help realise the Government's ambitions to level up the regions**, whilst also improving the lives of everyone.

“
If the full potential of the
automotive sector can
be reached, the benefits
for the economy and
society will be huge.”



Academia

David Greenwood

PROFESSOR,
ADVANCED PROPULSION SYSTEMS, WMG,
THE UNIVERSITY OF WARWICK

The UK has a global reputation for science and innovation, yet historically it has industrialised few of its outstanding inventions. While UK government support for the innovation pipeline is well-structured and reasonably well-funded, **private investment has typically focused on short term returns and avoided sectors like automotive, especially for early-stage companies.** This means our innovators have either had to look overseas for support or to give up altogether.

Times are changing though; as transport moves towards connected, shared, electric and ultimately autonomous vehicles, **the pace of innovation has already shifted gear with increased opportunity for new market entrants. At the time of writing,** a company only founded in 2003 now has the second-largest valuation of any global carmaker, and the primary components, systems and suppliers for its vehicles as little as a decade ago were not volume players in the automotive supply chain.

Academia has a strong role to play – not just educating the engineers, businesspeople, lawyers, and financiers whom our industries need, but also delivering deep understanding and new technology to enable industry to push beyond the state-of-the-art. However, it has not always been easy. **In most universities, scientific discovery was traditionally prized above industrial impact,** and while many may claim otherwise, the metrics against which their academics were judged favoured the publishing of papers in the highest-ranked journals and winning “gold standard” grants from EPSRC

rather than the delivery of their technology in a mass-market product. **Universities became greedy for IP** – insisting on full ownership, then often failing to protect or exploit it effectively.

Again, times are changing – perhaps more slowly in this case. Nonetheless, a new generation of academics, particularly in more modern universities, have embraced the research opportunities which come from working closely with industrial organisations, both large and small. These universities offer substantial intellectual and physical assets **to help companies take their technology out of the laboratory and into the marketplace.** They provide financial and IP terms which are much more attractive to companies and investors using a variety of commercial models to get technology into the marketplace. Government R&D support mechanisms such as Innovate UK, Advanced Propulsion Centre, Faraday Battery Challenge, and Driving the Electric Revolution **enable early-stage companies to engage with this academic support at no direct cost** – albeit still leaving start-ups with the task of finding matched funding for their own activities from investors with an understanding of the need for patient capital.

These changes – a market more accepting of innovation, joined-up government support for innovation, and an academic sector ready to play its full part – mean that **the investment landscape for the automotive industry is totally unlike that of a decade ago.** Companies, technologies and products are emerging faster than ever before. The technologies which the industry will need are no longer the same ones they have been finessing for a century; they are developing rapidly, with plenty of room for competitive innovation and fewer large-scale incumbent suppliers to displace. Innovation is no longer the sole preserve of the corporate R&D lab – **small companies have the chance to make a difference.** Whether they can achieve scale alone, through partnerships, through licensing or through M&A will depend on the nature of the innovation, but they now have far greater potential to get their technology to market and provide returns for investors than ever before.

“

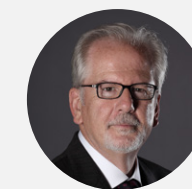
The balance between Government and private sector funding and/or investment in innovative ideas must be right.”

This report is very timely and underlines the strength of the UK’s automotive sector and the broad array of technology companies that operate as part of the supply chain or alongside the major automotive OEMs.

Innovate UK, part of UKRI, has been at the forefront of the UK’s automotive innovation ecosystem for over a decade, working closely with industry and government partners to deliver **a world-leading system of support.** Amongst the variety of programmes, we operate for the Department for Business Energy and Industrial Strategy (BEIS) including the Advanced Propulsion Centre, the Department for Transport (DfT) and Centre for Connected Autonomous Vehicles (CCAV) **we can see many of the grant holders in these programmes reflected in this report.**

However, to deliver the UK’s aspirations around connected, autonomous and electrified vehicles, **the balance between government and private sector funding in innovative ideas must be right** with the right financing accessible at the right time. Innovate UK will continue to use a variety of funding mechanisms including grants, loans, investor partnerships and R&D procurement contracts to support SMEs turn into high growth companies. **Larger organisations and the UK’s research and academic institutions will also benefit through access to these SMEs as well as funding.**

We cannot do it alone though; **private finance, including Angels and VCs, must be leveraged effectively** as technologies and the companies behind them move up the Technology Readiness Levels (TRL) towards production. UK headquartered companies such as Arrival,



Government

Simon Edmonds

DEPUTY EXECUTIVE CHAIR & CHIEF
BUSINESS OFFICER, INNOVATE UK (IUK)

Oxbotica, FIVE, and YASA have been successful in striking this balance. **Securing multiple government-backed grants to innovate has, in part, enabled them to secure further private sector investment.** They are growing as a result, and while a testament to their hard work and dedication, it demonstrates what the UK must see more of in the future.

Finally, COVID has had a profound impact on our industry. **And while we must recognise that 2020 will be a challenging year for the automotive sector it is encouraging to see an apparent resilience by some companies to the pandemic.** To build on this resilience, we must ensure effective communication of funding and finance opportunities provided by the government, including Innovate UK, while also connecting Angels and VCs with leading-edge companies, encouraging their investment.

We look forward to working with initiatives such as that offered by Prospedia Capital and increasing the number of automotive companies that make it to the Beahurst database of high-growth companies.

“

We must ensure effective communication of funding and finance opportunities provided by both Government and VCs.”



Industry

Neville Jackson

CHAIR, THE ROYAL ACADEMY OF
ENGINEERING 'INCREASING R&D
INVESTMENT' PROJECT,
FORMERLY CHIEF OF TECHNOLOGY AND
INNOVATION AT RICARDO PLC

In the March 2020 Budget, the UK government presented ambitious plans to more than **double public investment in R&D by 2025**. At 1.7%, the UK ranks 11th in the EU in the proportion of GDP spent on R&D while South Korea invests 4.2%, Germany 2.9% and the United States 2.7%. The **COVID-19 crisis has brought into sharper focus the vital role R&D has to play in the UK's future**, both in responding to upcoming challenges of the pandemic but also in driving the economic recovery, building back better and pursuing ambitions of becoming a global science and innovation superpower.

We can also draw lessons from the 2008 financial crisis: when innovation had previously accounted for 51% of productivity growth and 63% of economic growth in the UK. After the recession, France, Germany, South Korea, and Japan all increased their investment in innovation and technology, giving them **a chance to build a competitive advantage**. Despite the UK being in 2010 the only country with a lower R&D budget than in 2007, the UK Innovation Survey 2011 found, nonetheless, that **it was innovative businesses that had performed better during the crisis** [1].

Evidently, **we must do more to encourage R&D investment** for the UK to become internationally competitive and to drive a resilient economy. While it ranks very well globally at generating new ideas and delivering

leading-edge research from academia, we need to get much better at innovation, **turning that research and those ideas into commercially successful products, services, and ultimately new businesses at scale**.

So-called **'late-stage' R&D is a fundamental requirement for business growth**, and some sectors have taken outstanding initiatives to support this critical area such as the UK Advanced Propulsion Centre. Apart from the usual calls across academia and industry to increase budgets for public funding support and UKRI in general, as a priority, **we need to increase the appetite for investment risk**, particularly for R&D that commercialises new ideas **to address economic, environmental and societal challenges**.

We must develop **additional funding schemes and instruments that can de-risk commercial investments**. By covering losses, for example, where products and services do not succeed as expected, but can be repaid if the product or service meets its agreed commercial goals. We need schemes that can support new ventures that are business-as-usual for our international competitors in the US and South Korea. We should also encourage and support academia and further education organisations to develop specific 'innovators' and associated innovation skills. These initiatives mean **identifying and supporting researchers and graduates who can be the next generation of entrepreneurs** engaging successfully with the seed investment and venture capital community.

Finally, we could do a lot better to **encourage innovation via public sector procurement**. The need to exclusively deliver value for money in public procurement means that only tried and tested technologies are viable options which preclude new approaches and higher risk-and-reward alternatives. It would also further encourage private investment in new products and services by reducing the risk of market failure.

1) *Stimulating R&D for a Faster and Better Recovery, Royal Academy of Engineering, June 2020*

As we emerge from the full force of the global pandemic crisis, **we are all now turning to the prospects for economic recovery**. The Chancellor's summer statement announcing his ambitious £30bn package may go some way to face the most urgent challenges. **It demands an intense focus to address the needs of key sectors – such as the automotive and transport industry**.

The recent launch of proposals for the Recapitalisation of Businesses, resulting from the work led by CityUK, in which I have participated, was drawn up in response to the impact of necessary support measures implemented by the UK government, but which **we estimate will result in over £100 billion in unsustainable debt**. A significant proportion of this is likely to be carried by small businesses when they need to start repaying the government-supported CBILS and BBILS loans with **a substantial number unable to repay the loan or the interest incurred**.

The report highlights that **businesses will carry 75% of this debt in the regions outside London**, where companies in critical sectors are most affected by the pandemic, but where there also is much less access to equity.

There is also a need to rebuild growth capital across the UK as a vital aspect of the UK's economic recovery and to **ensure that the many small innovating high-growth businesses can access the risk capital they need to scale successfully**. As this very welcomed and timely Prospedia Beauhurst study further reveals, the level of growth capital has been severely reduced these past months, with a **40% reduction in capital available**.

“

A strengthened angel and early-stage investment ecosystem is a vital part of the strategy for economic recovery.”



Investment

Jenny Tooth OBE

CHIEF EXECUTIVE,
UK BUSINESS ANGELS ASSOCIATION

We similarly identified this growth capital gap in The Future of Growth Capital report to which I also contributed. It now stands at £15 billion as we emerge out of COVID and calls for a 'National Blueprint for Growth' based on a joined-up approach to economic recovery to **support and champion more consistent and productive economic growth across all regions and sectors**.

The UKBAA recognises that a **strengthened angel and early-stage investment ecosystem is a vital part of the strategy for economic recovery**. There is also **a need to address the pre-existing lack of access to angel investment across the regions and challenges of access for critical sectors as well as for women and ethnic minority entrepreneurs**. As angel investment emerges from the difficulties of COVID, many investors now feel that **impact and sustainability have the potential to be a core underlying objective for their future investments**, whatever the sector or theme.

How can our investments help to preserve and sustain the planet's resources and how we can address the many human and social needs that COVID has revealed? We know that so **many small businesses are bringing innovative solutions to impact on these environmental and societal challenges** and many more companies have seen the opportunity to innovate and disrupt the market, taking advantage of core technological developments at this time.

Methodology

This report looks at **high-growth** companies in the UK who are developing and commercialising technology with applications in the automotive sector. To be included, a company must have **met one of Beauhurst's eight growth triggers**. All data is up to date as of 30/06/2020.

HIGH-GROWTH TRIGGERS



Equity investment



Academic spinouts



Scale ups



High growth lists



Accelerator attendance



Major grant recipients



MBO/MBI



Venture debt

MEASURING COVID-19 IMPACT

We have manually assessed and then reviewed each company tracked in the Beauhurst database. Where possible, we've drawn on information published on company websites and social media channels. Just under a third of tags were assigned based on explicit evidence. Where a company has not announced any changes to its activity, we've conducted some careful analysis of the business model, target markets and sector of operation to determine the likely impact of the lockdown rules and current economic situation.

STAGES OF EVOLUTION

Seed

- Youngish company with a small team
- Source of funding: likely to be grants or angel investors

Established

- Active for 3-15 years with a 3 year consecutive profit of £5m+
- Turnover of £20m+
- Household names

Venture

- Active for a few years
- Funding received and valuation in £ms
- Source of funding likely to be VC firms

Exited

- Undergone an IPO or corporate acquisition (MBOs are not considered to be exits)

Growth

- Multiple offices
- Substantial revenues, some profit
- Valuation in £ms

Zombie

- In administration, liquidation, dissolution etc
- Website and/or social media with prolonged neglect

Dead

- Ceased all activity
- Parent company has been dissolved

Overview

THE 'HIGH-GROWTH' UK AUTOMOTIVE SECTOR

A source of national pride since the early 20th century, the UK automotive industry has seeded some of the world's most iconic car brands: Vauxhall (1903), Rolls-Royce (1904), Morgan (1910), Aston Martin (1913), Bentley (1919), Lotus (1952), and McLaren (1969). Today, the UK houses more than 60 specialist car makers, as well as 13 premium, sports and mainstream car manufacturers. But there is much more besides: four commercial vehicle, eight bus & coach, and 11 engine manufacturers, as well as 25 design and research & development (R&D) centres.

The Society of Motor Manufacturers & Traders (SMMT) estimates that the industry adds £19 billion of value to the UK economy each year, accounting for 14 per cent of total UK exports worth £44 billion while investing almost £4 billion in advanced R&D. This report looks at the youngest and fastest-growing companies truly representative of the 21st century in a long tradition of advanced automotive engineering and cutting-edge innovation for which the UK is also renowned.

They are developing diverse and utterly new technologies for the sector and its highly-evolved global supply chain, including breakthrough vehicle designs and construction methods, alternative non-fossil fuels, lightweight

composite materials, artificial intelligence, and much more besides. These companies will be central to building an automated, connected, electrified, and shared (ACES) future of mobility.

To be included, a company must have hit at least one of Beauhurst's high-growth triggers (page 10), that indicate either its growth or ambition to grow. To build a comprehensive portrait of the various business models that have had success in this sector, we include companies at all stages of development. We look at businesses at the earliest conceptual stages, those flourishing very rapidly, and those who have exited through acquisition or initial public offering (IPO) on a stock exchange.

WHAT WE STUDY IN THIS REPORT

After mapping out the population of high-growth companies, we benchmark the investment activity, as mentioned above, of seed, venture and growth-stage businesses, looking at the frequency and volume of investment, trends in valuation, and average deal sizes. We then project the demand for funding from our current cohort of companies and calculate the investment deficit caused by the COVID-19 pandemic (page 15). Finally, we explore the ratio of public and private investment into the automotive industry and demonstrate the importance of private equity investment flowing into this crucial sector of the economy.

THE INNOVATION ECOSYSTEM

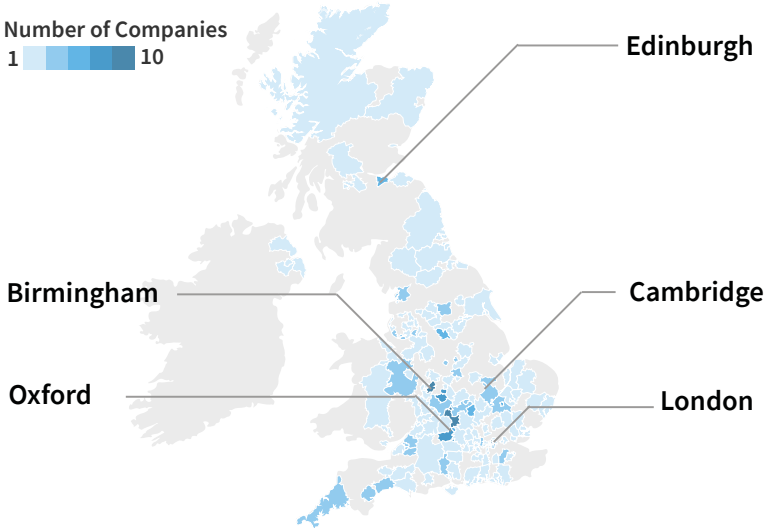
The automotive companies in this report have engaged with all aspects of the 'innovation' or 'high-growth' ecosystem. These phrases refer to the UK-wide activity that sparks and encourages innovation across sectors. A lot of this innovation is technology-based, but not all of it. The ecosystem includes all high-growth companies and the various supportive organisations found among them, including many different types of investors, grant bodies, accelerators, incubators, investment readiness programmes, universities, and other initiatives supporting enterprise growth.

Automotive company population



GEOGRAPHY

While innovative automotive companies can be found throughout the UK, there is a diagonal network of activity between London - and its thriving investment scene - and the West Midlands, with another broad corridor running from Bristol through Oxford to Cambridge. This ‘super saltire’ intersects at the Silverstone technology cluster near Milton Keynes. The diagonals encompass leading universities of Oxbridge as well as engineering centres such as WMG in Warwick and the Manufacturing Technology Centre (MTC) in Coventry.



Oxis Energy	£46.6M
Zenobe	£25.0M
YASA Motors	£18.0M
Paragraf	£16.2M
Wayve	£15.5M
POD Point	£13.0M
Oxbotica	£12.5M
Tonik	£10.0M
Audio Analytic	£9.4M
Moixa	£8.5M

TOP EQUITY RECIPIENTS IN 2019

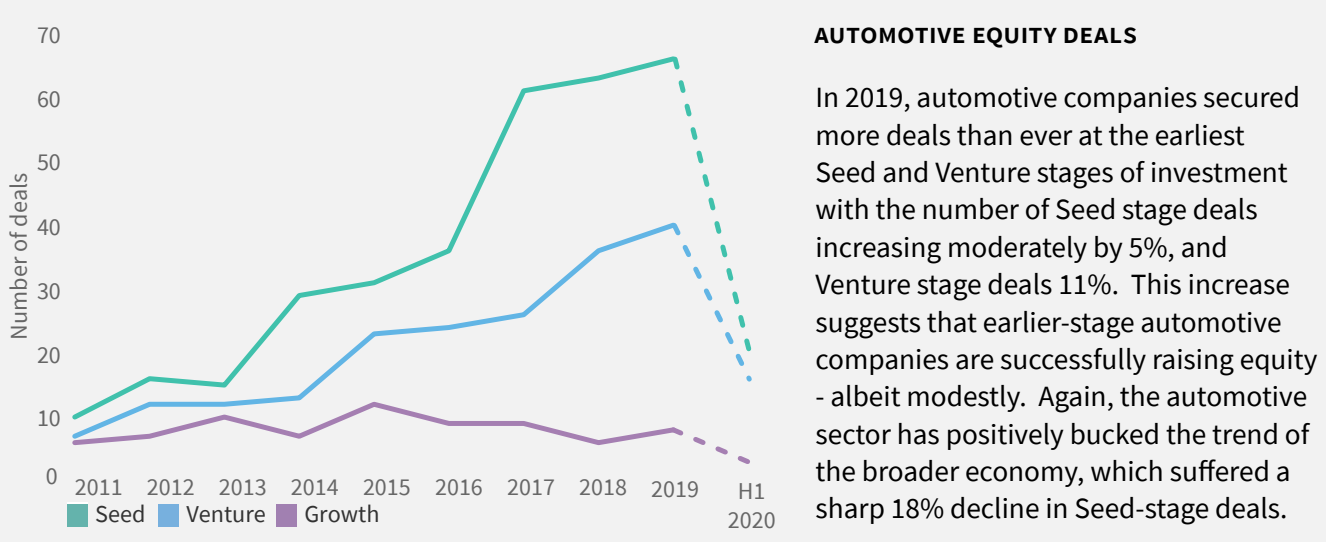
Companies developing electric motors and batteries secured the top three biggest deals. Oxis Energy tops the rank, with its £46m deal backed by the Brazilian company, CODEMGE, to develop a digital manufacturing plant mass-producing lithium sulphur cells. The battery storage and charging specialist, Zenobe, raised £25m from Japanese companies, JERA and TEPCO, while YASA Motors secured £18m from domestic and international investors.

Equity investment at the Seed, Venture and Growth stages



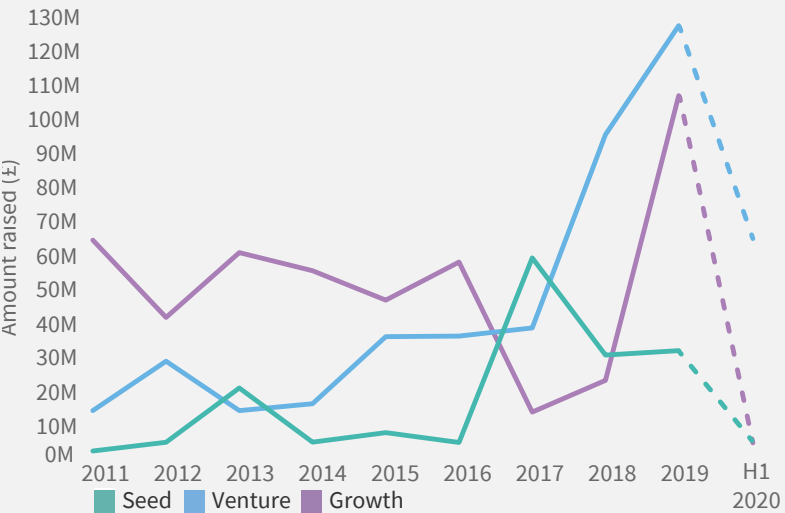
While the overall number of deals across all industries decreased between 2018 and 2019, albeit with a modest 8% increase in investment, automotive companies secured not only more transactions but also a 68% increase in investment. This significant increase includes a record number of eight mega deals (£10m+), accounting for more

than half (58%) of all investment in the automotive sector, and 7% of all deals. This a larger proportion than seen across all UK deals (4%). Consequently, we can argue that the automotive industry should focus on channelling investment into younger companies through smaller deals, to replenish the pipeline of startups and early-stage companies.



AUTOMOTIVE EQUITY INVESTMENT

The overall growth in investment, nonetheless, is mostly driven by large deals at the Venture and Growth stages with the top three equity recipients in 2019 securing almost one-third (32%) of the total amount invested. Venture-stage companies were the most successful, securing four of the eight mega deals and nearly half (46%) of all equity investment into the automotive sector.



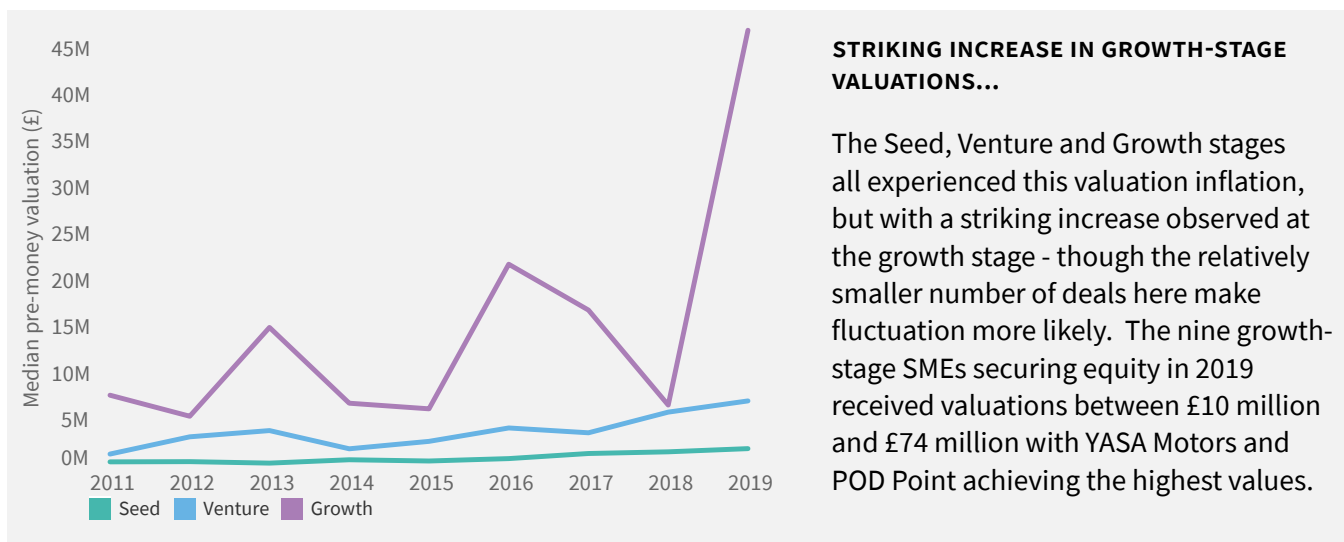
NOTE: Deals by Established companies are not shown in either figures.

Average valuations and deal sizes for Seed, Venture and Growth-stage deals



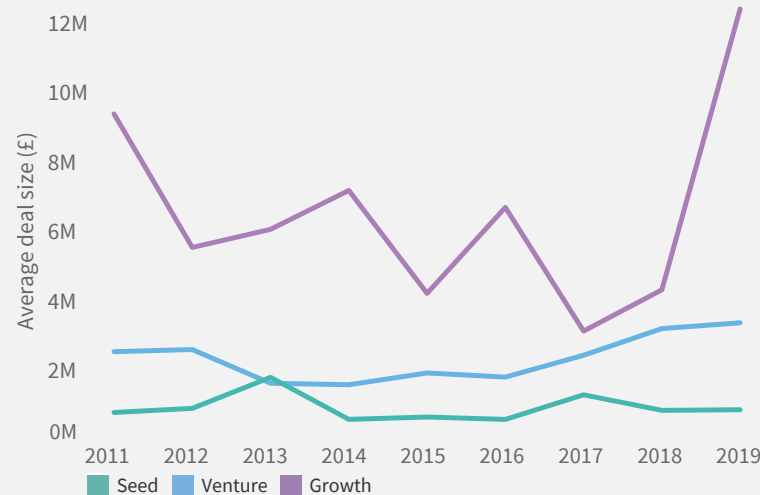
Small and Medium Size Enterprises (SMEs) in the automotive sector have not only secured progressively larger pre-money valuations over the last six years - the median company valuation of £3.6 million in 2019 is almost twice that achieved in 2014 - but they have also outpaced all other sectors. These higher valuations are most likely due to the

advanced technologies they increasingly employ. That said, and perhaps counterintuitively, the stake taken in automotive SMEs has declined since 2014, from 17% to 14%, albeit now more closely aligned with the national average of 15%, which may well be evidence of market convergence.



... IMPACTS DEAL SIZE

Despite the rollercoaster ride of growth-stage deals over the past decade, they ended on a high note with a median deal of more than £12 million, indicating a maturing of the high-growth automotive market. Like the wider UK economy, the automotive sector may have reached a stage where a small number of large deals can inflate the median valuation of the entire cohort. The Seed and Venture stages show less volatility in deal size and a steady increase in value.



NOTE: Deals by Established companies are not shown in either figures.

Projecting demand for early-stage investment

EQUITY INVESTMENT NEEDED TO LEVEL UP EARLY-STAGE COMPANIES

£891M
early-stage funding needed
at current rate of investment

£1.91BN
early-stage funding needed
at full market penetration

Automotive SMEs that have used private equity to fuel their development have required an average investment of £10 million to reach Growth stage. Of the 249 Seed and Venture stage companies studied for this report, more than half (58%) have raised equity, amounting to a total of half a billion pounds sterling (£504m). These investees now need a near billion (£891m) of further investment to scale up to the Growth stage.

To encourage high growth in all early-stage automotive companies, the sector will need around £2 billion in private investment. Moreover, the rate at which new companies enter the market, steadily increasing in recent years, is not even considered in these projections.

EARLY-STAGE INVESTMENT DEFICIT CAUSED BY THE COVID-19 CRISIS

-£73M
H1 2020 investment
versus H1 2019 investment

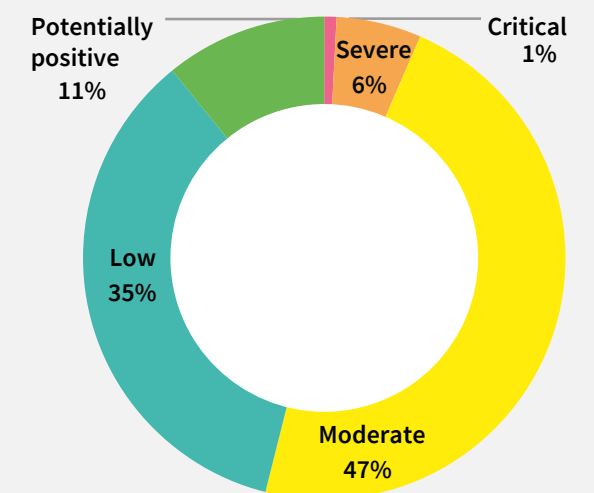
-£142M
projected 2020 investment
versus 2019 investment

COVID-19 has heavily suppressed equity investment across all sectors of the economy. The automotive industry is no different, with a reduction of 38% invested in the first half of 2020, compared with the same period in 2019.

But dig deeper, and we see that the decline has accelerated, with an 80% drop in investment in the second quarter. If this dramatic downturn continues, then we can expect early-stage automotive companies to secure a mere £135 million of investment in 2020.

COVID-19 IMPACT

Compared to other sectors, and despite the downturn in investment, automotive SMEs have nonetheless managed to avoid the worst of the economic impact of the pandemic. And whereas only 7% in this sector have faced severe or critical financial consequences compared to 12% across all industries, only 11% expect to harness any positive impact compared to 17% throughout the UK economy. The lockdown, however, has profoundly impacted manufacturing output with many engineering SMEs in the cohort relying on physical workplaces for production.



Private and public investment

67%

have raised equity

£924M

total equity raised

63%

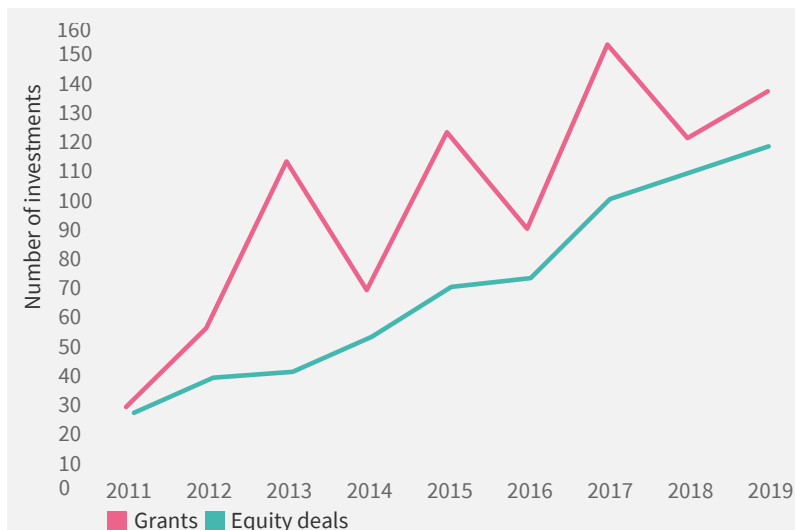
have received a grant

£268M

total grants received

These figures consider all grants, not just ‘major grant recipients’ which is one of Beauhurst’s triggers for tracking a company. Our focus throughout this report on Seed, Venture and Growth stage SMEs informs us that while a similar proportion (around two-thirds) have benefited from grants and equity funding most investment (78%) comes from private investors. For every £1 of grant money invested by

the UK government in an automotive SME since 2011, the private sector has invested £3.50. To receive a grant, early-stage companies must often find matched funding from the private sector. These numbers illustrate that the need for equity investment goes far beyond just meeting these requirements. Private investment is a critical fuel for innovation in the automotive sector.

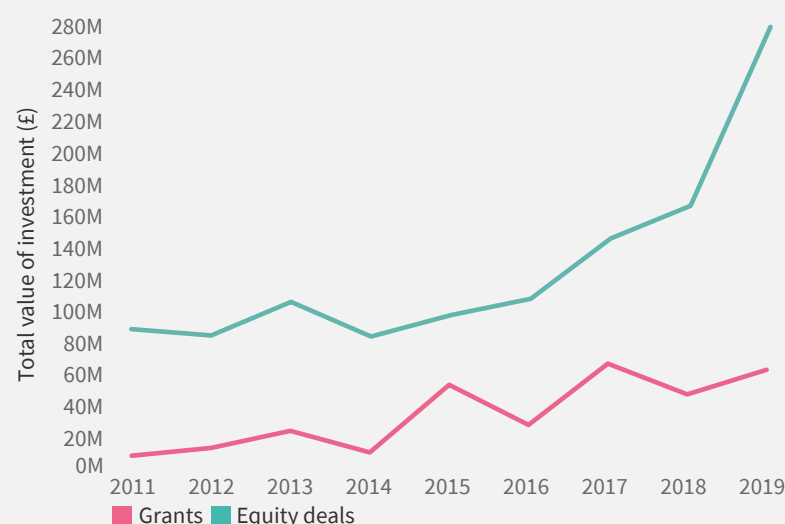


NUMBER OF INVESTMENTS

The number of individual investments in automotive SMEs has been progressively increasing from both private and public sources - more than quadrupling since 2011. There is patently more volatility in the number of grants compared to equity deals. Nonetheless, the underlying trend of grants awarded to automotive companies runs slightly higher than the number of equity deals – indicating that some grants are awarded without the need for matched funding.

TOTAL VALUE OF INVESTMENTS

The total equity investment into automotive SMEs has been not only higher than the value of grants received but has also risen sharply in recent years. In 2019, every £1 of grant money that the UK government is currently investing, the private sector is spending £4.50 in equity. While the underlying trend in grants awarded is steadily upwards, we see the same intriguing sawtooth pattern. Public investment in the future of road transport is far outstripped by that of private equity.



NOTE: Deals by Established companies are not included in either figures.

Spotlight technologies

CATEGORIES OF INNOVATION

This section explores some of the critical areas of innovation in the high-growth automotive and road transport sector: connected and autonomous vehicles (CAV); advanced propulsion, energy recovery and storage systems; fuels and energy carriers; as well as lightweighting and composite materials. The innovators in these sectors are tackling some of the biggest challenges in 21st-century mobility, including sustainability, pollution, automation, and connectivity. They are not alone. Major vehicle OEMs, their Tier 1 partners and some of the largest automotive engineering firms are also in the race to find market-ready solutions to these problems. However, with the right investors and ecosystem support behind them, pre-revenue start-ups and early-stage companies are more able to compete and contribute than ever before.

WHAT WE LOOK AT

To familiarise non-specialists, we summarise each area of innovation and the companies that are developing products and services within them. Highlighting the investment statistics from 2019 and some of the highest valued SMEs that operate in each space, we illustrate the degree of investment attention that each area of innovation gets and the difference between them.

We then address some of the essential context and critical challenges impacting the SMEs in each technology category. The tasks can include emissions targets set by the government, competition from large technology companies, or the difficulty in building a solid profit base with such high R&D costs. Finally, we outline the impact that the COVID-19 pandemic and its economic fallout have had on each category so far - though no part of the automotive industry is out of the woods just yet.

METHODOLOGY

Beauhurst and Prospedia Capital built and revised the cohorts of companies in these categories drawing upon academia, sectoral expertise and by consulting industry specialists. If relevant, we have included SMEs in more than one class of technology. Crucially, the company must be developing technology for the automotive sector and often will have mentioned applications on its website.

Connected and Autonomous

98

active companies

£65.3M

invested in 2019

32

deals in 2019

Some cars already offer features such as adaptive cruise control and lane-departure warnings. However, popular culture has long envisioned a future in which vehicles can ultimately drive themselves while communicating with each other and the surrounding infrastructure. Not only do we imagine a more relaxed transport experience, but a safer one given that human error is currently responsible for over 90% of all road accidents.

Companies developing self-driving technologies embrace computer vision and machine learning algorithms, virtual simulation testing facilities, localisation and mapping software, pedestrian & cyclist behaviour analytics, as well as the build of complete vehicles.

Similarly, SMEs seeking to elevate vehicle connectivity enfold technologies such as traffic monitoring and management systems, mobile networking and satellite hardware, digital fleet management software, V2V and V2G communication systems, vehicle sharing businesses, and smart city infrastructure and design. Cyber-security and digital resilience are also important.

INVESTMENT

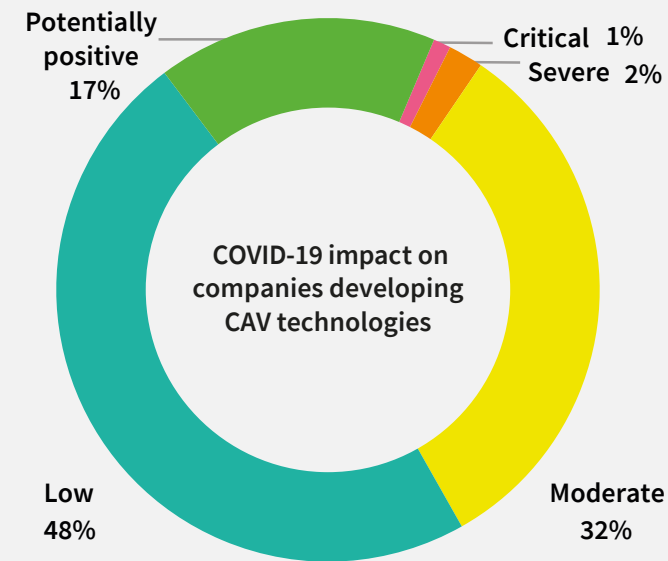
CAV technologies make up a quarter (26%) of the companies and almost a quarter (23%) of all equity invested in automotive SMEs, securing in 2019 a record £65 million while attracting two-thirds (69%) more investment than in 2018.

Wayve, a software developer employing machine learning to develop self-driving systems, attracted almost £16 million investment - the largest deal ever secured by an emerging SME. The second-largest value deal of nearly £13 million went to Oxbotica, which integrates cameras and lasers to sense and navigate the surrounding environment.

The top deal by a company developing connected technology was AppyWay. It secured £7.6 million to help build its online tools to map parking spaces in real-time.

CONTEXT

Government grants have been instrumental in leveraging private equity in this space. Much of this is down



Of all the high-tech disciplines discussed in this report, CAV technologies are the most likely to experience a positive impact during the COVID-19 pandemic. As well as having significant digital operations that can adapt well to home working, some key opportunities present themselves to CAV companies whilst the need for social distancing continues. Driverless vehicles, for example, can help meet the demand for contact-free delivery of medicines, diagnostic equipment, food, and other critical supplies. Be that as it may, vehicles will still need disinfecting between deliveries, perhaps reducing the benefit of autonomy. Exploiting these opportunities relies on quick responses, including rapid testing and deployment schemes. Already, UK companies may have the edge over those in countries ratifying the 'treaty on treaties' Vienna Convention, which can obstruct autonomous vehicle testing and development.

to Zenzic, an organisation that brings together government, industry, and academia, to deliver the UK's ambitious mission for the CAV space.

The amount of investment by large companies is beyond the scope of this report, which focuses on SMEs. Nonetheless, since its inception in 2017, Zenzic has committed to an initial £200 million of private-public funding. Acting as a crucial catalyst, it has brought together a wide variety of SMEs and large organisations to drive innovation.

Daniel Ruiz, CEO of Zenzic, describes how the establishment of the Centre for Connected and Autonomous Vehicles (CCAV), the Intelligent Mobility Fund, and CAM Testbed UK are vital expressions of the UK's leadership. He also highlighted recent research by Zenzic, which showed that "the interoperable cluster of testing facilities in the UK ... is the most mature and most comprehensive set of capabilities offered globally, all within a 3-hour drive, and linked by common processes and protocols."

The UK government has also set a crucial standard for other countries by developing CAV guidance and legislation as demonstrated in the Code of Practice, 2018 Automated and Electric Vehicles Act, and the on-going Law Commission Review.

This proactivity led by the UK government and matched by industry have made the UK one of the

HIGHEST VALUED COMPANIES



Oxbotica develops software for driverless vehicles, using cameras and lasers to sense the surrounding environment. They were valued at £55M in 2019.

AppyWay builds online tools to map parking spaces in real-time, inform users about restrictions and facilitate payment. They were valued at £42M in 2019.



Audio Analytic develops embedded software that uses AI to accurately recognise the sources of auditory data. They were valued at £25.6M in 2019.

best places in the world for CAV innovation. With the CCAV's proposed 5-year programme under consideration for inclusion in the Autumn Spending Review, and the UK Automotive Council itself adopting CAM as one of its two central missions, Ruiz says the future looks bright for CAV in the UK.

Propulsion, Energy Recovery and Storage Systems

129
active companies

£127.2M
invested in 2019

44
deals in 2019

The industry must move quickly to find sustainable ways to make vehicles if the UK is to achieve its target of emitting virtually zero carbon by 2050. Meanwhile, a ban on new petrol, diesel and hybrid cars will be brought forward from 2040 to 2035 under the latest government proposals.

Reducing fuel consumption is critical in minimising the output of greenhouse gases (GHG) and tailpipe emissions, requiring more efficient ways to convert energy into motion. It means developing advanced propulsion systems including internal combustion engines; electric vehicles; hydrogen fuel-cells; hybrid technologies; energy storage systems; electrical motors, generators, inverters, controllers and batteries; as well as energy recovery systems.

This chapter considers SMEs building complete vehicles, including those in the L-category comprising two and three-wheelers, quadricycles, and microcars, as well as e-bikes. Where there is significant

overlap in practical applications of new propulsion systems, we have included companies in the aerospace and motorsport sectors.

INVESTMENT

SMEs developing advanced propulsion systems make up a third (34%) of this report, and in 2019 secured almost half (46%) of an unprecedented £127 million invested into these technologies. It reflects more than a third (36%) increase in private equity investment compared with 2018.

It includes, since 2011, the three largest recipients of investment into SMEs developing electric and battery technologies. Oxis Energy secured £47 million in the largest deal ever negotiated by a battery company; Zenobe £25 million for its storage technology; and YASA £18 million for its compact, lightweight, and powerful electric motors favoured by Ferrari.

Even these investments were dwarfed by Intelligent Energy, which raised £109 million to support its development of fuel cells and went on to make a £55 million IPO in 2014. Nexeon, which develops lightweight silicon anodes for lithium-ion batteries, is also a notable equity recipient, having secured £76 million including a £40 million deal backed by both Invesco and Touchstone Innovations in 2011.

CONTEXT

Fund managers are making some of their more substantial investments into companies developing electric vehicles and related technologies. It's understandable. By proposing an end to new passenger cars with an internal combustion engine by 2035 or even earlier, the UK government has issued a strong vote of confidence in electric propulsion systems.

However, the reality of meeting carbon emissions targets will require a more nuanced approach to policymaking. Battery production is highly carbon-intensive when considering the extraction of materials, manufacturing, and disposal processes. Fuel cell technology requires both batteries and hydrogen, the latter of which is currently sourced primarily from natural gas, a fossil fuel. When analysing the full life cycle of these technologies, the realised carbon footprint grows, and the benefit they have on reducing

HIGHEST VALUED ACTIVE COMPANIES



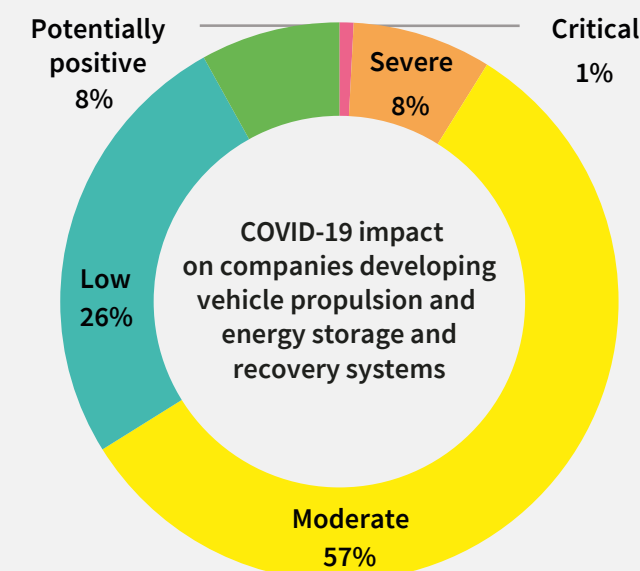
Reaction Engines has developed a lightweight heat exchanger, which cools hot air in engines. The company's latest fundraising in 2018 valued them at £152M.

Intelligent Energy develops fuel cell systems which can act as range extenders for EVs. They were valued at £341M in 2014 before their IPO later that year.



YASA Motors develops and manufactures electric motors for automobiles. The company has received £61M in equity, and were valued at £72.5M in 2019.

carbon emissions can start to shrink. What is needed is a diverse suite of technologies to minimise environmental impact across a range of different applications and duty cycles. EV technologies, for example, can play a vital role when utilised for inner-city transportation, primarily because of their improved effect on air quality. The challenge, of course, is to balance the need to improve local air quality with the need to reduce GHG emissions.



The COVID-19 crisis has profoundly impacted SMEs developing propulsion and related technologies, with 9% currently tagged as being critically or severely affected. The good news is that this is almost half the 17% we identified at the beginning of the pandemic. Nationwide lock-down and economic insecurity means that fewer new vehicles are purchased. The future of private car ownership hangs in the balance, with individuals weighing up their fear of potentially contaminated public transport, and their declining need for a vehicle when working from home as online working has become the new norm. Those who do buy are leaning towards petrol models, which are still significantly cheaper than their electric counterparts. This trend may threaten the effort towards reducing inner-city tailpipe emissions, despite the need for cleaner air during a respiratory virus pandemic.

Fuels and Energy Carriers

65
companies

£72.3M

invested in 2019

27

deals in 2019

The fuels available to carmakers and consumers have become more varied than ever. Internal combustion engines currently dominate, but increasingly biofuels, electricity and hydrogen will all play an essential role in reducing the use of fossil-based petrol and diesel fuels.

This chapter looks at companies sourcing, processing, supplying liquid & gaseous fuels for automotive use, as well as those installing critical infrastructures such as charging points and refuelling stations. While the power generation industries are beyond the scope of this report, the future of electric vehicles and their popularity will be reliant on the resilience and sustainability of the national grid in dealing with increased demand.

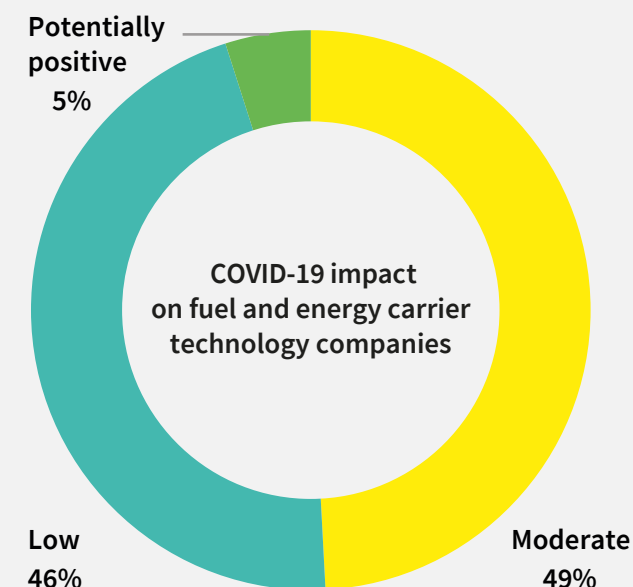
Companies analysed include not only those developing non-fossil fuels for petrol and diesel engines but also entirely different energy vector systems such as hydrogen for fuel cells. Included are generators of biogas and biofuel such as those converting waste products and biomass into fuels; those supplying pure fuel substances (e.g. hydrogen, ammonia); developers of chemical

additives and emulsifiers; and electric charging point installation companies.

INVESTMENT

Companies sourcing, processing and supplying fuels in this sub-sector accounted for one-sixth (17%) of high growth SME transactions, securing a record 27 equity deals in 2019 while accounting for a quarter (26%) of automotive technology investment. The money raised, however, of £72 million was less than the £84 million achieved through 21 deals in 2018 – albeit almost two-thirds (62%) of that was accounted for by a £52 million mega-deal secured by Green Biologics. The company uses advanced fermentation to produce renewable butanol from waste and agricultural by-products.

Bio-Bean, which converts waste coffee, received £4 million in the biggest deal in 2019 for a company developing biofuel. More recently, the supplier of wall-mounted and standalone charging points for electric cars known as POD Point secured £13 million and was quickly acquired by EDF Energy for an undisclosed amount. Preceding this deal



in 2019 was Tonik, which secured the third-largest investment of £10 million. It too develops electric vehicle chargers.

CONTEXT

Massive investment in EV charging infrastructure is crucial for the future of electric mobility that the government and much of the industry strives to achieve. These companies can help facilitate the uptake of such vehicles in cities and urban areas, where they are needed the most. Compared to suburban and rural homes, city apartments are less likely to have private parking spaces to charge vehicles, making public access even more necessary.

During COVID-19, the SMMT observed a promising spike in EV registrations. But it remains a drop in the ocean. Internal combustion engines still account for most (98%) of the vehicles registered for use on UK roads, which in April 2020 surpassed 40 million, including 5 million commercial vehicles. The SMMT data also reveals that the fleet now includes more than three-quarters of a million low, ultra-low and zero-emission cars. The number of these cars grew by a quarter (26%) last year, with 533K hybrids, 144K plug-in models and 93K battery-electric vehicles now in use, although this segment still makes up just 2.2% of the overall car parc.

So, we have a long way to go in a short time. It is why biofuels and synthetic fuels are essential in

While the national lockdown meant that there was far less demand for fuel, it didn't eradicate the need for key workers, delivery operators and public transport fleets to continue using their vehicles.

Infrastructural and civil engineering projects were among the first to reopen, so companies continue developing charging and refuelling centres. It may explain why fewer have experienced a severe impact compared to those producing vehicles and their components.

The pandemic nonetheless may put alternative fuels in an awkward position. Batteries and fuel cells were already a more expensive option compared to petrol and diesel, and the ongoing price wars between oil-producing countries and a burgeoning recession have only exacerbated the situation.

HIGHEST VALUED ACTIVE COMPANIES

pod POINT
Charging your Electric Car

POD Point supplies a range of charging points for electric cars. They were acquired by EDF in 2020 after achieving a valuation of £73.7M in 2019.

Gasrec builds and operates natural gas and biogas refuelling stations for HGVs, and offer consultancy services. They were valued at £47.3M in 2019.

gasrec

tonik

Tonik develops electric vehicle chargers as well as supplying renewable energy to homes across the UK. They were valued at £23M in 2019.

reducing the carbon emissions of this existing fleet. During the production of these renewable fuels, carbon is removed from the atmosphere, either through photosynthesis or synthetic chemical reactions, which counterbalances the emissions released when burnt. As well as being compatible with the ubiquitous fuel stations and combustion engines, biofuels and synthetic fuels are also critical for de-carbonising heavy-duty vehicles, aviation, and shipping.

Composite Materials and Lightweighting Technologies

48

active companies

£20.0M

invested in 2019

5

deals in 2019

Reducing vehicle mass is crucial for slashing energy consumption. Lighter vehicles require less energy to propel, making them more efficient per kilometre travelled. The automotive industry, therefore, must continue to pursue critical developments in lightweighting if it is to address the challenge of ever more massive and hence range-limited battery-electric SUVs.

Composites combine at least two constituent components, a reinforcing fibre, and a continuous matrix. Both have desirable qualities, and usefully a wide range of raw material, including carbon, fibreglass, Kevlar, and reinforced plastics such as epoxy resin can be used.

We also include companies providing sintering and stamping facilities, 3D printing and injection moulding, as well as a handful of those developing extremely resistant coatings.

INVESTMENT

While the 48 SMEs in this technology

category represent one in eight (13%) of all 381 actively trading companies analysed for this report, they secured only one-fourteenth (7%) of the equity invested in 2019. Of all four technology categories, this category achieved the fewest deals and received the least amount of investment. It means looking back to 2016 to find that £28 million was the most substantial annual investment ever achieved.

By comparison, in 2019, the largest deal secured was £16 million. The venture-stage company known as Paragraf, a producer of graphene-based products, alone accounts for most (81%) of all investment secured last year by companies in this vital category. FAC Technology, a composite material manufacturer, secured £2 million, which was the second-largest deal.

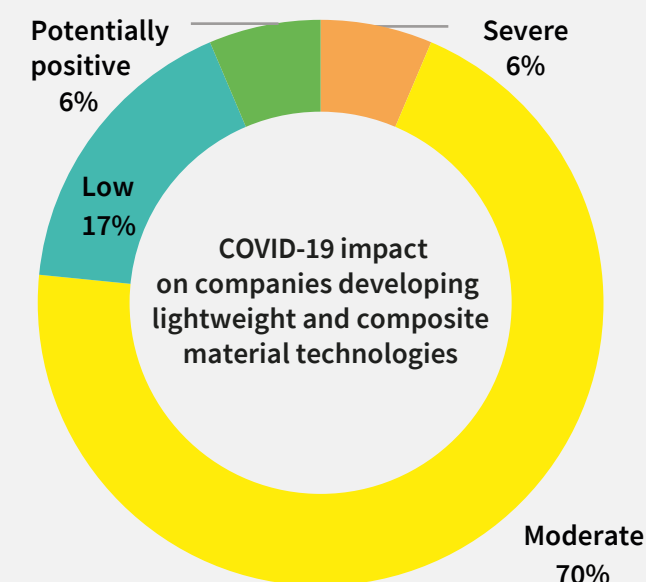
Reviewing the past decade, we can see the challenges. Metallises, a producer of metal alloy powders for advanced manufacturing applications, accumulated a total investment amounting to

an impressive £92 million, hence averaging fundraising of £10 million a year. Even so, the company faced financial difficulties and in 2019 was bought out of administration by the mining company, Power Resources Group. This journey illustrates the problem that materials companies can have in establishing a stable revenue base alongside their crucial, yet expensive, research facilities.

CONTEXT

While lightweighting materials are in demand across many sectors such as aerospace, shipping and the renewable wind energy sector, the automotive and motorsport industries unsurprisingly have made the most progress. It is the mass market, of course, that is the most price-sensitive. The 7-year model cycle in the automotive industry and the 2,360,298 average annual new car registrations since 2003 means the industry can test innovative designs relatively more quickly than in other sectors. Hence, it acts as an innovation centre for adjacent industries.

Moreover, when it comes to materials, one type will not fit all solutions; carmakers need a diverse range of options for different purposes, even within one vehicle. At the premium end of the market, BMW constructs its i3 electric and hybrid models using aluminium for the powertrain, chassis, battery, and crash structure, and carbon fibre composites for the passenger cell capped



HIGHEST VALUED ACTIVE COMPANIES



Surface Generation designs and manufactures fibre reinforced composite processing solutions. Their latest pre-money valuation was calculated at £18.3M.

Paragraf produces a variety of graphene-based products. The company was valued at £14.8M during their 2019 equity round worth £16.2M.



HiETA Technologies are specialists in lightweight additive manufacturing (metal 3-D printing). Their latest pre-money valuation was £11.7M.

by a composite roof made with recycled carbon fibre. The interior also incorporates recycled materials and other composites made with natural fibre reinforcements. Exterior body panels, hood and fenders are made with what BMW terms an “unreinforced” thermoplastic. The economy brands, meanwhile, integrate lower-cost glass fibres with poly and vinyl esters.

While no material companies have experienced the worst level of ‘critical’ impact from coronavirus, it has severely impacted 6 per cent of SMEs in this technology category. However, an equivalent percentage may be able to leverage the opportunity and achieve a positive outcome. With wide-ranging applications, materials companies may be able to allocate their production to other, less impacted sectors than automotive, or even lend their expertise to make respirators or PPE. The pandemic highlighted the vulnerability of UK supply chains to international disruption. Manufacturers could not always access the critical components they needed to continue production. ReshoringUK says that by bringing manufacturing facilities back to the UK, companies can improve quality while increasing opportunities to innovate.

Glossary

ACADEMIC SPIN-OUT

We define an academic spin-out as a company that meets condition number 1 below and at least one other of the following prerequisites:

- 1) A start-up established to exploit intellectual property developed by a recognised UK university, which is broadly in line with the Higher Education Statistics Agency (HESA) definition of a spin-off
- 2) It can license the intellectual property rights (IPR) owned by the university
- 3) The university owns shares in the company
- 4) Founders and investors have the right, via an option or warrants contract, to purchase shares in the company

ACCELERATOR

An eligible accelerator programme must have all the following characteristics:

- 1) Start and finish date
- 2) Structure with one of the following: a syllabus, milestones, events with required attendance
- 3) Competitive application process
- 4) No or low attendance fees as to its length and perks

ACES (TECHNOLOGIES)

An acronym referring to 'automated, connected, electrified and shared-ownership (or shared-mobility)' vehicles.

ACTIVE (COMPANIES)

SMEs that are still trading and showing clear signs of growth and activity. Excludes any companies that have ceased trading or have shown signs of inactivity, such as their website being down, out of date social media channels, etc.

'CAV'

An abbreviation of connected and autonomous vehicles.

EARLY-STAGE

Seed and Venture stage companies.

EQUITY INVESTMENT

Equity investment is the issuance of new shares by a company to fund its growth, which Beauhurst can track for all equity investment in the UK, even those companies that go unannounced in the press.

'EV'

An abbreviation for an 'electric vehicle'. Sometimes abbreviated to BEV meaning battery electric vehicle; FCEV for fuel cell electric vehicle; HEV for a hybrid electric vehicle; PHEV meaning plugin hybrid electric vehicle; and occasionally REEV for a range-extended electric vehicle.

LARGE INNOVATION GRANTS

A company that has met our innovation grant trigger is one that has formally accepted a large grant offer for a specific innovation project. We define 'large' as £100,000 or more where the awarding body is UK-based, and €100,000 or more where the awarding body is the EU.

SCALEUPS

A company that has achieved an annualised average growth rate of at least 10 per cent in either turnover or headcount over three accounting years based on two prerequisites:

- 1) they must have ten or more employees in the base year of calculation to avoid small company bias
- 2) their growth would still have been at least 10% if we disregarded any directly attributable to the acquisition of other companies

SMALL AND MEDIUM ENTERPRISES (SMES)

Beauhurst uses the European Commission definition of an SME: the company has fewer than 250 employees and either an annual turnover less than €50 million or balance sheet assets of less than €43 million. If a company does not file its employee count or sales revenue, we assume these figures are below the above limits, and therefore it is an SME.

VALUATIONS

We calculate valuations using the share price when the investment monies were received, rather than any future commitment to investing.

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With thanks to:

- Ajay Kapadia, Knowledge Transfer Manager - Advanced Composites at Knowledge Transfer Network
- Daniel Ruiz, Chief Executive Officer of Zenzi
- David Greenwood, Professor, Advanced Propulsion Systems, WMG, The University of Warwick
- Faye Smith, Vice Chairman of Composites UK, and Advanced Materials Specialist at Department of International Trade (DIT)
- Jenny Tooth OBE Chief Executive UK Business Angels Association
- Neville Jackson, Chair of the Royal Academy of Engineering ‘Increasing R&D Investment’ project, and formerly Chief of Technology and Innovation at Ricardo plc
- Robert Evans, Chief Executive Officer of Cenex (Centre of Excellence for Low Carbon and Fuel Cells)
- Simon Edmonds, Deputy Executive Chair & Chief Business Officer at Innovate UK (IUK)

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Prospedia Capital is the UK’s first private equity seed-funding platform focused exclusively on co-investing into early-stage future mobility technology. We curate a selection of investable opportunities, with a team of senior academics and industry professionals who know the automotive sector inside out, in a mission to accelerate the automotive industry’s absorption of advanced technology. By drawing in matched funding from the private equity market, Prospedia Capital aim to complement government grants awarded to automotive companies, unleashing their innovation potential for the benefit of all: angel investors, technology developers, the automotive industry and ultimately the environment and retail customers.



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Beauhurst is a searchable database of the UK’s high-growth companies. Our platform is trusted by thousands of business professionals to help them find, research and monitor the most ambitious businesses in Britain. We collect data on every company that meets our unique criteria of high-growth; from equity-backed startups to accelerator attendees, academic spinouts and fast-growing scaleups.

For more information and a free demonstration, visit beauhurst.com

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