THE CENTRE FOR
LONG-TERM RESILIENCE

Growing the UK Bioeconomy

Achieving National Visions in Engineering Biology & Biological Security

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This report aims to generate actionable recommendations that secure long-term growth in the UK bioeconomy while demonstrably improving resilience to biological risks of national security consequences. This report is not a comprehensive treatise on the bioeconomy or biosecurity risks; it is purposefully scoped and may contain oversights. We welcome continued stakeholder input to help capture relevant information and practicable actions that will serve UK national security and economic prosperity interests.

Interviews were conducted across UK academia, industry, and Government departments to identify priority areas for UK Government intervention and to enhance its support of UK-based biotechnology innovation and scale-up. Particular attention was paid to life sciences innovation investment, public-private industry relationships, and technology areas of relevance that will achieve economic growth and increased national resilience.

The views expressed here are those of the authors and do not necessarily reflect the official opinions of interviewees. This report is a synthesis of the insights provided by a range of experts and publicly available reports.

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Oliver Payne, Paul-Enguerrand Fady, Lucy Di Nozzi, Sarah Winthrope and Cassidy Nelson

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EXECUTIVE SUMMARY

The biological threat landscape is becoming increasingly broad and complex. Biological events repeatedly occur; they can undermine national security, military readiness, economic stability and our social fabric. Furthermore, the misuse of technologies can exacerbate such threats, with consequences of national and global proportions. However, **engineering biology and artificial intelligence are technologies with enormous transformative potential for our health, the economy and national resilience. They should be embraced responsibly** to realise the UK's National Vision for Engineering Biology and 2023 Biological Security Strategy. The UK is firmly committed to growing its economy, and its bioeconomy should be a large driver of this aim. Simultaneously, the UK is committed to national security, including protection against biological threats. This report examines activities that can be strategically leveraged to grow the bioeconomy while improving resilience to biosecurity risks.

This report is informed by interviews with leading experts on biosecurity and the bioeconomy from the UK Government, academia, and industry. It makes clear that despite the UK's strong international standing in life science research and the generation of commercial startups, **the UK still suffers from a lack of success in commercial scale-up and a lack of sovereign, large companies.**

The Centre for Long-Term Resilience proposes recommendations that will simultaneously help grow the UK bioeconomy and build national resilience against future biological events:

1. Centralise the Government's external biosecurity funding opportunities into a single hub that industry and academia can readily access.
2. Improve public-private sector partnerships and increase the use of existing, efficient contracting frameworks.
3. Inform and incentivise the NHS and UK industry leaders to support UK life sciences startups, procure strategically and grow larger companies.
4. Convene a UK cross-sector event and identify priority domains of engineering biology for increased UK state investment.
5. Double down on the UK's strengths in genomics and other 'omics' to secure a world-leading economy.
6. Create a UK biotechnology action plan with a strategic focus on the adoption of AI in biotechnology to meet national strategic aims.

These measures directly support the mission-driven Government in achieving two of its five missions (kickstart the economy and build an NHS fit for the future (The Labour Party 2024a)). The Government should seize upon the narrowing window of opportunity to make the UK a bioeconomy world leader and re-commit to biosecurity and engineering biology as national endeavours of strategic priority.

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Introduction

The bioeconomy is an exciting area undergoing rapid growth due to developments in engineering biology. However, the term 'bioeconomy' is extremely broad and can mean different things to different people. This report limits the term to 'economic activity derived from biotechnology and biomanufacturing'. We apply the term to assess activities that increase national resilience to biological risks while simultaneously boosting the UK economy - directly supporting the Government's economic mission, the UK 2023 Biological Security Strategy (BSS) (UK Cabinet Office 2023) and National Vision for Engineering Biology (EngBio):

> **The UK 2023 BSS vision:** "...by 2030, the UK is resilient to a spectrum of biological threats and a world leader in responsible innovation, making a positive impact on global security, economic and health outcomes" (UK Department for Science, Innovation and Technology 2023).
>
> **The UK Government's EngBio vision:** "...for the UK to have a broad, rich engineering biology ecosystem that can safely develop and commercialise the many opportunities to come from the technology and the underlying science" (UK Department for Science, Innovation and Technology 2023).

The **UK Government defines engineering biology as:** "the design, scaling and commercialising of biology-derived products and services that can transform sectors or produce existing products more sustainably. It draws on synthetic biology tools to create the next wave of innovation in the bioeconomy" (UK Department for Science, Innovation and Technology 2023).

As a subcomponent of the greater bioeconomy, **biomanufacturing focuses on:** "integrating biology, automation, computation, and engineering to leverage biological systems to create commercial products at scale" (UK Department for Science, Innovation and Technology 2023).

These definitions apply to a wide range of science and technology, as well as industrial, economic, and societal domains, presenting the UK Government with tremendous choice in transforming the UK's economic prosperity. The UK economy has faced significant shocks in recent years, including the COVID-19 pandemic, reduced investment following the UK's exit from the European Union, high levels of economic uncertainty, and spiralling energy prices following Russia's 2022 large-scale invasion of Ukraine.

While the recovery has started, Britain's economy still faces several challenges; we welcome the Government's forthcoming Industrial Strategy (UK Department of Business and Trade 2024) and willingness to address the fundamental challenges that will lead to increased prosperity and higher living standards. The life sciences is one of the sectors identified in the Government's industrial strategy green paper as offering the highest growth opportunity for the economy and business. The bioeconomy, which encompasses engineering biology and biomanufacturing, falls directly under the life sciences sector.

In this report, we have identified several complementary, actionable recommendations to set the course for a **confident, robust and thriving UK bioeconomy** that is at the forefront of responsible innovation and is geared towards long-term growth.

However, the UK Government has a narrowing window of opportunity to take action and capitalise on opportunities in the biotechnology and biomanufacturing domains to supercharge the UK's industrial base and achieve its economic mission. The United States's bioeconomy (valued at US$1 trillion) is predicted to grow to more than US$30 trillion globally over the next 20 years (Attal-Juncqua et al. 2023). The last (now withdrawn) UK Government bioeconomy strategy, 'Growing the Bioeconomy', forecasted that "the annual turnover of the UK industrial biotechnology and bioenergy sectors" would almost triple between 2013 and 2035 (HM Government 2024). The EngBio vision published under the last Government committed to investing £2 billion over the next 10 years in research and development (UK Department for Science, Innovation and Technology 2023). At the time of writing, the Government has not yet reconfirmed this commitment.

More than 50 other nations have published bioeconomy strategies and are making engineering biology a strategic priority (Gardossi et al. 2023; Freemont et al. 2024). This global momentum and competition, coupled with concerning trends in biological risks, demand that the UK Government act swiftly to provide renewed commitments, leadership, guidance and judicious state-level intervention to secure long-term economic prosperity and national resilience.

The urgency of establishing a robust, agile, and growing UK bioeconomy cannot be overstated. Acting now will enable the establishment and scaling of much-needed, next-generation manufacturing capabilities in the near term. The recent decision by AstraZeneca to not invest in a £450 million vaccine plant in the UK (Gross and Kuchler 2025) highlights the importance of working more effectively with industry to secure and generate manufacturing scale-up, directly relevant to high-growth sectors. This is especially relevant in light of news that other nations, such as Spain and Germany, have successfully established vaccine plants with Britain's largest listed company (Gross et al. 2025).

While biological outbreaks of high consequence, such as COVID-19, Ebola and Influenza (H1N1, H5N1), may not be eliminated outright, embracing the potential of engineering biology and biomanufacturing technologies is a prudent, cost-effective way to mitigate disease outbreaks from becoming mass-casualty, national, or pandemic-level events.

Scope and limitations

This report was purposefully limited to ensure appropriate resources were available to support the work while adding maximum value. It has also sought to avoid duplication with other prominent works (House of Lords Science and Technology Committee 2025; Southwood et al. 2024; UK Health Security Agency 2024; Macon-Cooney et al. 2024; BVCA 2024) where possible. Whilst we recognise that investment into the bioeconomy needs to be underpinned by broader investment in infrastructure, energy supply, skills and career pipelines, industrial and domestic housing, etc., this is reported elsewhere (Southwood et al. 2024; House of Lords Science and Technology Committee 2025) so these topics have been omitted.

The scope of this work is limited to:

1. Examining the effectiveness of existing innovation funding streams.
2. Investigating the retention and scale-up of existing commercial UK startups.

3. Identifying specific existing biotechnology areas of strength for increased UK state investment that best serve national security resilience and economic prosperity purposes.

Risks and opportunities

The biological threat landscape is becoming increasingly broad and complex. Incidences of infectious disease outbreaks (e.g., coronavirus, Mpox, Marburg (US Centers for Disease Control and Prevention 2025; UK Health Security Agency 2025), increased spillover risk of zoonotic diseases (H5N1 (CEPI 2024)), and rising antimicrobial resistance (World Health Organisation 2023) are all evidence of biological risks increasing and, in some cases, being realised with disturbing regularity. In addition, the (intentional or unintentional) misuse of new technologies may generate new threats with increased potential for consequences of global proportion.

Rising human migration, increasing encroachment into natural habitats, and reduced biodiversity are all trends contributing to the increased likelihood of new pandemics and economic shocks occurring. Pandemics are one of the most serious risks facing the UK, as the experience of COVID-19 has shown us, and they remain one of the most serious national security risks facing us, as captured in the 2025 National Risk Register (HM Government 2025). As outlined by the COVID-19 Inquiry, lessons from the previous pandemic must be learned (Hallett 2024). Recommended actions should be applied promptly to ensure the UK can withstand and recover more efficiently from future pandemic-level events. This includes reducing bureaucracy in how the Government prepares for and responds to biosecurity threats, increasing our industrial capacity and strengthening our onshored capabilities.

At a time of growing consensus on the increasing risks of biological threats across the deliberate, accidental, and naturally occurring spectrum, harnessing engineering biology and biomanufacturing provides an unparalleled opportunity to address a broader range of biological threats more rapidly than current processes afford. Simultaneously, this offers the opportunity to address these threats in a way that is hardwired to boost the economy. A bioeconomy that is resilient to strategic shocks and globally competitive is an economy that has security interwoven as part of its economic fabric.

We present options for the Government to capitalise on the UK's strengths within the life sciences sector and hardwire economic growth into measures that increase national resilience to biological threats. The UK has a unique legacy of thought leadership, discovery, and expertise in biological sciences, from the theory of evolution to the discovery of penicillin and the structure of DNA, as well as more recent advances in fields such as genomics and mRNA vaccines.
With biotechnologies rapidly evolving in scale and complexity - and our adversaries innovating just as quickly - the UK Government, in collaboration with industry and academia, must remain committed to leveraging innovations for societal security and prosperity.

Embracing responsible innovation and committing to the bioeconomy through targeted, judicious state interventions and investment will demonstrate that the UK values innovation and national security. However, only through swift action will the UK's world-renowned strengths in the life sciences sector be unlocked to generate its enormous economic potential.

Report methodology

Evidence for this report was gathered primarily through:

Desktop research: A thorough review of the literature was conducted, taking into account publications by relevant UK Government departments, national strategies, inquiries, academic articles, conference papers, trade association publications, third-party private sector analyses, and press articles from mainstream media and specialised biotechnology publications.

A structured questionnaire: An online form was generated to elicit cross-sector insights into bioeconomic and biosecurity-related challenges and priorities and to identify areas where Government intervention would best stimulate economic growth and increase resilience. However, several stakeholders preferred to provide information during interviews.

Interviews: A series of online and face-to-face interviews were conducted with experts from industry, academia, Government departments, and the third sector. Discussions covered the questionnaire contents and provided additional sector experience and insight.

No claim made by individual participants is attributed (as agreed with participants during the data collection process). References have been provided where claims reflect publicly available evidence.

Recommendations

After synthesising the information collected through desktop research, interviews and a structured questionnaire, and analysing repeated themes, six recommendations for the UK Government emerged as detailed below:

Recommendation 1 - Centralise the Government's external biosecurity funding opportunities into a single hub that industry and academia can readily access.
Experts from across sectors repeatedly highlighted that visibility and clarity on the Government's priority biosecurity challenges and the full range of funding opportunities was a situational awareness pinch point. Using the BSS coordination function, the Cabinet Office should cohere this information into a single hub that industry and academia can readily access. This recommendation requires no new capital investment money in and of itself. Instead, it makes more efficient use of existing information and funding streams. Communicating the launch of this central hub effectively will generate broader industry input to solving biosecurity challenges and enhance the value for money of UK Government investments.

Rationale

For the Government to best leverage the innovative solutions that industry can provide in overcoming national biosecurity challenges, UK industry needs to be informed about the Government's external priority challenges and efficiently signposted to the relevant innovation funding streams. Such information remains disparate and scattered across multiple websites with little or no interconnectivity. Aside from input from relevant experts citing situational awareness as a pinch point during interviews, we separately identified at least nine different UK Government departmental strategies containing overlapping interests in biotechnologies and biological security (see **Figure 1**) and at least twelve different UK innovation funding entities or initiatives of relevance to biotechnology, biomanufacturing or biosecurity (see **Figure 2**). This excludes other international charitable grant funders who work with the UK Government (e.g., the Wellcome Trust) to generate breakthroughs in biosecurity areas such as infectious disease.

Figure 1: UK Strategies*: the UK Biological Security Strategy (2023), EngBio vision (2023), the UKHSA Science Strategy (2023-2033), the UKHSA Pathogen Genomics Strategy (2024), Accelerating genomic medicine in the NHS (2022-2027), the Animal and Plant Health Agency (APHA) science strategy (2021-2026), the National Food Strategy (2021), Defence Industrial Strategy (2021), Defra digital and data transformation strategy (2023 to 2030).*

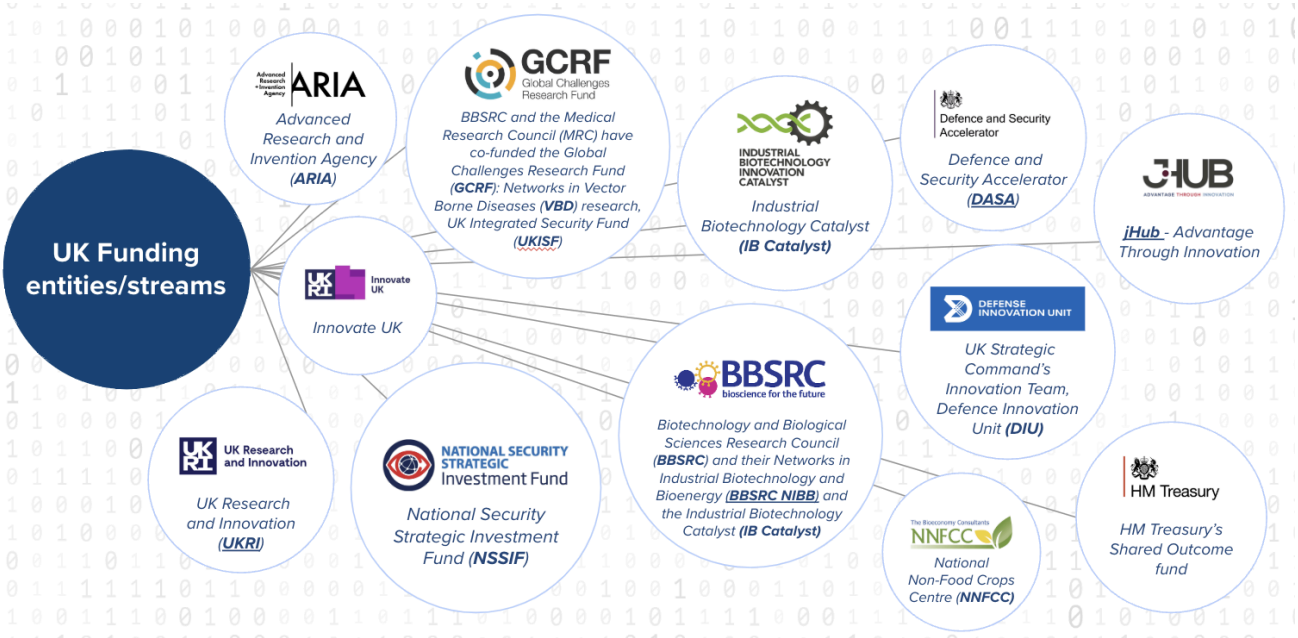

Figure 2: UK Funding entities/streams: *Advanced Research and Invention Agency (ARIA), Defence and Security Accelerator (DASA), UK Research and Innovation (UKRI); the National Non-Food Crops Centre (NNFCC), the Industrial Biotechnology Innovation Catalyst (IBIC), Biotechnology and Biological Sciences Research Council (BBSRC) and their Networks in Industrial Biotechnology and Bioenergy (BBSRC NIBB) the BBSRC and the Medical Research Council (MRC) have co-funded the Global Challenges Research Fund (GCRF): Networks in Vector Borne Diseases (VBD) research, UK Integrated Security Fund (UKISF), HM Treasury's Shared Outcome fund, National Security Strategic Innovation Fund (NSSIF), jHub - Advantage Through Innovation; UK Strategic Command's Innovation Team, Defence Innovation Unit (DIU), Innovate UK.*

Navigating these various entities, their visions and challenges, and synthesising them into the highest-priority challenges that meet national security aims is complex and opaque. We recommend that the UK Government use the coordination function within the BSS to collate the overlapping challenge requirements of biosecurity-relevant strategies and visions into a single hub alongside the associated innovation funds. This could also include the integration of relevant departmental Areas of Research Interest (ARIs). Collating this information into a single hub will provide a powerful forum through which wider industry and academia can access, navigate and respond to the Government's needs.

The Cabinet Office should widely communicate this new enterprise to reach the largest number of industry and academic innovators who can meet its challenges. This recommendation does not require new capital investment money. Instead, it will make more efficient use of existing funding streams and likely enhance the value of the money the UK Government invests.

The Government also needs to demonstrate that it is a good customer by clearly showing that there is a pathway to scale up from innovation-level funding with the Government through to larger HMG contracts, should any commercial enterprise be successful in meeting a Government innovation challenge. This will be addressed in **Recommendation 2** and **Recommendation 3**.

Recommendation 2 - Improve public-private sector partnerships and increase the use of existing, efficient contracting frameworks.

More effective private-public sector partnerships are needed for the Government to accelerate the delivery of strategies and achieve its economic prosperity mission. There already exists efficient contracting frameworks for industry to work with the Government on matters of national security importance. These should be more widely adopted to make best use of the vast resources available in the private sector of the life sciences. The Defence and Security Accelerator (DASA) is one proven model for launching biosecurity-related challenge competitions and rapidly placing contracts efficiently and equitably; it does not disadvantage smaller enterprises from entering during competition callouts. Additionally, a secure, trusted commercial supplier system (e.g., 'R-Cloud') should be more widely rolled out to expand the private sector community upon which the Government can call, to meet biological security strategy and engineering biology challenges.

Rationale

With the civil service under increasing pressure to cut jobs, find efficiencies and reduce waste in spending (Mason 2024), more effective private-public sector partnerships are needed for the Government to achieve its economic mission and national security aims. Experts interviewed repeatedly highlighted the importance of aligning industry and academia with the Government's priorities. Specific references to improving clarity on how BSS outcomes will be delivered were also mentioned.

Forging closer working public-private sector relationships, where responsible innovation and national security issues may be discussed securely, will improve the effectiveness of these relationships and will likely become increasingly relevant to mitigating threats, as well as delivering economic prosperity.

The increased adoption of existing, trusted public-private sector frameworks is one viable mechanism through which commercial entities can deliver outputs aligned with national priorities. The BSS contains 15 outcomes and three strategic enablers, all of which require varying degrees of industry involvement to deliver real-world prosperity and security.

Not all BSS outcomes will be delivered in the same way or will have the same draw upon Government or private resources. However, adopting a sliding scale approach for private sector involvement in delivery and oversight is a method that would allow the Government to maximise efficient use of its limited civil service resources (see **Figure 3**). The Government should adopt this approach to identify where each of the 15 BSS outcomes sits on the scale for implementation, providing clarity to those who lead and those who support delivery. Where the Government identifies cross-cutting functions, outcomes, or dependencies (e.g., data fusion and knowledge management) HMG must prioritise its resources and take on higher levels of responsibility for governance and delivery. Establishing precise BSS outcome requirements will help ensure any capabilities developed are fit for purpose, mitigating scope creep and enabling the Government to hold those who lead on outcome delivery accountable.

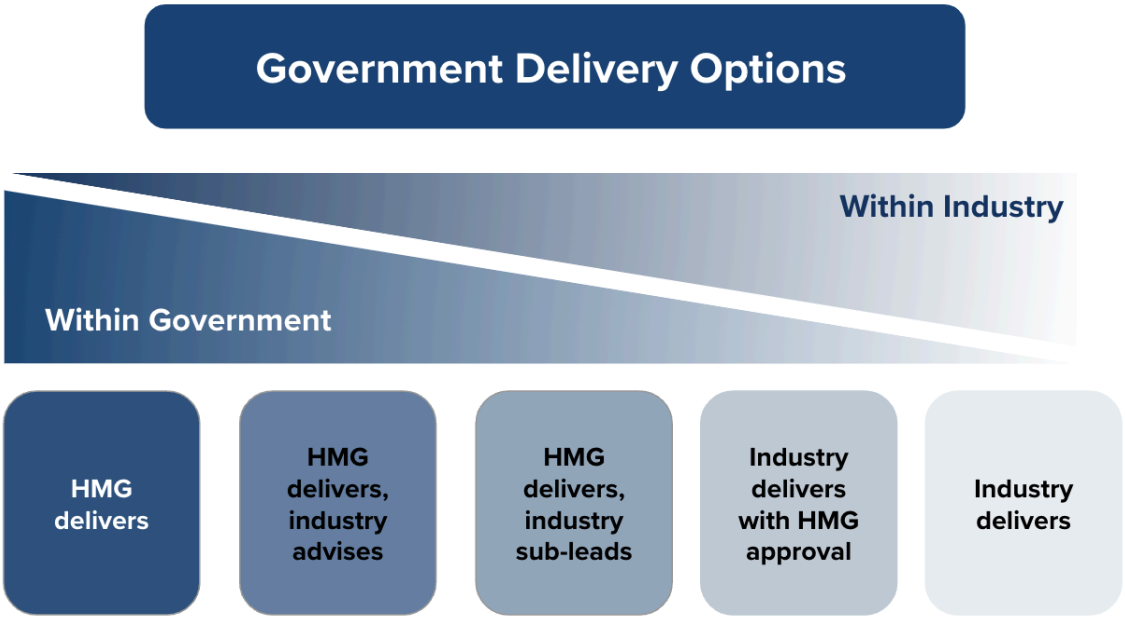

Figure 3: Illustration of a sliding scale approach to industry involvement in delivering the 15 BSS outcomes

The Defence and Security Accelerator (DASA) is a proven, trusted and expedient model that enables the rapid contracting of industry and academia to meet UK Government challenges. Additionally, the model does not disadvantage smaller enterprises from entering Government-led competition callouts. The Defense Science and Technology Laboratory runs the 'R-Cloud' system on behalf of the Ministry of Defence (MOD), which provides defence with a trusted cohort of suppliers to address security challenges. This ranges from non-traditional defence suppliers, micro-businesses, small to medium-sized enterprises (SMEs), and academic institutions to large organisations.

In conjunction with an R-Cloud type system (Defense Science and Technology Laboratory 2022), a DASA-type model should be more widely rolled out to generate an extensive, trusted industry and academic community from which the Government can rapidly contract to meet One Health biosecurity-related needs. This would be an influential convening forum through which industry, academia and the third sector could tackle the widest number of biosecurity issues. This systems approach would also facilitate an environment where confidential public-private conversations may be held to address national security concerns and align industry with UK strategic priorities.

Recommendation 3 - Inform and incentivise the NHS and UK industry leaders to support UK life sciences startups, procure strategically and grow larger companies.

Whilst the Government cannot directly force private businesses to make specific decisions, it can inform and incentivise UK industry leaders and the NHS to make strategic procurements and foster the growth of UK startups into larger entities. The NHS holds significant procurement power, which should be better leveraged to sustain and grow commercial entities that serve commercial national health requirements during business as usual but may rapidly modify products for biological crisis response. Temporary, catalytic Government support will help scale up these industries, creating a globally competitive bioeconomy and an increasingly agile NHS that is more resilient to crises.

Rationale

The UK is widely recognised as the most attractive startup ecosystem for biotechnology in Europe (McKinsey & Company 2021) and the world's second most attractive startup ecosystem for biotechnology companies behind the United States. UK biotechnology companies' share price increases are larger than the United States' or Europe's, and the UK produces many startups, which larger American corporations subsequently acquire (McKinsey & Company 2021). However, multiple sources ((Nguyen 2023; Macon-Cooney et al. 2024; ARC 2024), including experts interviewed within industry, make it abundantly clear there remains a long-standing and worsening lack of UK success in scaling up and retaining these commercial startups. There were no life sciences initial public offerings (IPOs) in the UK in 2023, compared to nine IPOs in 2021. Whilst other countries have also experienced similar declines, the United States and China have retained their lead, and this shortage of IPO activity strongly indicates limited scale-up opportunities for UK biotechnology startups (Nguyen 2023).

Furthermore, the increasing shortfall of UK investment at and above the £50 million mark makes for stark reading. As of 2023, 94.3% of deals over £50m involved foreign investors, compared to 89.7% (2019-2023 average). For smaller deals (£20m-£50m), foreign involvement was 87.1% of deal value in 2023, compared to 80.1% (2019-2023 average) (BVCA 2024). The recent House of Lords Science and Technology Committee report further articulates the issue and need for increased capital investment to overcome challenges in scaling the UK life sciences economy (House of Lords Science and Technology Committee 2025).

Informed risk appetite and capital investment are the primary routes to changing this decline in UK-based growth. However, more intelligent use of existing, large, UK-based entities also provides an affordable solution to successfully scale up UK startups and SMEs. Other economic sectors, such as UK aerospace engineering, make excellent use of large UK companies which are adept at investing in smaller UK companies and scaling them up. Large companies in this sector have also helped HMG exploit economic opportunities, producing a white paper on solution options for scale-up of UK Industry (BAE Systems 2022). This approach should be encouraged and adopted within the life sciences sector, as those who excel at innovation may not be the best equipped to scale up. This partnering of SMEs with higher-tier companies who have experience working in the sector is also being used in defence (Defence and Security Accelerator 2024), and this model should be applied to the bioeconomy.

Thanks to its public health system, the UK is uniquely positioned to foster meaningful growth and scaling up of novel biotechnology companies. In its own words, the NHS "is one of the biggest commercial organisations in the country, buying on behalf of the fifth biggest employer in the world" (NHS England). In concrete terms, this means the organisation "collectively spends approximately £8 billion annually on buying medical equipment and consumables, from gloves and paper to stents and prosthetic hips" (House of Commons Committee of Public Accounts 2024).

The Government has an opportunity to leverage an approach that encourages investment into UK-based biotechnologies in a manner that benefits society and homeland security. This would increase the proportion of technologies and products - for instance, sequencing-based diagnostics - developed and manufactured in the UK and used within the NHS. This incentive structure would provide impetus for further development of domestic manufacturing, whether by British or foreign innovators. Integrating novel technologies as part of dedicated 'testbed' sites could also help small and medium enterprises scale the production of their technologies and trial them in real-world conditions prior to broader rollout.

This would require creative regulatory approaches to promote a pipeline unhindered by pre-existing frameworks but would ultimately embolden innovation and provide investor confidence for SMEs to grow. Informing the NHS, and connecting them with UK-based companies who can innovate in manufacturing and deliver products (e.g., lateral flow devices for business-as-usual purposes (Gates Foundation 2022; CBInsight 2025)), which the NHS has a clear demand for (e.g., seasonal flu or sexually transmitted infections), creates an economic environment in which UK companies can develop and scale production. Utilising the NHS's scale and budget to incubate such companies has the added benefit of retaining UK-onshored capabilities that can be readily repurposed and scaled to address specific needs in the event of a new disease outbreak.

In addition, HMG recognises that security, trade, and foreign policy objectives can mutually reinforce one another. Through international development spending, the Government can improve security and resilience for partner countries and create new markets and opportunities for UK businesses. More effectively utilising the NHS and UK industry to support HMG's security and resilience capability delivery could benefit UK prosperity through future commercial exports. The UK bioeconomy holds enormous potential for increased global competitiveness and trade growth, with the opportunity to displace reliance upon sole-nation providers of health-related products. By enhancing public-private sector partnerships and launching new initiatives for scaling up manufacturing, the UK will foster a robust and worthwhile total addressable market in which to invest.

Recommendation 4 - Convene a UK cross-sector event and identify priority domains of engineering biology for increased UK state investment.

A UK cross-sector event should be convened in 2025 to identify and agree on priority domains for increased state investment to best serve BSS outcomes while boosting the economy. The event should include the attendance of the Government's Chief Scientific Advisor, Minister of State for Science, Research and Innovation, Minister for AI and Digital Government, Representation from National Wealth Fund, Department for Science, Innovation & Technology (DSIT), Department for Health and Social Care (DHSC), MOD, Department for Environment, Food and Rural Affairs (Defra), Animal and Plant Health Agency (APHA), Senior Responsible Owner of the Biological Security Strategy (BSS), as well as representation from the House of Lords, the Biotechnology Industry Association (BIA), the Engineering Biology Advisory Panel, the Responsible Innovation Advisory Panel (RIAP), the Wellcome Trust, the Biotechnology and Biological Science Research Council (BBSRC) and UK Research and Innovation (UKRI).

Rationale

As previously mentioned, UK-based investment remains lacking for scaling up commercial entities and the UK is experiencing a decline in inward life sciences foreign direct investment (see **Figure 4**). Furthermore, the UK ranked eighth amongst comparator nations in 2023, which suggests a weak position in attracting late-stage international capital (Nguyen 2023).

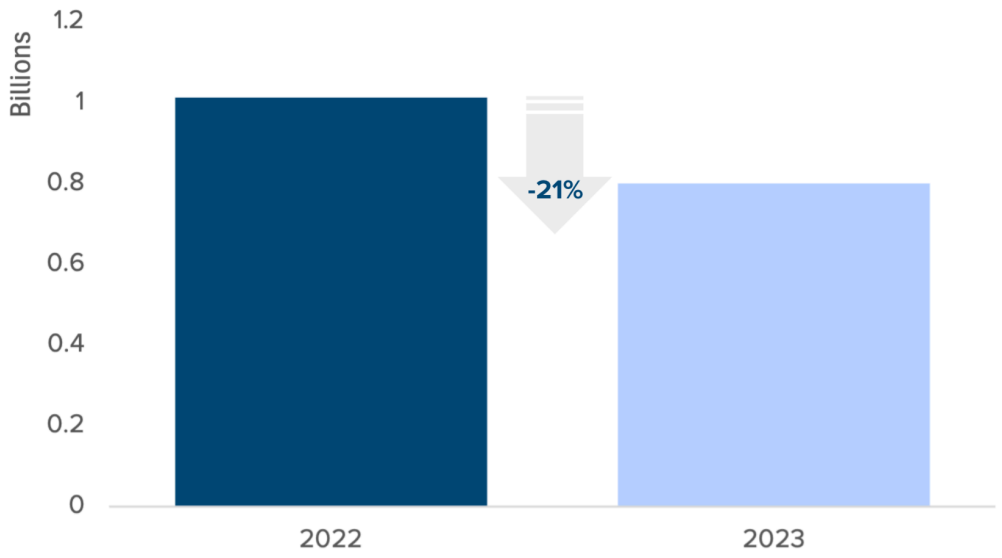

Figure 4: Inward life sciences foreign direct investment in 2023 compared to 2022.

The UK life sciences sector has been experiencing year-on-year decreases in raising equity finance since 2021 (see **Figure 5**), and whilst the UK ranked third in 2023 (behind the United States of America and China), this decline, coupled with a lack of UK-based investment, highlights the need to respond to these alarming trends.

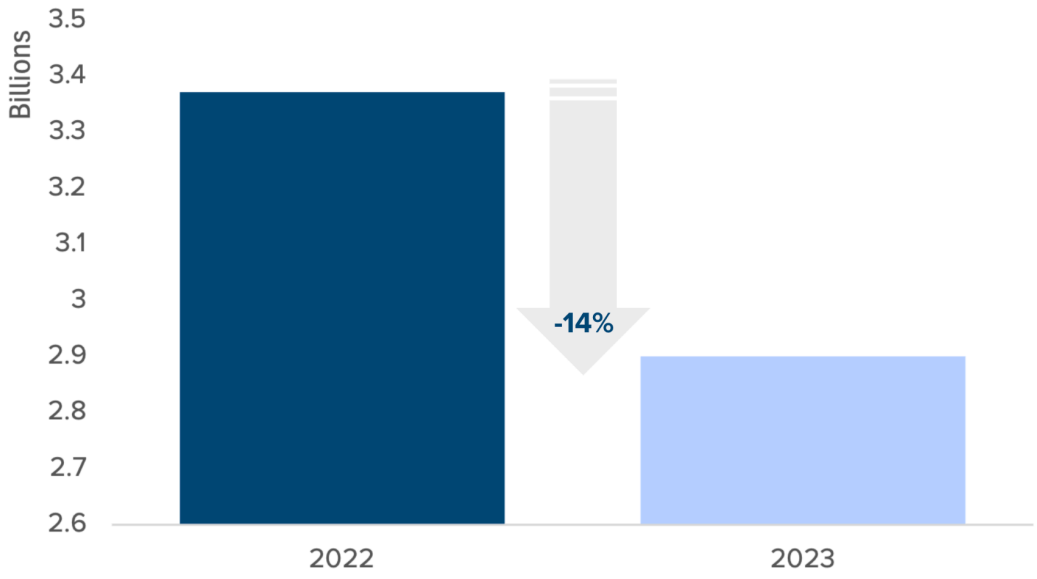

Figure 5: Decrease of equity finance raised in UK life sciences sector

Targeted HMG intervention and state investment are needed to bridge this well-trodden 'valley of death' to generate long-term economic growth in the bioeconomy. We both welcome the Government's mission of economic growth (GOV.UK) and recognise it has finite resources to invest. Therefore, we recommend convening a UK cross-sector event as early as practicable in 2025, aiming to reach a consensus on priority domains within engineering biology and biomanufacturing that should receive state-level investment. This selection process should factor in capabilities and technologies directly relevant to biosecurity applications, economic market potential, and demand. In exceptional circumstances, this may even include identifying current UK commercial entities that should be subject to UK state-level investment instead of foreign direct investment support and scale-up, where they are deemed vital to national security and sovereign capability.

Recommendation 5 - Double down on the UK's strengths in genomics and other 'omics' to secure a world-leading economy.

Experts across all sectors frequently cited the UK's world-leading capabilities in genomics as crucial to building future bioeconomic success and achieving biosecurity commitments under the One Health approach. The Government should capitalise on this specialist area of UK strength and intervene to secure talent and grow capabilities in the 'omics' space. The applications of omics-based technologies are already widespread, spanning medicine, agriculture, biosecurity, etc. Their importance in pathogen surveillance, health and environmental monitoring makes this biotechnology a clear candidate for targeted Government uplift.

Rationale

The UK genomics sector is thriving, with a projected market cap of £50 billion by 2040 (UK BioIndustry Association 2023). The UK is a global leader in genomics research and innovation with world-class research infrastructure. It has spearheaded numerous landmark initiatives like the 100,000 Genomes Project, UK BioBank, Our Future Health, and the NHS Genomic Medicine Service. These projects have led to new diagnoses for patients and the integration of cutting-edge genomics research into routine health care (Genomics England 2025), aligning with the Government's mission to build an NHS fit for the future.

During the COVID-19 pandemic, the UK's genomics capabilities shone, through the COVID-19 Genomics UK Consortium (COG-UK), which helped the UK contribute ~20% of all global SARS-CoV-2 genome sequences (Peacock 2023). The £32.2M invested in COG-UK generated an invaluable dataset of ~1 million viral genomes by 2021. Coupled with other UK sequencing efforts this enabled real-time tracking of COVID-19 variants, informed public health efforts and will remain useful to health professionals for decades to come.

The UK's genomics sector also has immense potential to drive further economic growth and improved healthcare outcomes. The main challenge lies in scaling up these successes to maintain the UK's status as a genomics superpower.

The UK's experience of conducting landmark initiatives, coupled with advanced research facilities and associated technologies (e.g., computational tools and high-throughput sequencing), places it in a strong position for leveraging new, cutting-edge, applied research in omics, such as genomics, transcriptomics, proteomics, and metagenomics. This field of science is integral to developing biosurveillance tools, vaccines and therapeutics against biological threats.

Biological surveillance will be crucial as part of an integrated early warning system in rapidly identifying future disease outbreaks and reducing the likelihood and impact of diseases becoming pandemic-level events. Cross-sector experts identified genomics and other 'omics' as high-priority areas for investment that will benefit ongoing biosecurity efforts. They also emphasised the importance of capitalising upon the UK's strong foundations and investing in maintaining a world-class status in research and generating UK-based omics-based capabilities that deliver biosecurity and economic benefits.

The exploitation of omics technologies will be critical to successfully delivering all three outcomes within the Detect Pillar of the BSS: Outcome 9 - “A national biosurveillance network engendering a One Health approach”; Outcome 10 - “Enhanced capability to rapidly roll out diagnostics for population use in response to new or existing biological threats”; Outcome 11 - “A strengthened national microbial forensics capability”(UK Cabinet Office 2023). Investing in these biotechnologies and adopting a One Health approach to secure biosecurity for humans, plants, animals, and the environment will ensure the UK increases its resilience to strategic shocks such as long-term trends in climate change and disease outbreaks.

Recommendation 6 - Create a UK Biotechnology Action Plan with a strategic focus on the adoption of AI in Biotechnology to meet national strategic aims

Biotechnology is a rapidly expanding field and is becoming increasingly intertwined with advances in artificial intelligence (AI) and machine learning. Building better defensive technology to tackle some of the biggest threats we face (such as pandemics) should be a national priority. In particular, the power of AI should be leveraged for developments in rapid diagnostics, drug discovery, vaccine development, biosurveillance anomaly detection, personal protective equipment, microbial forensics, and biosecurity-relevant data integration and management. However, given the dual-use nature of growing capabilities in engineered biology, the misuse risks from AI need to be thoroughly assessed and managed (Moulange et al. 2024; Rose et al. 2023; Smith et al. 2023). We recommend that the Government consult with relevant cross-sector experts to generate a long-term strategy for AI in UK biotechnology and life sciences. The accompanying 'Biotechnology Action Plan: Government Response' should address these key touchpoints, including guidance on responsible innovation and data-sharing legislation.

Artificial intelligence (AI) and machine learning are catalytic drivers of capability leaps in the UK bioeconomy. In 2025, it has never been easier to manipulate biology for an increasingly long list of applications. For example, AlphaFold3 by Google DeepMind can accurately predict the structures of proteins and their interactions, unlocking significant advances in the understanding of biology and therapeutic development (Abramson et al. 2024). However, AI is a dual-use technology: capability leaps that benefit society and defensive actors can also enable threat actors. The positive developments need to be leveraged while safeguarding against potential misuse risks. The UK Government, with its commitment to responsible innovation, is well positioned to adopt a defensive acceleration position: purposely setting out to build technology that protects the nation from biological threats (Clifford 2024).

The amount of data generated within the life sciences is astounding in complexity and size. Accessing high-quality, curated datasets is both an enabler and a limiting factor within AI-enabled biology. The sharing and accessing of biological data across Government departments for biosecurity purposes remains highly challenging. Whilst AI can revolutionise biosecurity-relevant technologies and capabilities through enhanced detection, analysis, decision support and response to biological events, no Government strategy specifically addresses the integration of AI with biotechnology. The Government has published an 'AI Opportunities Action Plan: Government Response (2025)' (Department of Science Innovation and Technology 2025) however, it does not provide details on leveraging AI in the life sciences. A recent House of Lords report on AI and creative technology scale-ups (House of Lords Science and Technology Committee 2025) provides valuable information on the cross-cutting barriers and solutions to industry scale-up but does not address the integration of AI in the life sciences, which will require a nuanced approach. Entities such as UKRI and the BBSRC support the development of new AI approaches relevant to biological sciences including the application or adaptation of existing AI approaches (UK Research and Innovation 2024). This includes assessing:

- Convergence with other technologies (e.g., engineering biology, omics and bio-imaging).

- Responsible research and innovation in bioscience (for instance, the need for AI applications that are secure, safe, reliable, and operate in a way we can all understand and that we can investigate if they fail).

We recommend the Government publish a ‘Biotechnology Action Plan: Government Response’ which describes how AI and biotechnology will converge and be integrated for strategic economic and security benefits. In line with the UK’s longstanding commitment to responsible innovation, we recommend that the risks of AI in the life sciences be thoroughly assessed, and proportional mitigation measures should be taken where appropriate.

Conclusion

The 2024 Labour manifesto states:

> "The world has become increasingly volatile, with a major war in Europe for the first time in a generation and ever greater threats to the living standards of working people. This 'age of insecurity' requires the Government to step up, not stand aside.
>
> This means a return to the foundations of good government: **national security**, secure borders, and **economic stability**. But it also requires an **enduring partnership with business to deliver the economic growth we need**. It needs **more focus on long-term strategy…"** (The Labour Party 2024b).

Biosecurity is a matter of national security, and the bioeconomy is directly tied to broader economic prosperity and improved living standards for all. These two areas, biosecurity and bioeconomy, are intimately linked. A bioeconomy with biosecurity hardwired into it is geared toward resilience to strategic shocks and is postured for long-term stability. In this report, we have distilled a limited set of recommendations to help generate long-term bioeconomic growth and resilience to the next large-scale biological event. These recommendations are not exhaustive; they complement other report recommendations on the bioeconomy and aim to help the UK Government achieve its prosperity and national security goals.

We recommend the UK Government:

1. Centralise the Government's external biosecurity challenges and funding opportunities into a single hub that industry and academia can readily access.
2. Improve public-private sector partnerships and increase the use of existing, efficient contracting frameworks.
3. Inform and incentivise UK industry leaders and the NHS to procure strategically, support UK life sciences startups and grow larger companies.
4. Convene a UK cross-sector event and identify priority domains of engineering biology for increased UK state investment.
5. Double down on the UK's strengths in genomics and other 'omic' sciences to secure economic leadership.
6. Generate a long-term defensive acceleration strategy for UK adoption of AI in biotechnology and create a 'Bioeconomy Action Plan: Government Response'.

Prosperity is intrinsically vital to the quality of life; it gives people security and dignity, leisure and comfort, opportunity and economic freedom. It also allows us to lead the way in world-changing scientific endeavours, such as engineering biology, to create a safer world where diseases are more easily managed and people can flourish.

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