



INNOVATION AND RESILIENCE IN A CRISIS

THE IMPACT OF COVID-19 ON UK BUSINESS R&D

MAY 2021

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EXECUTIVE SUMMARY

This report investigates the impact of the Covid-19 pandemic on the research and development (R&D) activities of businesses operating in the UK, and their R&D and innovation-focused interactions with universities. A parallel report – *The Effects of the Covid-19 Pandemic on the Ability of Universities to Contribute to Innovation*, looks at the impact Covid-19 has had on the ability of universities to contribute to innovation.

The findings presented in this report are based on responses to a survey of decision makers in 500 R&D active businesses in the UK. They investigate not only how the pandemic has impacted *the extent to which* businesses are engaging in R&D and innovation, but also *how* they engage. In particular, the survey considers whether activities in collaboration with external partners have been affected more than internal R&D and innovation activities.

The survey of businesses ran throughout September 2020, following the first national lockdown but before the second national lockdown in November 2020. It provides a snapshot of business decision making on R&D and innovation at this particular point in the pandemic.

01

Businesses were already experiencing both positive and negative factors in the UK R&D and innovation system, prior to the pandemic.

The survey investigated the extent to which business' needs were being met when it came to conducting different types of R&D and innovation activities in the UK. The most cited area where businesses said their needs were not being fully met was access to sufficiently qualified labour for R&D (64% of respondents reported this as a factor). 62% of businesses cited insufficient or unsuitable access to finance for R&D and innovation in the UK.

These findings show that although the immediacy of the pandemic is at the forefront of most minds, it is important to recognise that some businesses were already experiencing challenges in conducting R&D and innovation activities in the UK prior to the pandemic. This needs to be taken into account when assessing the impacts of Covid-19. Where there were challenges, particularly in relation to accessing qualified labour and finance, and with other framework conditions that are conducive to R&D and innovation, there is a need for a long-term strategy that stretches beyond the immediate challenges caused by the pandemic. This includes further work to make it easier for those businesses that currently find it difficult to access or co-develop R&D and innovation projects with universities and other partners in the UK or develop suitable facilities and equipment in the UK for R&D and innovation, or that find the innovation and entrepreneurial culture less conducive to R&D and innovation than elsewhere in the world.

02

91% of businesses reported that Covid-19 had disrupted some of their R&D and innovation activities

Covid-19 has had a significant impact on business R&D and innovation activities. Almost all (91%) of the businesses surveyed reported that Covid-19 had impacted at least one of the seven R&D and wider innovation activities investigated, including minor and major delays as well as ending projects entirely. Projects were more likely to have been delayed than stopped altogether. However, outright stoppages to activity were most commonly cited in research and training to build capability to undertake R&D, with 12% of business respondents reporting cancellations.

03

Product/service demonstration, testing and trial production faced the greatest disruption

Amongst our respondents, product/service demonstration and testing and trial production innovation activities faced greater disruption than any other R&D activity, with over half of business respondents (54%) who engaged in this activity before the pandemic reporting major delays or stoppages.

By contrast, research activities were relatively less affected. These results are concerning as product/service demonstration and testing is a critical later stage in the R&D and innovation process and will shape the commercial benefits realised from investments in R&D and wider innovation activities.

Our findings suggest that we need to pay more attention to the ability of businesses to continue developing the outputs emerging from R&D and innovation undertaken into applications developed in the UK. In other words, we need to think much more actively not just about value creation through R&D, but also UK value capture.

04

96% of businesses that had been engaging with universities prior to the pandemic reported some change to their activity

96% of businesses who were engaging with universities before the pandemic reported delaying, reducing, refocusing or cancelling projects with universities. Project delays and extensions were more commonly cited than ending activities altogether, though 37% did report cancellations.

The most commonly cited reasons for changes made to projects with universities or other publicly funded research institutes were business' lack of personnel available to engage productively with a university (34%), lack of access to facilities, equipment and raw materials (33%) and financial resources (30%).

A quarter (25%) of businesses made changes to their projects with universities based on a belief that the university would not be able to adequately deliver on project objectives. A further 19% reported that their strategic objectives were no longer aligned to university expertise or capabilities.

05

Findings suggest that collaborative R&D with universities may recover slower than internal R&D

Business' plans to engage in innovation activity in the next 12 months varied. The majority (56%) of businesses were not planning on increasing their internal R&D and innovation activities between September 2020 and August 2021. 19% said they planned a decrease. Fewer than half of respondents (44%) planned increases, suggesting that for most businesses in this sample recovery from the decline observed during the first wave of the pandemic will be slow.

The survey suggests that collaborative R&D and innovation activities with universities may take even longer to recover. 64% of those who had engaged with universities in the year before March 2020 said they did not have any plans to increase their R&D activity with universities at all in the next 12 months, while a quarter (25%) planned decreases.



01

INTRODUCTION

The Covid-19 pandemic has had a significant impact on businesses across many sectors of the UK economy. Almost all businesses have had to make changes to how they operate and how they interact with customers, with many experiencing significant changes in demand as well as disruption to their supply chains. Measures taken to suppress the Covid-19 virus, including national lockdowns to restrict interaction and transmission, have had immediate impacts on business' trading and revenue. In May 2020, during the first national lockdown, 18% of UK businesses had temporarily closed or paused trading. Of those still trading, 62% reported a decline in turnover¹.

Throughout the pandemic, many business leaders have had to focus on business continuity², including cutting costs, driving productivity and implementing costly Covid-19 safety measures. As the UK looks towards longer-term recovery, there is important evidence that suggests companies that are able to continue investing in R&D and

1 Office for National Statistics. (2020) Coronavirus and the impact on output in the UK economy: May 2020. Retrieved from www.ons.gov.uk/economy/grossdomesticproductgdp/articles/coronavirusandtheimpactonoutputintheukeconomy/may2020

2 McKinsey & Company, (2020) Innovation in a crisis: Why it is more critical than ever. Retrieved from www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/innovation-in-a-crisis-why-it-is-more-critical-than-ever

innovation through a crisis are more likely to be resilient, more likely to expand into new markets during disruptions and more likely to be able to hold on to staff and grow in difficult trading conditions³. However, there is also early but mounting evidence to suggest that the pandemic has hampered business research and development (R&D) and innovation activities⁴.

The UK Government's R&D Roadmap recognises that R&D and innovation will be critical to the UK's economic and social recovery from Covid-19, as well as its response to the Fourth Industrial Revolution and climate change. Decisions made by business leaders in the months and years ahead will have a profound impact on the speed and shape of the UK's recovery. Business leaders will have difficult decisions to make on whether to invest in R&D and innovation over other priorities.



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As the Government further develops its R&D and innovation strategies and looks towards realising the ambitions set out within the R&D Roadmap, understanding the barriers that businesses are facing when conducting R&D and innovation activities here in the UK will be important to inform the design of effective policies to attract and retain these types of activities, and capture value from them, in the years ahead.

In order to build this understanding, the National Centre for Universities and Business (NCUB) and the University Commercialisation and Innovation (UCI) Policy Evidence Unit at the University of Cambridge conducted two surveys, one of business leaders and one of university leaders. This report sets out the findings of the survey of business leaders, investigating specifically the impact of Covid-19 on businesses' R&D and innovation activities and their collaborations with universities. A parallel report *The Effects of the Covid-19 Pandemic on the Ability of Universities to Contribute to Innovation* (UCI and NCUB, 2021) looks at how Covid-19 has impacted universities' ability to contribute to innovation.

The survey of businesses ran throughout September 2020, following the first national lockdown but before the second national lockdown in November 2020. The survey provides a snapshot of business decision making on R&D and innovation at this particular point in the pandemic.

The findings presented in this report provide insights into not only how the pandemic has impacted *the extent to which* businesses are engaging in R&D and innovation, but also *how* they engage. Crucially, the survey distinguished between different types of R&D, recognising that the factors influencing R&D and innovation investment decisions can be quite different, and the types of external partners that are likely to be involved is also likely to vary. As a result we are able to examine how the pandemic has affected different types of R&D.

Respondents to the survey were UK-based businesses, with sufficient coverage across the four nations of the UK and each of the English regions. The survey included some foreign-owned companies, but did not include charities and not-for-profit actors in the R&D and innovation system where there is also early evidence of significant disruption⁵.

³ Ibid.

⁴ Enterprise Research Centre and Innovation Caucus. (2020). Assessing the impact of Covid-19 on Innovate UK award holders: Survey and case-study evidence, wave 1 - June/July 2020. Retrieved from www.enterpriseresearch.ac.uk/wp-content/uploads/2020/09/ERC-Report-Assessing-the-impact-of-Covid-19-on-Innovate-UK-award-holders-Wave1.pdf.

⁵ National Centre for Universities and Business. (2020). Research to Recovery - Delivering an R&D-driven Industrial Strategy. Retrieved from www.ncub.co.uk/index.php?option=com_docman&view=download&alias=475-ncub-r-d-taskforce-report-2020-final&category_slug=reports&Itemid=2728

02

BACKGROUND

The NCUB R&D Taskforce and the NCUB/UCI business survey

Throughout the pandemic, NCUB has engaged with businesses and universities to understand the impact of Covid-19 on their R&D and innovation activities. Between August and November 2020, NCUB convened an R&D Taskforce at the request of UK Research and Innovation (UKRI), which included the Chairs of BT, Rolls Royce, GSK and Orsted as well as the Presidents of both the CBI and Universities UK, and Vice Chancellors from across the UK. The Taskforce had both an immediate and longer-term purpose.

Its short-term purpose was to provide rapid insight and evidence on the progress of universities and businesses in working towards financial stability and the stability of activities, as well as understanding their ability to contribute to the nation's recovery. Looking towards the longer-term, the Taskforce also considered how business investment and engagement in R&D and innovation could be increased to deliver the Government's ambitions for a more innovative economy.

This ambition was articulated in a Government R&D Roadmap, published in the midst of the pandemic in July 2020. The Roadmap pledged to transform the UK into "the very best place in the world to be a researcher, inventor or innovator"⁶, with an aspiration to "inspire the next generation of engineers, biologists, designers, historians and entrepreneurs, to strengthen not just our economy, but also to improve our health, wellbeing and environment". To realise these aspirations, the Government reaffirmed their target for UK R&D and innovation spending to reach the equivalent of 2.4% of GDP by 2027 and 3% in the longer term. This will require an increase in public R&D and innovation spending, but also an estimated £17.4 billion increase in private sector spend on R&D⁷.

To meet this target, it is critical to understand both the impact of Covid-19 on business R&D and innovation, and the baseline from which these activities will have to grow. This allows us to assess how well businesses are positioned to realise the ambitions of the Roadmap and adapt to changed customer demands and operating environments during and after the pandemic.

6 Department for Business, Energy & Industrial Strategy. (2020). UK Research and Development Roadmap. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/896799/UK_Research_and_Development_Roadmap.pdf

7 Oxford Economics. (2020). Modelling the impact of public R&D spending plans. Retrieved from www.ncub.co.uk/reports/modelling-the-impact-of-public-r-d-spending-plans

The impact of Covid-19 on business R&D and innovation activities

The work of the R&D Taskforce, and NCUB's ongoing engagement with businesses, suggests that the pandemic has significantly impacted business R&D and innovation activities. Businesses engaged through the Taskforce reported that as Covid-19 continues to impact the financial performance of businesses in many sectors, their ability to prioritise innovation and invest in R&D is declining.

Surveys – for example those undertaken by the Enterprise Research Centre, the Royal Academy of Engineering and McKinsey⁸ – undertaken at different stages of the pandemic, indicate a large majority of businesses reporting impacts such as R&D projects being delayed and even ceasing in the period since March 2020⁹. Businesses engaged through the Taskforce reported that R&D projects started before the pandemic are more likely to have been delayed than stopped, which appears encouraging. However, with the crisis continuing and pressure on businesses rising, it is unclear how long delays will be sustained before a decision is taken to cancel projects altogether. This reiterates the need for regular data collection to analyse impacts at different stages of the pandemic and longitudinal surveys must be welcomed.

Although there is strong and growing evidence of Covid-19 leading to disruption in business R&D and innovation activities, particularly in certain sectors, less is known about how Covid-19 has specifically impacted different types of R&D activities. Further, there is limited information on how the pandemic has impacted the collaborative activities of businesses with universities and other actors in the R&D and innovation system.

One of the UK's greatest strengths is its world class research base and globally renowned universities. Harnessing this strength is foundational to realising the UK's ambition to become a global science superpower. Therefore, understanding not just the extent to which the pandemic has impacted business R&D and innovation, but also the ways in which it has impacted business collaboration with universities in the R&D and innovation system is a core aim of this report.

8 Enterprise Research Centre and Innovation Caucus. (2020). Assessing the impact of Covid-19 on Innovate UK award holders: Survey and case-study evidence, wave 1 - June/July 2020. Retrieved from www.enterpriseresearch.ac.uk/wp-content/uploads/2020/09/ERC-Report-Assessing-the-impact-of-Covid-19-on-Innovate-UK-award-holders-Wave1.pdf

McKinsey & Company, (2020) Innovation in a crisis: Why it is more critical than ever. Retrieved from www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/innovation-in-a-crisis-why-it-is-more-critical-than-ever

Royal Academy of Engineering, (2020). Briefing - Covid-19 immediate impact on R&D intensive businesses. Retrieved from www.raeng.org.uk/publications/briefings-statements-letters/covid-19-immediate-impact-on-r-d-intensive-business

9 Enterprise Research Centre and Innovation Caucus. (2020). Assessing the impact of Covid-19 on Innovate UK award holders: Survey and case-study evidence, wave 1 - June/July 2020. Retrieved from www.enterpriseresearch.ac.uk/wp-content/uploads/2020/09/ERC-Report-Assessing-the-impact-of-Covid-19-on-Innovate-UK-award-holders-Wave1.pdf

03

ABOUT THE SURVEY

The NCUB/UCI Survey of businesses was designed to contribute to gaps in the existing evidence base on the impact of Covid-19 on business R&D and innovation activity and on collaborations between businesses and universities. The design of the survey was informed in part by the issues raised by NCUB's R&D Taskforce and associated Advisory Groups.

Specifically, the survey sought to gather information on the *extent to which* business R&D and innovation activities had been impacted by the Covid-19 pandemic, but to also investigate whether it has impacted *how* they conduct those activities. The survey examined how Covid-19 has impacted business collaboration with external partners, particularly universities, compared to its impact on internal R&D and innovation. It also investigated whether particular types of R&D activities appear to be more impacted than others.

The survey was distributed between 14th and 25th September 2020 to businesses undertaking R&D and innovation activities in the UK across all sectors of the economy. Five hundred decision makers within a diverse sample of R&D-active businesses completed the survey and are included in our analysis. The following section provides detail on the survey design, respondents and sample.

Survey design

To investigate how Covid-19 has impacted business R&D and innovation activities, businesses were asked questions related to (1) their R&D and innovation activities prior to Covid-19, (2) the effect of the first lockdown (March – July 2020) on their R&D and innovation activities, (3) the impact of Covid-19 on collaborations and interactions with universities, and (4) their plans for R&D and innovation activities in the year ahead.

Specifically, the survey explored the following:

Pre-Covid-19 period baseline (12 months prior to March 2020)	<ul style="list-style-type: none"> + The level of R&D and wider innovation activity, both internal and external, including a) research, b) technology/prototype development, c) other development activities, d) acquisition of existing knowledge for R&D, e) acquisition of advanced machinery, equipment, f) training to build capabilities to undertake R&D and g) product/service demonstration, testing, trial production. + The level of difficulty for businesses to undertake R&D and innovation activities in the UK. + The availability in the UK of key factors known to influence the location and success of business R&D activities.
The impact of Covid-19 on activities and investment	<ul style="list-style-type: none"> + The effect of the pandemic on R&D and wider innovation activities. For different types of R&D activities, businesses were asked whether the pandemic had caused minor or major delays to activities, if a majority of activity had to stop, or if the pandemic had no effect.
The impact of Covid-19 on collaborations and interactions	<ul style="list-style-type: none"> + For those businesses that had collaborated or interacted externally with universities or other publicly funded research institutes before March 2020, businesses were asked if there were any changes made to projects or other activities with universities. + The main reasons for changes made to projects, activities or interactions with universities.

- + Over the next year (up to August 2021), businesses were asked if there were likely to be any changes to the level of R&D activity of the following types: a) internal R&D activities, b) external R&D activities with other companies (not part of your enterprise group), c) external R&D activities with universities or other publicly funded research institutes, d) external R&D activities with Catapults or publicly funded technology and innovation development organisations, e) external R&D activities with consultants, commercial labs or private R&D institutes.

Looking forward

The survey distinguished between different types of activities at different stages of the R&D and innovation process. The categories were adapted from the OECD Frascati Manual and the UK Innovation Survey. ^{10 11 12}

Types of R&D and innovation activities examined:

Research	Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts
Technology/prototype development	The development of an original model constructed to include all the technical characteristics and performances of the new product
Other development activities	Including adapting products to local markets; development for market launch; development of enabling tools and software
Product/service demonstration, testing, trial production	The steps needed to deduce whether further improvements to the product are necessary before the manufacturing start-up phase can begin
Acquisition of advanced machinery, equipment	Including major (i.e. capitalised) machinery and equipment acquired for use in the performance of R&D. A software development project is classified as R&D if its completion is dependent on a scientific and/or technological advance, and the aim of the project is the systematic resolution of a scientific and/or technological uncertainty ¹¹
Acquisition of existing knowledge for R&D	Including purchase or licensing of patents and non-patented inventions, know-how and other types of knowledge from other businesses or organisations ¹²
Training to build capabilities to undertake R&D	Internal or external training for your personnel, specifically for the development and / or introduction of innovations

10 OECD. (2015). Frascati Manual. Retrieved from www.oecd-ilibrary.org/docserver/9789264239012-en.pdf?expires=1613740440&id=id&accname=guest&checksum=72DE3458F97B28EB1E3DDE9C95AC1B2E

11 Ibid.

12 Department for Business, Energy & Industrial Strategy. (2020). UK innovation survey 2019 questionnaire. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/870611/UK_innovation_survey_2019_questionnaire.pdf

The survey also distinguished between external and internal R&D using the UK Innovation Survey definition¹³:

- + **Internal R&D:** creative work undertaken within your business that increases knowledge for developing new and improved goods or services and processes.
- + **External R&D:** creative work performed by companies, including other businesses within your group, or by public or private research organisations and purchased by your business.
- + **Profile of respondents:** The survey was completed by 500 decision-makers with strategic oversight of business' R&D and innovation activities.

R&D decision-making

Figure 1 shows that over a third of respondents (36%) in our sample helped reach the final decision as part of a group/committee; over a quarter (26%) made the final decision with input from staff/management; and over one third (38%) were the sole decision makers at their business.

Figure 1

R&D and decision making

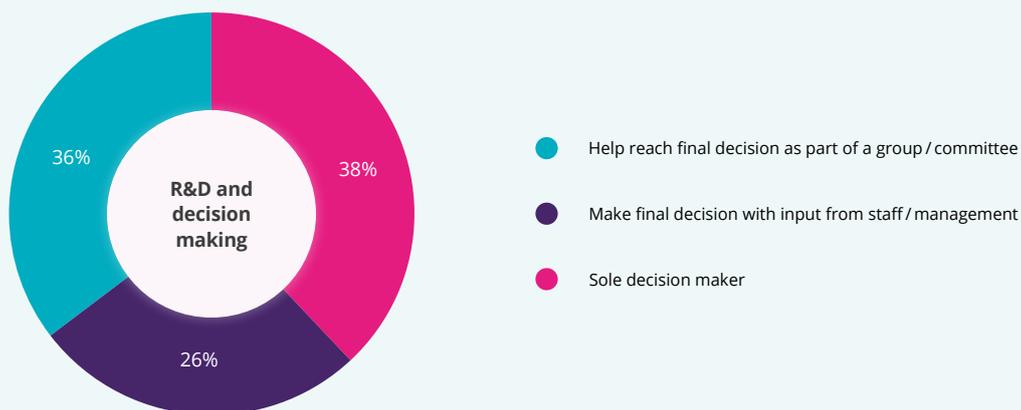
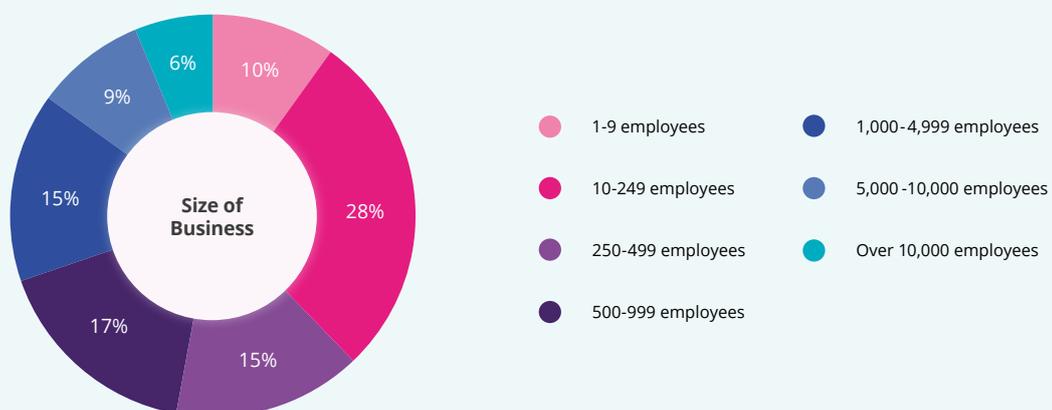


Figure 2

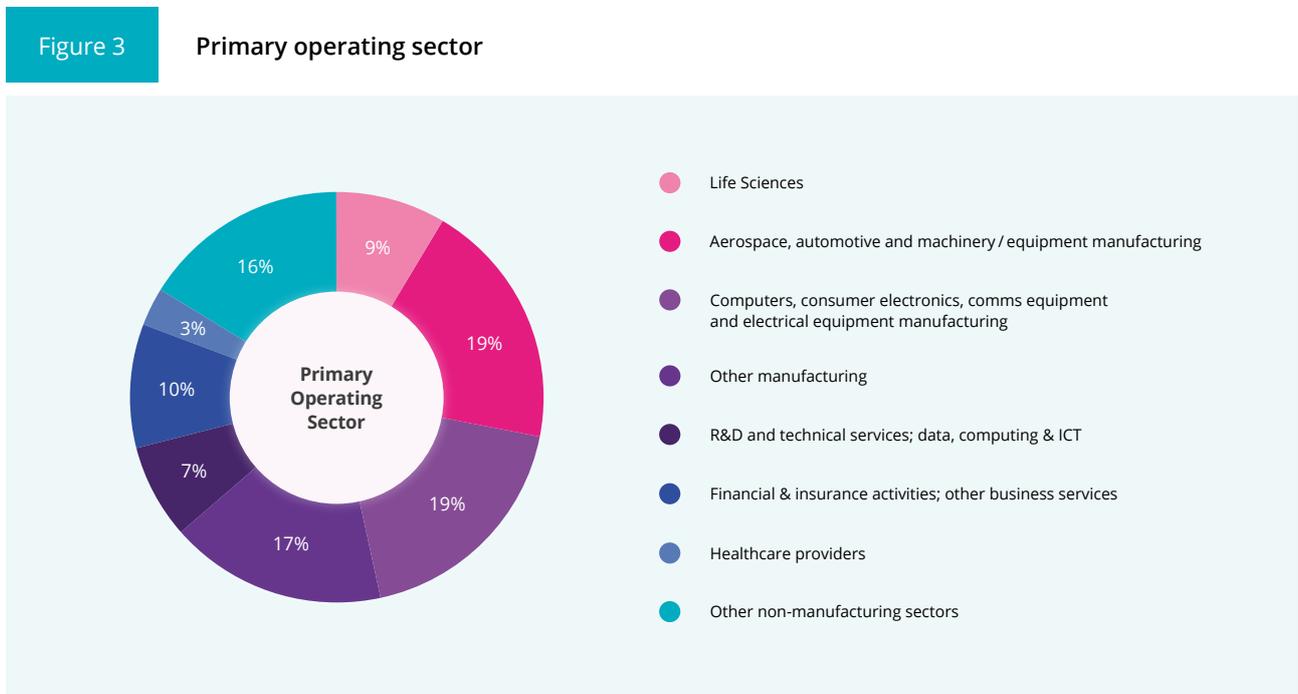
Size of business



Sample

By design, all of the businesses responding to the survey had invested in R&D in the year prior to March 2020. Figure 2 shows the distribution of respondents by the size of the businesses they represent. 10% of respondents came from micro businesses (1-9 employees), 28% came from SMEs (10-249 employees) and 62% of responses came from large businesses (250 or more employees).

Figure 3 shows the breakdown of businesses by sector. 64% of respondents to our survey came from businesses that operate primarily in manufacturing sectors¹⁴, while the rest did not. The importance of making a distinction between the manufacturing and non-manufacturing sectors is reflected in the manufacturing sector’s contributions to business R&D. In 2019/20, the manufacturing sector accounted for two thirds of overall R&D activity in the UK, as well as 45% of exports, 15% of business investment and 2.7m high value jobs. Pharmaceuticals and chemicals and the transport sector accounted for almost 70% of the total R&D spend between them¹⁵. Some of the hardest hit manufacturing sectors also happen to be some of the biggest R&D spenders, including both automotive and aerospace manufacturing¹⁶.



Data on the distribution of R&D spending from all UK businesses in 2018 (the latest year available at the time of the analysis underpinning this report) showed that 61% of all spending was made by businesses in manufacturing sectors, compared with 39% in non-manufacturing sectors¹⁷. A comparison between the distribution for all UK businesses and the distribution of our sample is presented in Figure 4¹⁸ below.

14 The survey defined manufacturing sectors to include: Life sciences (including pharmaceutical manufacturing, medical devices manufacturing and medical biotechnology R&D); Aerospace & defence manufacturing; Manufacture of motor vehicles and parts; Manufacture of machinery and equipment; Manufacture of chemicals and chemical products (excl. pharmaceuticals); Manufacture of consumer electronics, communication equipment and electrical equipment; Manufacture of computers and peripheral equipment; Manufacture of food products and beverages; Manufacture of non-medical precision instruments & optical products; Other manufacturing.
Non-manufacturing sectors included: Data infrastructure, telecommunications, computer programming, software development and related ICT activities; R&D and technical services (including non-medical biotech R&D services, engineering, technical testing & analysis); Other business services (including legal, marketing, accounting, management consultancy etc.); Healthcare; Financial and insurance activities; Creative industries and media; Utilities & construction; Agriculture, Forestry & Fishing; Extractive industries; Transport & logistics; Education; Leisure and hospitality; Other.

15 Make UK. (2019). UK Manufacturing Facts, 2019/20. Retrieved from www.makeuk.org/insights/publications/uk-manufacturing-the-facts-2019-20

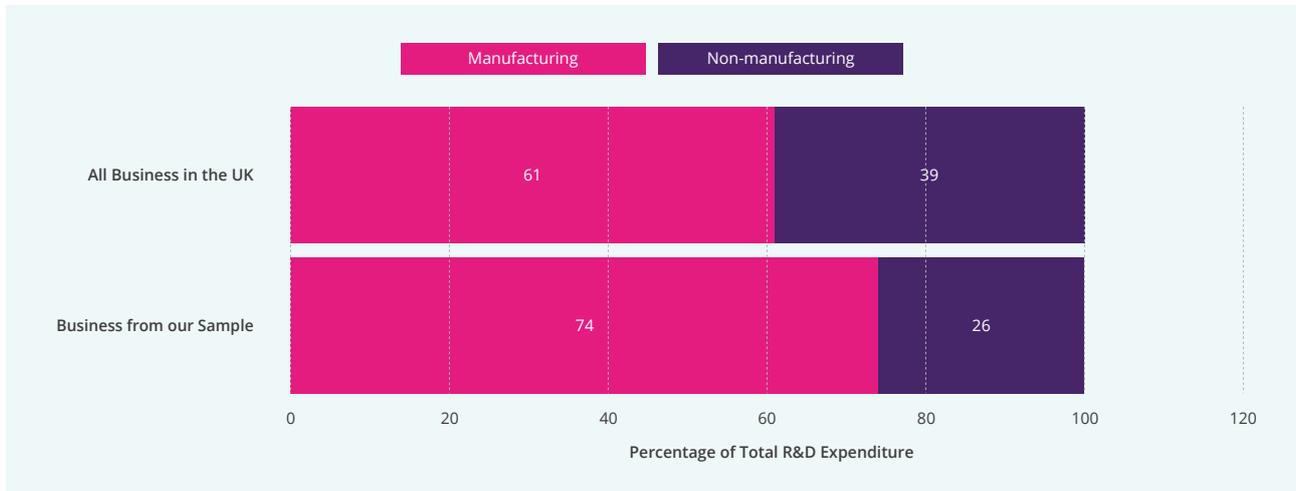
16 Tony Blair Institute for Global Change. (2020) The UK Innovation Landscape: The Impact of Covid-19 on R&D. Retrieved from <https://institute.global/policy/uk-innovation-landscape-impact-covid-19-rd>

17 Office for National Statistics (2019), “Business enterprise research and development, UK: 2018. Retrieved from www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/businessenterpriseresearchanddevelopment/2018

18 The R&D spend of businesses from our sample was calculated using the mean spend of businesses in manufacturing and non-manufacturing sectors.

Figure 4

Distribution of R&D between manufacturing and non-manufacturing sectors

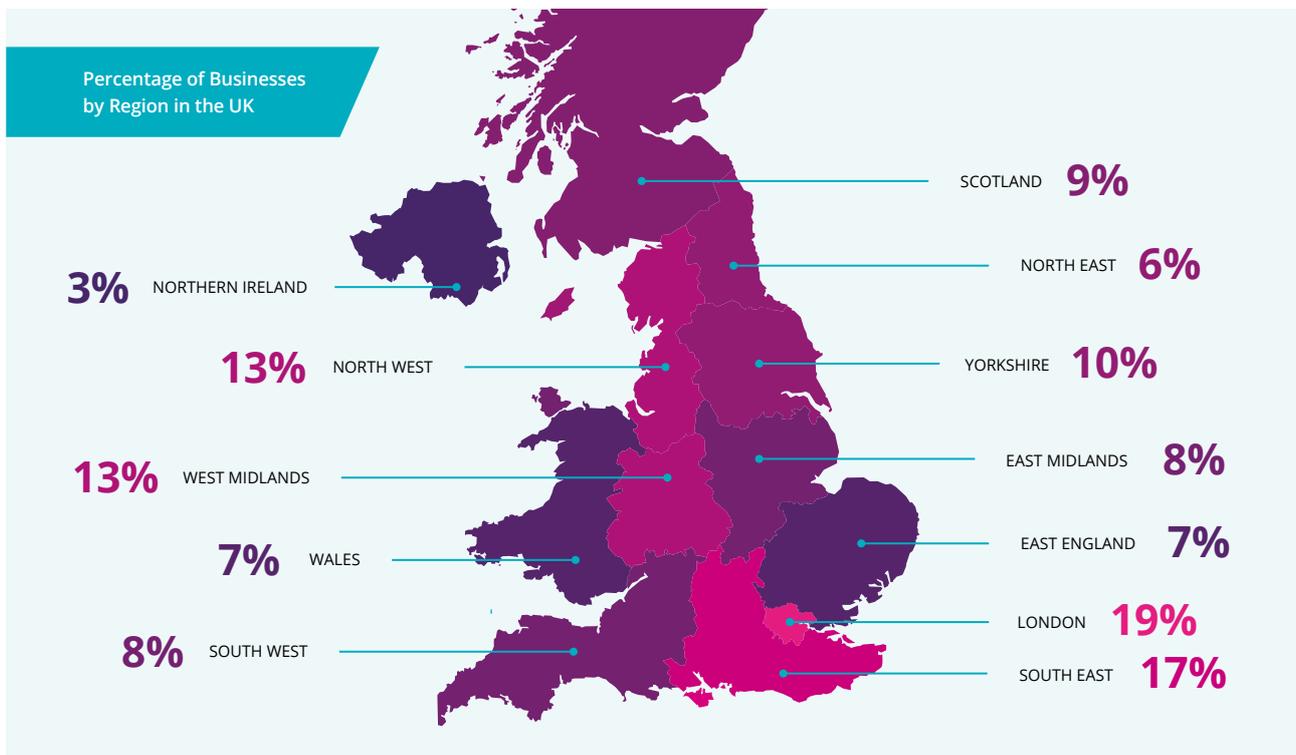


Sources: ONS Business enterprise research and development UK, 2018 and Innovation and Resilience in a Crisis: The Impact of Covid-19 on UK Business R&D.

Amongst respondents, 51% had their main UK-based R&D and innovation sites located in either London or the South East, 29% had sites located in the north of England, around 20% of businesses had sites located in the Midlands, and 8% of businesses had sites located in the South West. 9% had sites located in Scotland, 7% in Wales and 3% in Northern Ireland. Where respondents had multiple main R&D sites, they were able to select more than one location. Figure 5 below shows the full distribution¹⁹.

Figure 5

Regional distribution of R&D sites for businesses



¹⁹ Respondents were able to select multiple regions.

04

PERFORMING R&D IN THE UK BEFORE THE COVID-19 PANDEMIC

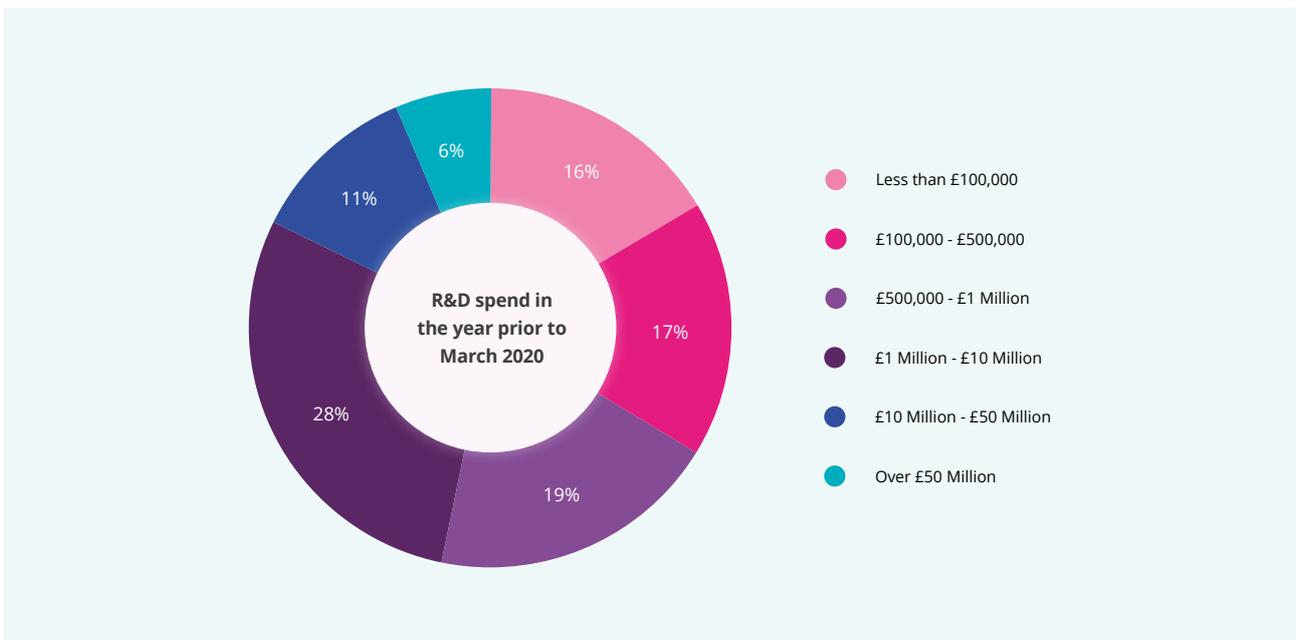
The survey investigated the R&D activities of responding businesses in the year before the Covid-19 pandemic, including: (1) the types of R&D activities undertaken by the businesses and whether these were undertaken either internally or externally in collaboration with partners; (2) whether businesses had found it easy or difficult to carry out these different activities in the UK prior to the pandemic, and (3) whether the UK was meeting their needs in terms of the wide range of factors impacting UK business investment in R&D and innovation. The findings set out in this section help establish a baseline for investigating the effects of the pandemic on R&D and innovation.

The scale and nature of R&D and wider innovation activities undertaken by UK-based businesses prior to the pandemic

The businesses responding to our survey invested approximately £4.1bn in R&D in the last financial year prior to the onset of the pandemic²⁰. The distribution of this R&D spending by businesses in the sample is illustrated in Figure 6 below²¹.

Figure 6

R&D spend in the year prior to March 2020



20 Respondents were presented with six ranges of R&D spending. We used the mid-points of each bounded category and £50 million for the upper, unbounded category to estimate the total R&D spend by the sample and distribution across sectors.

21 This was calculated using the means for both groups – businesses in manufacturing sectors and businesses in non-manufacturing sectors.

Figure 7

R&D/wider innovation activity in the 12 months prior to March 2020

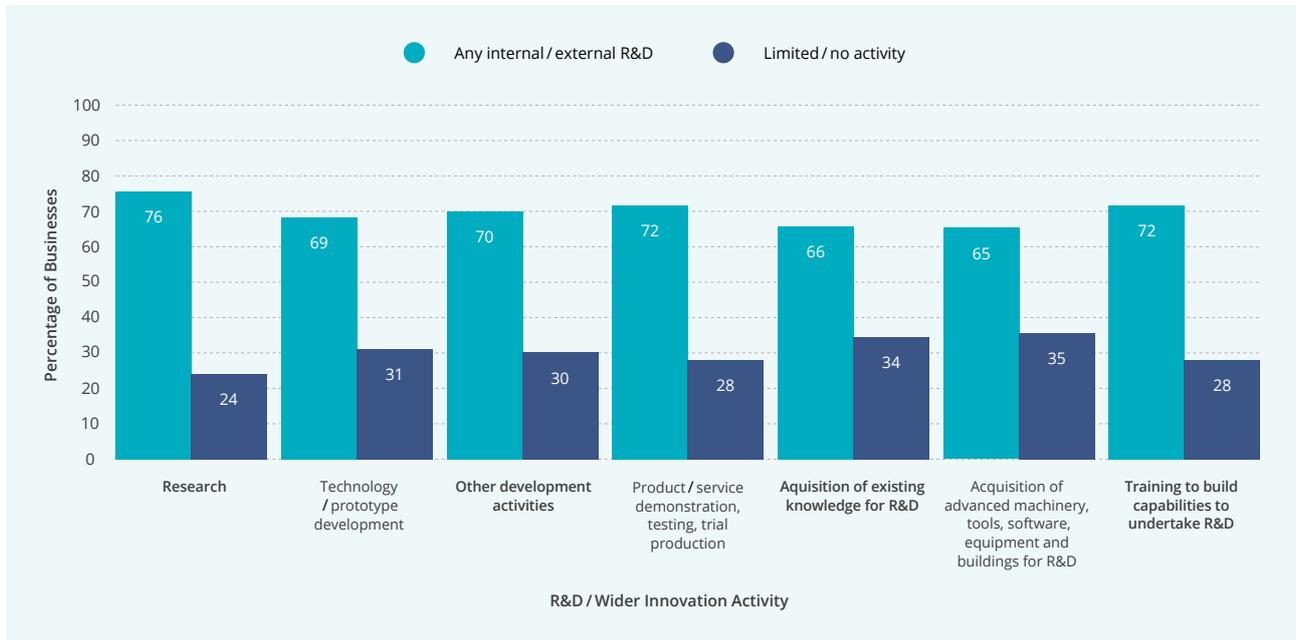
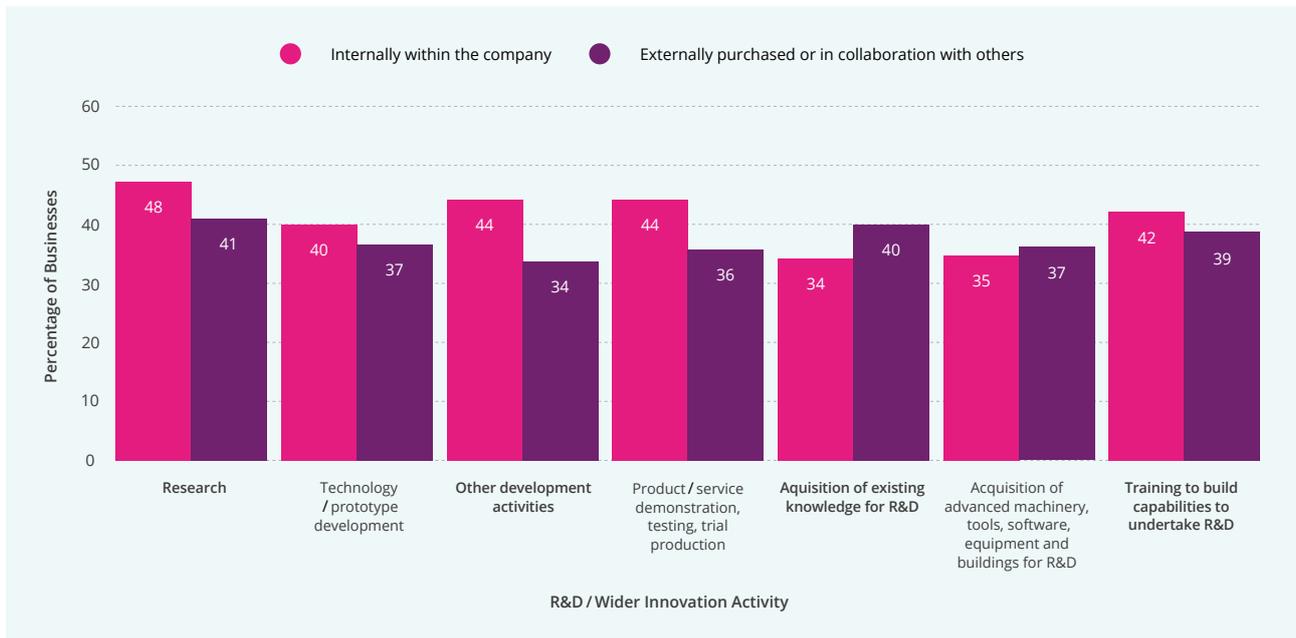


Figure 7 shows the percentage of responding businesses investing in R&D and wider innovation activities in the 12 months prior to March 2020. It is notable that a majority of respondents were engaged in activity across different stages of the R&D and innovation process. 76% of respondents had engaged in research activities, 69% in technology/prototype development, 70% in other development activities, 72% in product/ service demonstration, testing, and trial production. Further, 66% had engaged in the acquisition of existing knowledge for R&D, 65% in the acquisition of advanced machinery, equipment, tools and software and buildings for R&D; and 72% in training to build capability to undertake R&D.

Figure 8

Internal and external R&D activities in the 12 months prior to March 2020



Note: Respondents were able to choose more than one option.

As well as investigating the types of R&D activities invested in by businesses, the survey explored whether these activities were delivered internally (within the company) or externally (purchased or in collaboration with others).

Figure 8 shows the proportion of responding businesses investing in different types of R&D and innovation activities internally and externally. It shows that almost half of respondents had invested internally in research before the pandemic; 40% in technology/prototype development; 44% in other forms of development activity; and 44% in product or service demonstration, testing and trial production. A further 34% had invested internally in the acquisition of existing knowledge for R&D, 35% had invested internally in the acquisition of advanced machinery, equipment, tools and software and buildings for R&D; and 42% had invested in internal training to support their R&D activities.

External and collaborative activities are an important part of business R&D and innovation activities. Looking across all categories, 80% of responding businesses had invested in some form of external R&D. This highlights that many businesses work with external partners to deliver a wide range of R&D and innovation activities.

The percentage of businesses engaging in external R&D was higher for earlier stages of the R&D and innovation process, particularly research, and decreased only slightly as research progressed towards development and application stages. 41% of businesses engaged externally for research; 37% for technology and prototype development; and 34% for other development activities. Almost four in ten of the responding businesses engaged externally for R&D training activities.

Figure 9

External R&D activity prior to the pandemic



Figure 9 above shows the level of external R&D and innovation engagement with different types of partners. Universities and public research institutes are clearly an important partner to businesses in the R&D and innovation process, with 31% of respondents engaging with this type of partner before the pandemic. This is broadly consistent with the broader evidence base on the prevalence of university-business engagements in the UK economy.

The survey also found that 23% of business respondents engaged with Catapults and 34% engaged with consultants, commercial labs or private R&D institutes.

Difficulties in undertaking R&D activity in the UK prior to the pandemic

A key interest of the NCUB R&D Taskforce was to better understand the ability of businesses to undertake R&D in the UK, even without the additional challenges brought on by the Covid-19 pandemic. To explore this topic we asked businesses in our survey the extent to which they found it easy or difficult to undertake different types of R&D and related activities in the UK in the 12 months prior to March 2020 and the first national lockdown.

Overall, 52% of businesses responding to the survey faced some difficulty in undertaking at least one type of R&D; of those that found it difficult, 16% of businesses found at least one type of R&D very difficult.

Figure 10

Ability of businesses to undertake R&D in the UK in the 12 months prior to the pandemic

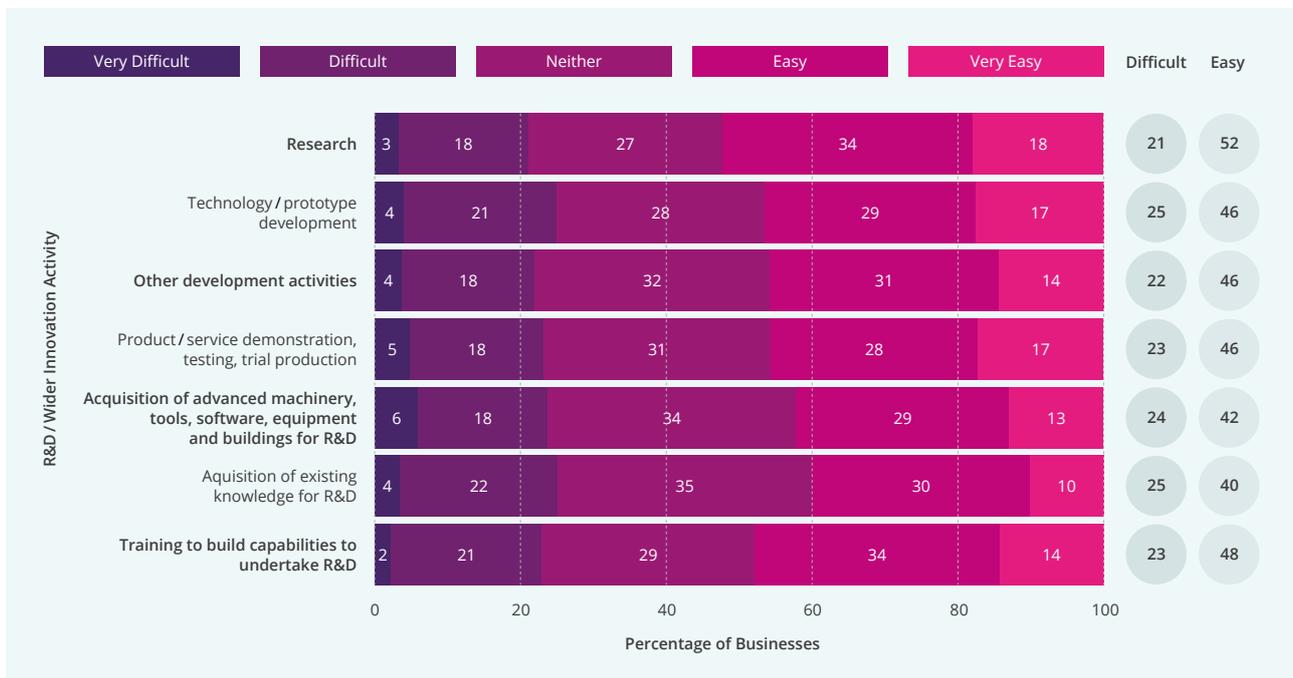


Figure 10²² presents the breakdown of these results by type of R&D and innovation activity. There does not appear to be much variation in the extent to which businesses faced difficulties in undertaking different types of R&D in the UK pre-pandemic. 21% of businesses in our sample cited research activity as either difficult or very difficult, 25% cited technology and prototype development the same and a further 25% of businesses said that acquiring knowledge for R&D activities was either difficult or very difficult. By contrast, just over half of respondents (52%) said they found it either easy or very easy to undertake research in the UK, while just under half (48%) said they found it easy or very easy to undertake training to build R&D capabilities.

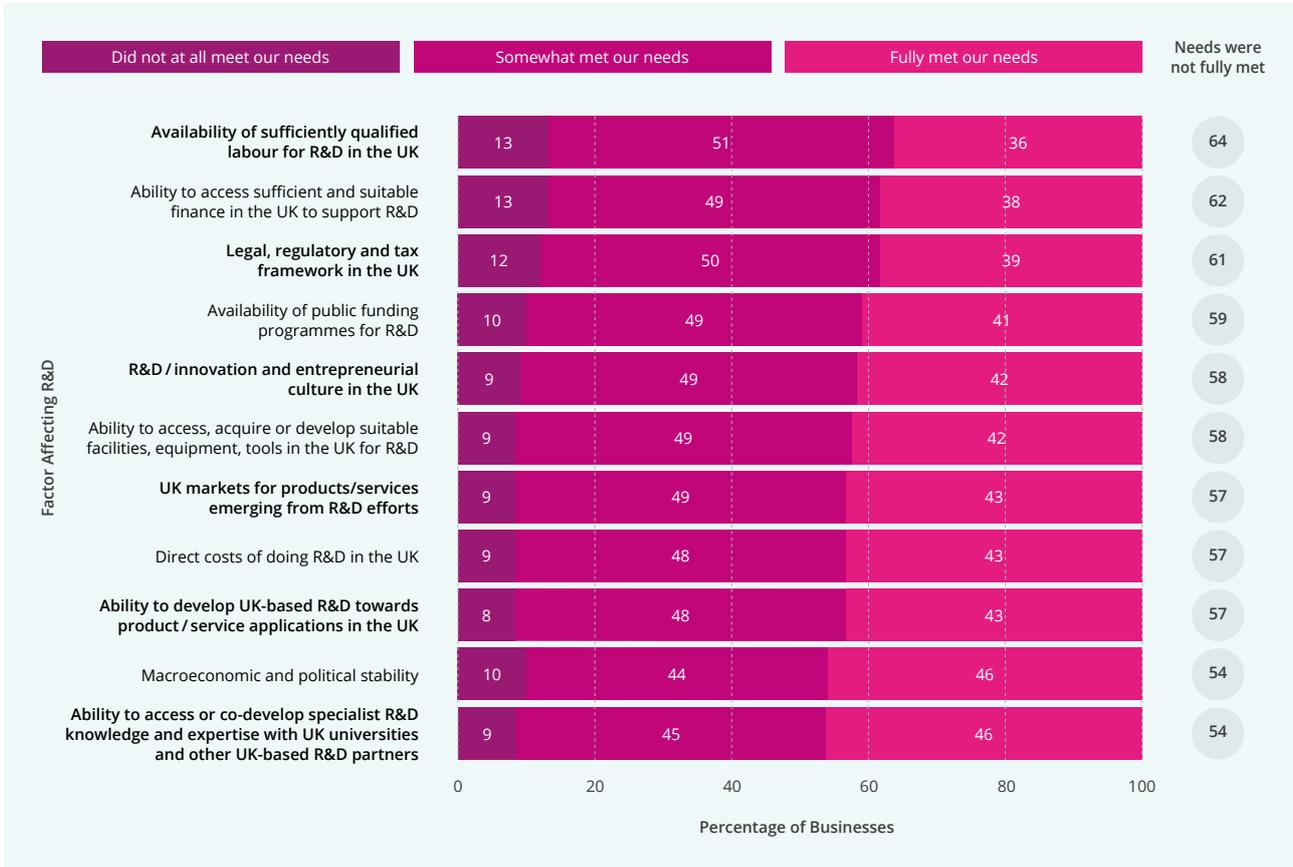
Factors affecting business' R&D and innovation activities prior to Covid-19

To understand if respondents might be experiencing difficulties in performing R&D in the UK pre-pandemic, our survey explored the extent to which businesses believed their needs in a wide range of areas for undertaking R&D and innovation in the UK were being met prior to March 2020. Figure 11²³ summarises their responses.

²² Percentages presented in Figure 10 may not add up to 100 per cent due to rounding all values to the nearest whole number.

²³ Percentages presented in Figure 11 may not add up to 100 per cent due to rounding all values to the nearest whole number.

Figure 11 Factors affecting R&D prior to March 2020



Access to sufficiently qualified labour was the most commonly cited need not being fully met (64%). Breaking this down, 51% of businesses stated that their needs were somewhat met, while 13% said that their needs in this area had not been met at all. Access to sufficient and suitable finance, as well as the legal, regulatory and tax framework, were also regularly cited as areas where business needs were not being fully met by 62% and 61% of respondents respectively. A further 59% of respondents said that the availability of public funding programmes for R&D did not fully meet their needs, with one in ten saying that they did not meet their needs at all.

Just under half of the businesses in our sample (46%) reported that their needs had been fully met regarding their ability to access or co-develop specialist R&D knowledge and expertise with UK universities and other partners. This means that the needs of many R&D-active companies were not being fully met in this area pre-pandemic; something that would warrant further investigation.

43% of respondents felt that their needs regarding their ability to develop UK-based R&D towards product/service applications in the UK were fully met. This is a potential concern as it suggests that for less than half of the businesses in our sample, the UK meets their needs for supporting later, and closer to market, stages of the R&D and innovation process. 48% of respondents reported that their needs had been partially met, with 8% saying that their needs had not been met at all. A more detailed investigation into the reasons why those companies felt they were not able to progress their R&D towards applications in the UK would be instructive to ensure that the UK government is doing everything it can to not just create value in the UK but capture as much of the value here as well.

Although the focus of the survey and this report is on the impact of Covid-19 on R&D and innovation activities, it is clear that businesses faced a range of challenges in conducting R&D and innovation activities in the UK prior to the pandemic. The types of challenges identified align strongly with those identified by NCUB's R&D Taskforce and should be investigated further as the UK develops its Innovation Strategy.

05

THE IMMEDIATE IMPACT OF COVID-19 ON BUSINESS' R&D AND INNOVATION ACTIVITIES

This section presents the evidence gathered through the survey on the immediate impact of Covid-19 on business R&D and innovation activities and collaborations with universities and other public research institutes. It focuses on impacts reported by responding businesses during the period between March and August 2020.

Impact on the level of business R&D and innovation activities

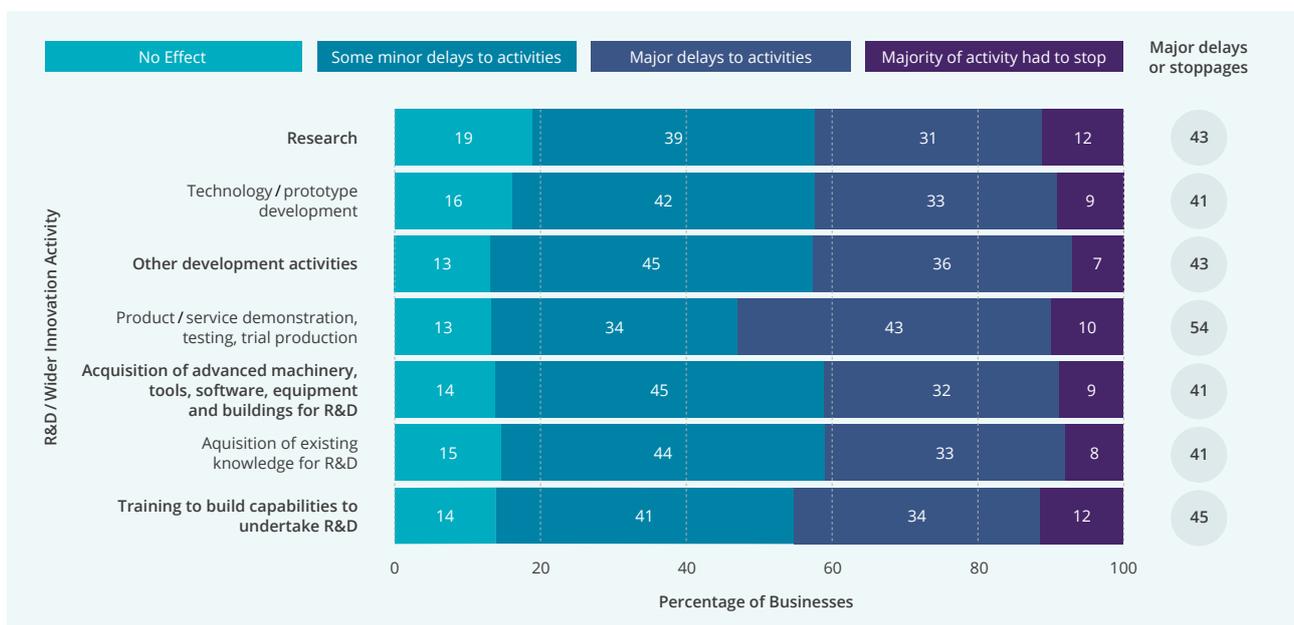
Responding businesses were first asked to report on the impact of Covid-19 on their R&D and innovation activities. The vast majority of businesses (91%) saw some impact to at least one of the seven R&D and wider innovation activities investigated, meaning that just 9% saw no negative impact to their R&D and innovation activities at all. Two thirds of respondents (66%) reported disruption (delays or stoppages) across all the types of activity that they engaged in before the pandemic. It is important to note that only a relatively small minority of businesses had to stop a majority of their activities and that most of the effects were delays (minor or major).

Figure 12 shows a higher percentage of businesses (54%) reported major delays or stoppages to product/service demonstration, testing and trial production than any other activity. This compares to 43% of businesses reporting major delays or stoppages to research, 43% citing major delays/stoppages to development, and 45% to training to build capabilities to undertake R&D.

The most commonly cited activities where a majority of activity had to stop were research and training to build capabilities to undertake R&D (both 12%). While the evidence points to a significant disruptive effect of the pandemic on business research, it should also be noted that almost one in five respondents investing in research saw no change to this type of activity between March and August 2020.

Figure 12

Effect of the pandemic on R&D and wider innovation activities



Effects of the pandemic on business engagement with universities

Thirty one percent of businesses responding to our survey indicated that they were working with universities or publicly funded research institutes on R&D and innovation activities at the time of the first lockdown. The survey examined in some detail how those interactions (ongoing in March 2020) had been impacted by the Covid-19 pandemic. In particular, it asked businesses interacting with universities and publicly funded institutes what types of changes had been made to collaborative projects and activities, if any, and what the reasons were for any changes.

As Figure 13 shows, almost all (96%) of businesses that had been interacting with universities or research institutes at the time of the first lockdown reported that some change had been made to their interactions (such as project delays, reduction, refocusing or cancellation) with just 4% citing no change at all. The scale of change identified in the business survey appears to be consistent with findings from the parallel universities' survey²⁴.

Across those businesses interacting with universities or publicly funded research institutes at the time of the first lockdown, 42% of respondents saw project deadlines or milestones for projects extended during the pandemic, 39% reported delays to planned start dates, and 36% reduced the scale of their projects. 37% reported cancellation of projects. Further, almost four in ten refocused projects to address shorter-term company needs, while 33% sought to renegotiate financial and other terms of project contracts.

Figure 13

Effect of the pandemic on collaborative projects with universities or publicly funded research institutes

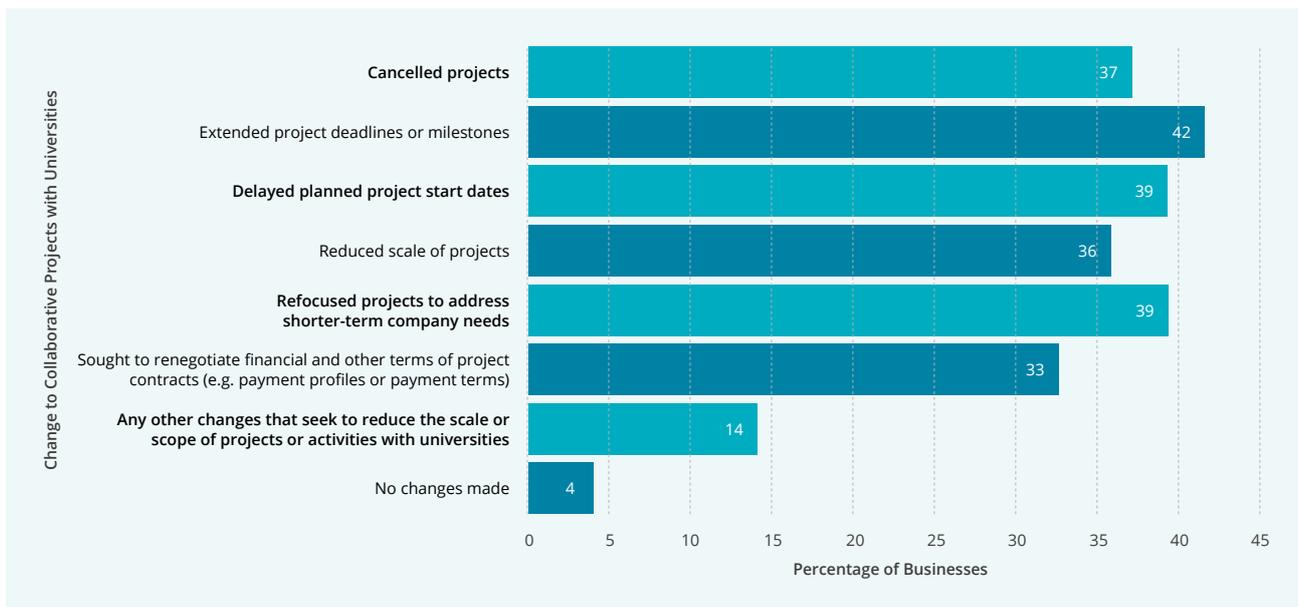
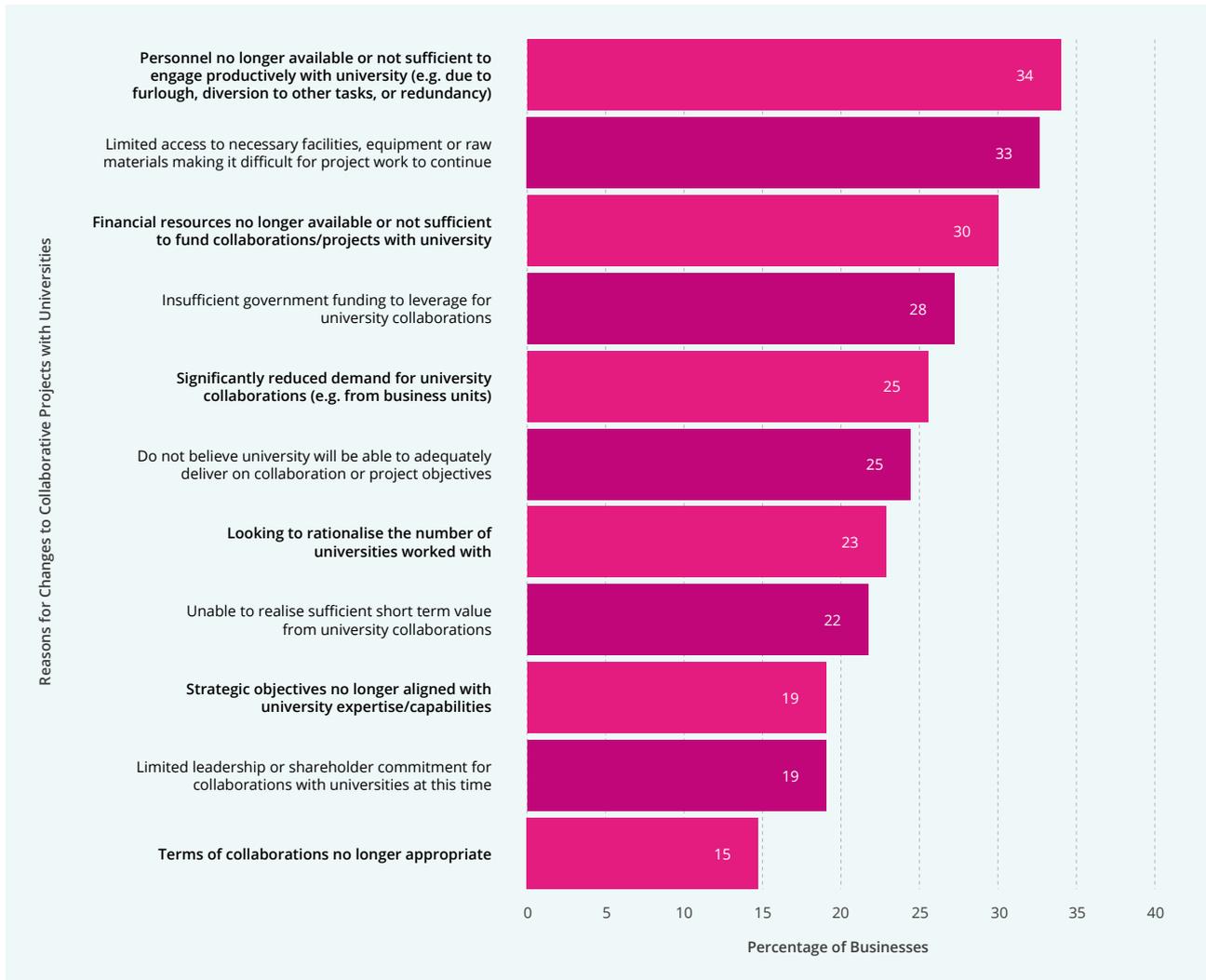


Figure 14 examines the most commonly cited reasons for changes being made to projects with universities or publicly funded research institutes during the pandemic. Perhaps unsurprisingly the most common issues related to access to key resources that underpin interactions: a lack of personnel available to engage productively with a university was cited by over a third (34%) of respondents; 33% reported a lack of access to facilities, equipment and raw materials; and 30% reported that financial resources were no longer available or sufficient to fund the engagements.

²⁴ The UCI/NCUB report: The Effects of the Covid-19 Pandemic on the Ability of Universities to Contribute to Innovation showed a vast majority (88%) of universities experienced declines in innovation-focused activities. These universities reported that a 'significant proportion' (more than 10%) of their innovation projects had been delayed.

Figure 14

Main reasons for changes to projects, activities, and interactions with universities or publicly funded research institutes



Beyond the pressures of finances, personnel and access to facilities, many businesses also reported issues with their ability to realise value from their interactions. A quarter (25%) of businesses made changes to their projects with universities based on a belief that the university would not be able to adequately deliver on project objectives, and 22% claimed that they were unable to realise sufficient short term value from their university collaborations. These results suggest growing concerns from business partners of the need for their university partnerships to deliver tangible value to their organisations in the short term.

Internal demand for collaborations and activities with universities was also affected: a quarter of businesses cited significantly reduced demand for university collaborations (for example, from their business units), while 19% reported that their strategic objectives were no longer aligned to university expertise and capabilities.

The results also show that 28% of businesses cited insufficient government funding to leverage for university collaborations as a key reason for making changes.

There is some evidence to suggest that businesses are choosing to engage more with strategic university partners, and rationalise the number of universities engaged with, with 23% of respondents citing this as a reason for making changes to collaborative projects and activities with universities during the pandemic.



06

FUTURE PLANS FOR INTERNAL AND EXTERNAL ACTIVITIES

Evidence indicates that in past recessions it has taken time for private R&D and innovation investment and activities to recover to pre-crisis levels²⁵. As well as investigating the immediate impacts of the pandemic, we explored businesses' plans for R&D and innovation activities in the year ahead. We asked businesses whether or not they anticipated increasing or decreasing their internal and external R&D activities between September 2020 and August 2021. It is important to note that the survey took place as lockdown measures were easing in September 2020 and, given the subsequent national lockdowns in November 2020 and from 26th December onwards, it is inevitable that businesses' outlook may have since changed.

Figure 15^{26,27} presents a mixed picture. A significant minority (44%) of businesses that had invested in internal R&D prior to the onset of the pandemic stated in September 2020 that they had plans to increase their internal R&D activities in the following 12 months, suggesting some bounce back in this important activity for innovation moving forward. By contrast, 19% planned a decrease and 3% no longer had plans for internal R&D activities at all. However, for many businesses any increase, whether to internal or external R&D, may come off the back of the declines noted earlier in this report.

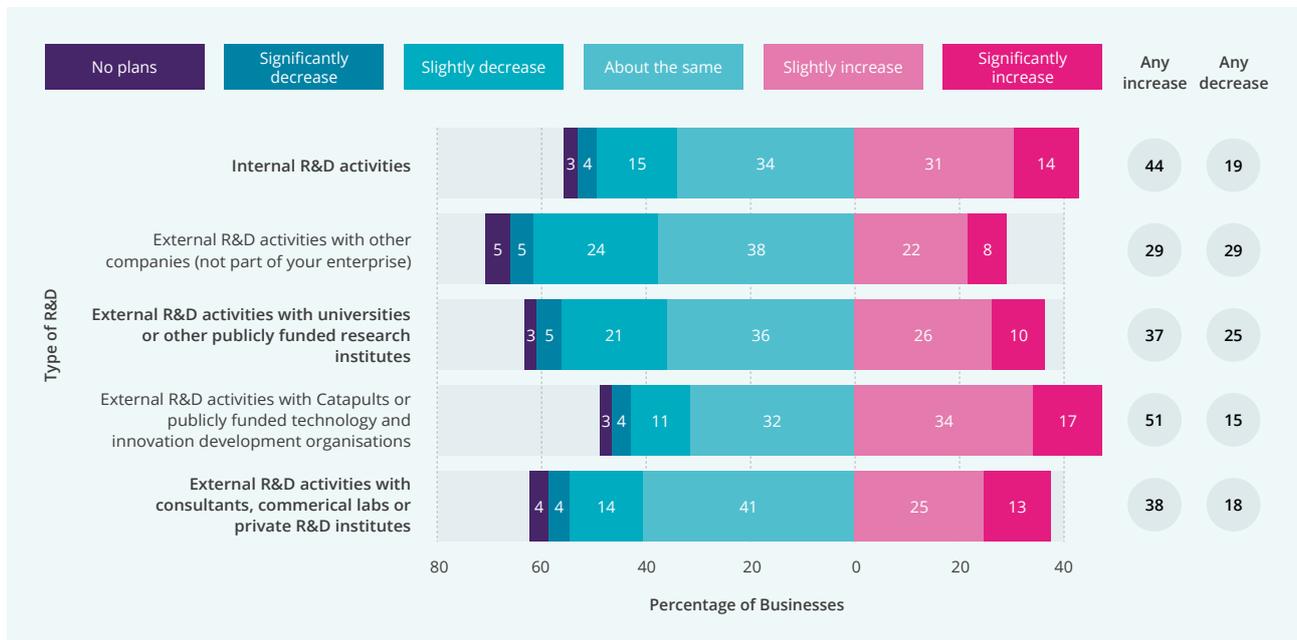
²⁵ Roper, S, Van Reenen, J (2020) "What will coronavirus mean for innovation by firms?", Retrieved from www.economicsobservatory.com/what-will-coronavirus-mean-innovation-firms

²⁶ Figure 15 only includes data on businesses that had taken part in that type of R&D activity in the 12 months prior to March 2020.

²⁷ Percentages presented in Figure 15 may not add up to 100 per cent for each individual category due to rounding all values to the nearest whole number.

Figure 15

Plans for R&D activities over the next year (to August 2021)



This survey provides some evidence that external R&D and innovation activities with universities may take longer than internal R&D to recover. 64% of businesses that engaged with universities and public research institutes before the pandemic did not have plans to increase their R&D and innovation activities with universities in the next 12 months. Amongst those businesses that engaged with universities and institutes in the period before March 2020, just over a quarter planned decreases and 3% had no plans to engage at all in the next 12 months.

The survey also suggests that more businesses are likely to increase R&D and innovation activities with Catapults and other publicly funded technology and innovation development organisations than with universities and publicly funded research institutes. More than half (51%) of businesses that engaged with catapults prior to the pandemic planned increases compared with just 37% of businesses that planned increased activity with universities. 15% of businesses that engaged with catapults prior to the pandemic planned decreases in activity with catapults (compared with 25% of businesses that planned decreases in their activity with universities). This may reflect the acute need for many businesses to focus their R&D efforts on activities and partnerships that deliver value in the short term. It raises important questions for universities as they develop their knowledge exchange portfolios moving forward.

07

CONCLUSIONS

The nation's response to the Covid-19 pandemic has demonstrated how important technology, R&D and innovation is to our society, our health and our economy. It will be as important, if not more so, as we move beyond the pandemic towards economic recovery and start to tackle other urgent global, national and local societal and economic challenges. UK businesses will have to adapt to the new industrial landscape in order to stay competitive in global markets and R&D and innovation will be integral to this process.

This report adds to the growing body of evidence revealing the significant disruption business R&D and innovation activities have faced as a result of the pandemic and the national lockdown imposed to help control the spread of the virus. Worryingly, almost all of the 500 senior business leaders surveyed identified delays and even stoppages to R&D activities in at least one part of their innovation process. Two-thirds identified such effects across all their R&D activities. Most businesses reported that they have chosen to delay, rather than cancel, their R&D and innovation activities so far. For how long this can continue before difficult decisions have to be made on reprioritising or reducing investments is an important question. As we move towards the 2021/22 financial year, and through the next stages of the Covid-19 pandemic, this will need to be monitored closely.

Designing effective policies to deal with the significant disruption caused to R&D and innovation activities that have been felt right across the regions and nations of the UK must recognise the significant challenges that businesses across many sectors were facing prior to the pandemic and which may have been exacerbated by the pandemic today.

In particular, there are three observations to highlight from this survey.

01

Prior to the pandemic, businesses were experiencing both positive and negative factors in the UK R&D and innovation system

Although the immediacy of the pandemic is at the forefront of most minds, it is important to recognise that some businesses were already experiencing both positive and negative factors in conducting R&D and innovation activities in the UK prior to the pandemic, and this needs to be taken into account when assessing the impacts of Covid-19. Where there were challenges, particularly in relation to accessing qualified labour and finance, and with other framework conditions that are conducive to R&D and innovation, will require a long-term strategy that stretches beyond the immediate challenges caused by the pandemic. This includes further work to make it easier for those businesses that currently find it difficult to access or co-develop R&D and innovation projects with universities and other partners in the UK or develop suitable facilities and equipment in the UK for R&D and innovation, or that find the innovation and entrepreneurial culture less conducive to R&D and innovation than elsewhere in the world.

We also need to pay more attention to the ability of businesses to continue developing the outputs emerging from R&D and innovation undertaken in the UK into applications developed in the UK, in other words we need to think much more actively not just about value creation through R&D, but also UK value capture.

02**Product/service demonstration, testing and trial production faced significant disruption**

The report also showed how different types of R&D and innovation activities were disrupted by the pandemic, recognising that the drivers of research are quite different from those shaping development, demonstration and deployment. We show that while disruptions were felt across all types of R&D and innovation activities, it was notable that product/service demonstration and testing and trial production, was most badly affected. By contrast, research was relatively less affected. These results are concerning as product/service demonstration and testing is a critical later stage in the R&D and innovation process and will shape the commercial benefits realised from investments in R&D and wider innovation activities.

03**Recovery may take time, and internal R&D may recover faster than external R&D with universities**

The report also highlights that, for the majority of businesses, easing Covid-19 restrictions will not lead to an immediate recovery in R&D and innovation activities. Rather it is likely that the recovery, as with previous crises, will take time. Indeed as of September 2020, many of the businesses responding to our survey had no plans to increase R&D and innovation spending – internal or external – in the coming year. We also show that it is likely that internal R&D and innovation may recover faster than R&D and innovation investments with universities and other publicly funded research institutes. By contrast, activities with Catapults and other technology and innovation development organisations may bounce back more easily. This fits with the survey findings that Covid-19 had the least impacts on research, and the most impact on nearer to market, commercial products. This provides both an opportunity and a challenge for universities. Many universities are already helping companies to innovate and will need to grow this activity to meet business' needs. Overall, the evidence points to businesses being much more concerned with how to realise value from their R&D and innovation investments in shorter timescales than pre-pandemic.

The disruptions to businesses' R&D and innovation activities caused by the pandemic are widespread and need to be addressed. Realising the important ambitions of the R&D Roadmap, and unlocking the benefits of a knowledge intensive and innovating economy, requires business investment and engagement in R&D and innovation.

It also requires collaboration.

In the months and years ahead, businesses, research performers and government have a critical part to play in setting the future direction of UK R&D and innovation. University leaders should be placing greater emphasis on helping partners to innovate and businesses should be looking to universities for support and ideas.

