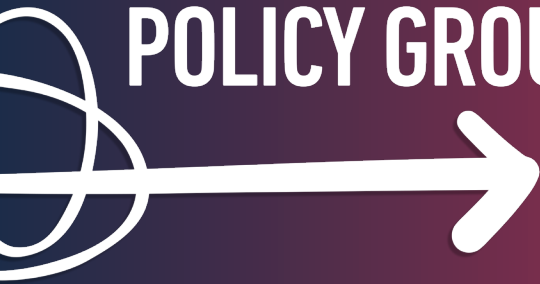


**COMMON SENSE  
POLICY GROUP**



**Northumbria  
University  
NEWCASTLE**



Non-Animal New Approach Methodologies  
(NAMs): More effective, more ethical and  
more economically productive

A Common Sense business case commissioned by Lush



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# About the Common Sense Policy Group

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The Common Sense Policy Group, based at Northumbria University, produces cutting-edge research, analysis and tools to underpin domestic policymaking. Its economic modelling expertise underpins its work as it makes the case for progressive, redistributive policy that addresses the multiple crises facing the UK. It undertakes consultancy aligned with these aims.

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# A Five-Minute Common Sense Summary

In November 2025, the Government published its *Replacing animals in science* strategy.<sup>1</sup> It stated that it will ‘create a revolutionary research and innovation system that replaces animals with alternative methods wherever possible’, bringing ‘clear benefits for animal welfare and a host of economic and scientific impacts, through leveraging the UK’s strong science base’ and that the strategy ‘marks a step-change in placing the UK at the forefront of international efforts to drive this crucial and exciting agenda.’ This report identifies some of those benefits by examining the UK’s Non-Animal New Approach Methodologies (NAMs) sector. NAMs refer to ‘full and partial replacement approaches for assessing chemical or drug toxicity data’<sup>2</sup> compared to existing animal-based methods.

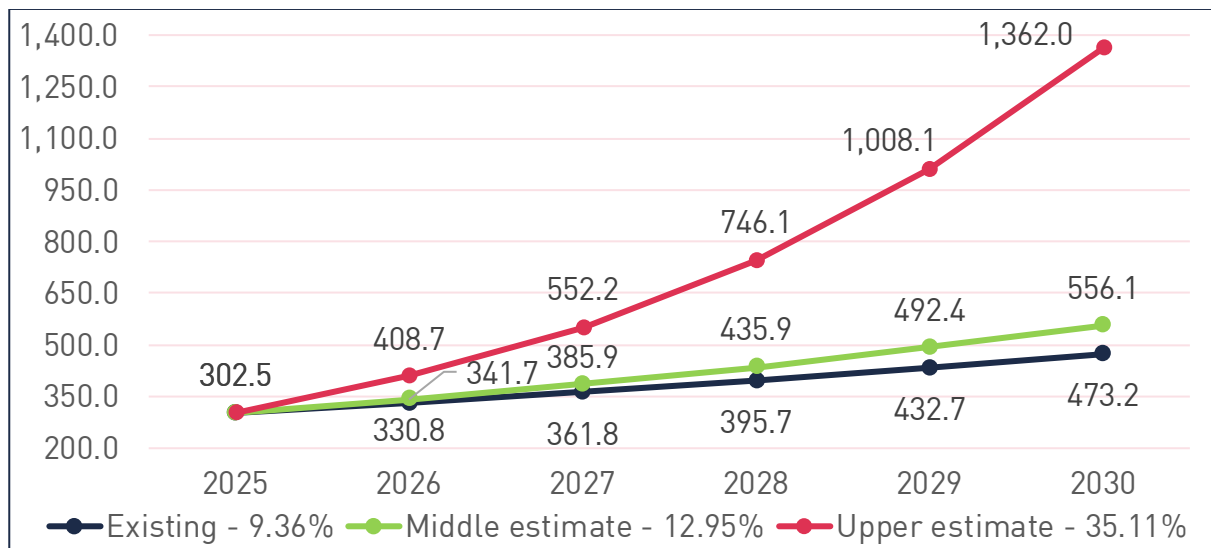
Our economic assessment of the commercial sector based on a 75-company list and using Companies House<sup>3</sup> and Annual Business Survey<sup>4</sup> data finds that from 2021-24:

- Turnover (from £947 million to £1.24 billion) and GVA (from £212 to £277 million) both grew by the equivalent of 9.4% per year.
- Employee numbers grew by 12.8% per year (CAGR), from 4,209 to 6,037.
- Overall cost of employment grew by 8.4% per year, from £374 to £477 million.
- Activity by registered office is concentrated in the East of England (2024 – GVA, turnover: 38.3%; employment: 36.1%) and South East (GVA, turnover: 34.7%; employment: 20.5%). Note that registered office may not reflect where NAM, or even broader productive activity, is undertaken. For example, Certara UK Limited is registered in London but has offices in Glasgow, Oxford and Sheffield.

Under existing trajectories, we project that between 2024 and 2030:

- Turnover (to £2.12 billion) and GVA (to £473 million) will increase by 71.1%.
- Employee numbers will more than double (+105.7%) to 12,419.
- Overall cost of employment will rise by almost two thirds (62.3%) to £774 million.
- Cost per employee will fall more than a fifth (-21.1%) from £88,922 to £62,299.

The figure below shows projected growth in GVA under the 2021-24 trend of 9.4%, a middle estimate of 12.9% and an upper estimate of 35.1% (see Figure 8 for details).



Projected NAM sector growth in £m: existing, middle and upper assumptions (2025-30)

The All-Party Parliamentary Group for Human Relevant Science found that human-relevant NAMs funding was just £2 million in 2019 compared with between £300 million and £1.1 billion on research involving animals, representing 0.2%-0.6% of biomedical research funding and approximately 0.02% of total public R&D expenditure.<sup>5</sup> Based on the Government's own conservative estimates of productivity gains from investment in R&D and the existing tax-to-GDP ratio, we estimate that were the Government to invest an additional £100 million in NAMs, an annual increase in productivity after six years of £80 million could be expected, with £32 million returning to the treasury via channels like corporation tax, income tax, national insurance and capital gains as well as business rates. Based on estimates of productivity gains from Innovate UK R&D grants, the £100 million investment would see an almost immediate productivity multiplier of £82 million, and a potential increased tax take of £248 million over the first 7 years.

There would clearly be a need to scale at pace existing and new companies and research organisations for an investment of this size to work, but even without significant existing public investment, the sector appears capable of very rapid growth. Given market analyst projections that key NAM technologies like organ-on-a-chip will grow at a CAGR in the 30s%,<sup>6</sup> the UK must leverage its National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs) and new UK Centre for the Validation of Alternative Methods (UKCVAM) infrastructure,<sup>1</sup> strong pharmaceutical sector and world-leading Higher Education (HE) life sciences expertise and post-Brexit regulatory role.<sup>7,8</sup>

The need for such investment is highlighted by around nine in 10 new drug candidates failing despite having passed the preclinical, often animal-testing-dependent, stages,<sup>8,9</sup> and the same proportion of chemicals on the market being deemed to have limited or poor characterisation of their hazards and exposures.<sup>8</sup> Early analysis suggests that AI-identified molecules have a 90% success rate in Phase I trials, and (with a small sample size) around 40% in Phase II, representing a significant improvement.<sup>10</sup> The financial and social costs associated with these issues are enormous, with Sertkaya and colleagues' study<sup>11</sup> of drug development costs in the US from 2000-18 identifying a mean figure of \$173 million including postmarketing studies, which increased to \$516 million when accounting for failures and \$879 million when including capital opportunity costs at the same risk level as the drug candidate investment. In the UK, the Association of the British Pharmaceutical Industry (ABPI) reported that in 2024, 578 industry clinical trials were initiated, with 94 in Phase I, 222 in Phase II and 262 in Phase III.<sup>12</sup> The costs of failure in this process are particularly relevant given the NHS' role as a nationalised health system that purchases and uses medications on a very large scale while also providing clinical trial services.

Hope and Bailey's (2025) review<sup>13</sup> identifies four key barriers to NAMs adoption: concerns about reliability (despite evidence to the contrary), publication bias favouring animal studies, limited funding and lack of standardisation. The authors recommend greater funding for both academia and industry, enhanced knowledge transfer and skills development, increased collaboration between HE, industry, regulators and government, and regulatory modernisation including international harmonisation.

The findings of this Common Sense Policy Group report indicate that transitioning to NAMs represents not solely an ethical imperative but also a significant economic opportunity aligned with the *Life Sciences Sector Plan*<sup>14</sup> and *Replacing animals in science* strategy<sup>1</sup>

# Common Sense opportunities and recommendations

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Based on these findings, the Government should consider the following measures to build on their November 2025 strategy<sup>1</sup>:

- 1. Increase public funding for NAMs companies, research bodies and HE research groups.** Given that NAMs funding in 2019 was just £2 million compared with up to £1.1 billion for research involving animals,<sup>5</sup> it should be possible to have a very large and positive impact on the sector and NAM technologies by redirecting a relatively modest proportion of the total. An additional £100 million would approach the scale of the Netherlands Government's funding for the Ombion Centre for Animal-Free Biomedical Translation.<sup>15,16</sup> Productivity gains from a £100 million investment in NAM could result in an additional tax take of £248 million over the first 7 years to spend on other national priorities. Specific channels could include:
  - a) Further dedicated funding via UKRI and Innovate UK.
  - b) Tax reliefs and incentives for companies developing NAMs.
  - c) Public procurement policies, including through the NHS, favouring NAMs-validated products.
  - d) Support for life sciences sector companies and organisations to transition to NAMs.
- 2. Establish a legally binding date for a ban on all animal testing** to create a time horizon for the sector to develop NAMs that meet current and projected needs, in line with approaches for the Net Zero transition.
- 3. Distribute funding across the country** to encourage development of NAM companies, research groups and HE institutions in each region.
- 4. Specifically support skills development** in partnership with NAM companies and research groups receiving public funding. Given a projected a 133,000 skilled-worker shortfall by 2030, including research and development scientists, data science and informatics, bioprocessing specialists, regulatory professionals and clinical experts,<sup>17</sup> there is a need to ensure that development is encouraged in all regions.
- 5. Accelerate regulatory modernisation through the UK Centre for the Validation of Alternative Methods (UKCVAM)** and the associated cross-sector network of public and private laboratories. This should support international collaboration and leadership in line with the Government's November 2025 strategy.<sup>1</sup>
- 6. Create a regularly updated database of NAM companies in order to facilitate analysis.** Companies House data is difficult to access and analyse due to a lack of standardisation and data for smaller companies. Broader reform would enable much greater accuracy in identifying and assessing developing, high-growth sectors that the Government must focus on in order to achieve the Prime Minister's Mission of Kickstarting Economic Growth.<sup>18</sup>

# 1.0 Introduction

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In November 2025, the Government published its *Replacing animals in science* strategy,<sup>1</sup> aligned with its July 2025 *Life Sciences Sector Plan*,<sup>14</sup> stating that it will ‘create a revolutionary research and innovation system that replaces animals with alternative methods wherever possible’, bringing ‘clear benefits for animal welfare and a host of economic and scientific impacts, through leveraging the UK’s strong science base.’ The Government claimed that the strategy ‘marks a step-change in placing the UK at the forefront of international efforts to drive this crucial and exciting agenda.’

Lush has met with approximately 200 policymakers since November 2023, including government officials from the Home Office and Department for Science, Innovation and Technology (DSIT), advisors and MPs as part of its longstanding campaign<sup>19</sup> for the UK to end animal testing and divert funding to Non-Animal New Approach Methodologies (NAMs).<sup>8</sup> NAMs are an alternative to animals in testing chemicals for safety and the prospective effects of new drugs, including lab-cultured organoids, *in silico* (computer) and artificial intelligence modelling, organ-on-chip technologies, and 3D cell cultures.<sup>20</sup> As part of this campaign and having heard from policymakers and stakeholders that a lack of data was a barrier to progress, Lush commissioned the Common Sense Policy group to establish up-to-date NAM commercial sector economic figures and opportunities as part of a prospective business case. The intention of the business case is to build on the Government’s *Replacing animals in science* strategy<sup>1</sup> and identify further economic opportunities resulting from a more rapid transition.

The cruelty-free cosmetics market, where greater progress has been made, reflects these preferences, with a global value estimated by Grand View Research of \$14.8 billion in 2023 and projected to grow at the equivalent of 6.8% (Compound Annual Growth Rate: CAGR) (2025) to \$23.5 billion by 2030.<sup>21</sup> Europe, which has been at the forefront of banning animal testing in cosmetics<sup>22</sup> – albeit imperfectly<sup>23</sup> – was estimated to hold 37% of global market revenue.

This large and growing market reflects public preferences. A January 2025 YouGov survey<sup>24</sup> commissioned by Animal Free Research UK of 2,533 UK adults found that 70% would support the introduction of a ban on animal experiments in medical research by 2035 alongside support for scientists to transition to NAMs. Three quarters (75%) would support funding NAM research with funding currently used for animal experiments.<sup>24</sup> This builds on a January 2024 NSF and TGM Research Panel survey with 1,004 UK adults which found that 68% said ‘animal wellness is either very or extremely important to purchasing decisions’ while 72% said it was ‘very important or extremely important that companies demonstrate consistency and compliance with animal wellness throughout their supply chain’.<sup>25</sup> 73% said they were more likely to purchase products certified by third parties for animal wellness and just 13% were unwilling to pay higher prices for those products.<sup>25</sup>

In this report, we provide an up-to-date analysis and projection of the commercial NAM sector in the UK based on a new list of 75 companies. We also contextualise the findings with a literature review and identify opportunities for growth of the sector as part of the Government’s Mission of Kickstarting Economic Growth.<sup>18</sup>

## 2.0 Objective and methods

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The objective of this report is to provide an economic assessment of ending animal testing in the UK and diverting funding to Non-Animal New Approach Methodologies as part of a business case to build on the Government's *UK's Modern Industrial Strategy Life Sciences Sector Plan*<sup>14</sup> and *Replacing animals in science: A strategy to support the development, validation and uptake of alternative methods*.<sup>1</sup> It has two main sections.

### Section 3: Economic assessment of the commercial sector

Building on the methods outlined in Cebr's *The economic impact of the UK's New Approach Methodologies sector*,<sup>26</sup> we provide an updated economic assessment of the NAM commercial sector since 2021 and a projection to 2030. The analysis includes turnover, Gross Value Added (GVA – total revenue minus total intermediate expenditure, i.e. the contribution of firms in the sector to UK Gross Domestic Product [GDP]), employment and costs of employment. We provide projections using the existing growth rate, a middle and an upper assumption.

The proposal for this part of the project relied on obtaining the list of relevant NAM businesses from Animal Free Research UK who commissioned the original Cebr report.<sup>26</sup> However, the list was unavailable following commission. As a result, and given resource constraints, we proceeded with an AI-assisted method which built on the broad approach described in the Cebr report to generate a list. A detailed method is provided in the 6.2 of the 'Appendix', below. Claude for Education's Opus 4.1 model was used for this stage. The Government's 'Bioscience and health technology sector statistics 2021 to 2022: life sciences sites'<sup>27</sup> dataset, the latest dataset available that was comparable to the one used by Cebr, was used for this stage. More recent versions no longer include site-level data.<sup>28</sup>

Claude for Education identified 88 companies from the workbook using a method that included prioritising certain Standard Industrial Classification (SIC) codes, assigning a score to each company based on NAM-relevant keywords in the dataset and excluding some companies focused on non-NAM areas of the industry. Some manual spot checks on the list identified several companies that should not have been included as NAM operators. As such, we used Claude's Opus 4.5 model, which was released during the course of the project, to identify any further NAM operators through web searches as the dataset covered the period only between 2021-22, and to categorise each into each of the following types of NAM operator, as well as level of confidence (high, medium, low) in that categorisation:

- NAM Developer
- CRO using NAMs
- NAM Developer and CRO
- Firm using NAMs for drug discovery
- CRO with own NAMs
- Fully animal free CRO
- Not a NAM industry company

We used Claude to identify changes in ownership or structure since 2020 to facilitate identification of reasonably consistent Companies House<sup>3</sup> accounts from 2021-2024. We sourced accounts from the Companies House API, where possible, and used an AI tool to input employee numbers (available for all companies), turnover and employment costs (usually only available for medium and large companies). This stage required further manual work where the automated process was unsuccessful, and during this process, further companies that were identified as not NAM industry operators were removed from the list and another was added.

The final list contained 75 companies, with some merging between 2021 and 2024. Although full and extended manual checks may identify some candidates that should not have been included and others that should have been, we believe that the list represents the most accurate and sufficiently broad account of the subsector that we could identify within project resourcing constraints.

To produce the final analysis, we imputed GVA and other missing data using Annual Business Survey (ABS)<sup>4</sup> data based on relevant SIC codes and ratios within the accounts data we were able to obtain from Companies House. Greater detail is provided in subsection '6.4: Imputation of missing data' in the 'Appendix'.

## Section 4: Analysis and opportunities

We then reviewed existing literature to identify an estimated spending multiplier for additional Government investment in non-animal NAMs to facilitate understanding of the economic and tax return on public investment via productivity gains.

We also sought to identify and contextualise potential costs, benefits and opportunities from ending animal testing in the UK and redirecting funding, focusing on:

- Economic opportunities
- Pharmaceutical and chemical testing
- Regional development opportunities

In undertaking the review, we initially used Claude for Education's Opus 4.1 and 4.5 models to search for academic and grey literature and produce an initial very rough draft. We then checked all sources and assertions and heavily revised and reorganised the text. The result is that almost all of the review differs significantly from the original draft.

### 3.0 Economic assessment of the commercial sector

Table 1, below, shows that almost three quarters (73%) of New Approach Methodologies companies (NAMs) are in one Standard Industrial Classification (SIC) code, namely, 72110: Research and experimental development on biotechnology.

Table 1: Standard Industrial Classification (SIC) codes and SIC descriptions of identified NAM industry companies

SIC Number	SIC Description	NAM companies
26511	Manufacture of electronic instruments and appliances for measuring, testing and navigation, except industrial process control equipment	1
32990	Other manufacturing n.e.c.	1
71200	Technical testing and analysis	1
72110	Research and experimental development on biotechnology	55
72190	Other research and experimental development on natural sciences and engineering	8
72200	Research and experimental development on social sciences and humanities	2
74909	Other professional, scientific and technical activities (not including environmental consultancy or quantity surveying) not elsewhere classified	3
82990	Other business support service activities not elsewhere classified	4

**Notes:** Some companies may operate under more than one SIC Code. For example, Certara Limited undertakes work under 63110 (Data processing, hosting and related activities) and 72200 (Research and experimental development on social sciences and humanities). We have assigned the SIC Code we believe most relevant to NAMs.

Although some of the NAM companies categories used in the Cebr’s original report are sufficiently similar and overlapping that it is not necessarily possible to strictly delineate between them, Claude’s Opus 4.5 model indicated the distribution in Table 2, below, with almost half (48.0%) identified as NAM Developers. Again, only one fully animal-free company was identified: XCellR8 Limited.

Table 2: NAM companies by type

Category	Count	Percentage
<b>NAM Developer</b>	36	48.0%
<b>CRO using NAMs</b>	17	22.7%
<b>NAM Developer and CRO</b>	11	14.7%
<b>Firm using NAMs for drug discovery</b>	9	12.0%
<b>CRO with own NAMs</b>	1	1.3%
<b>Fully animal free CRO</b>	1	1.3%
<b>Total</b>	75	100.0%

Table 3, below, shows the location of the registered office of NAM companies. Note that the office registered with Companies House may not reflect where NAM, or even broader productive activity, is being undertaken. For example, Certara UK Limited is registered in London but has offices in Glasgow, Oxford and Sheffield. However, using the registered office indicates an uneven distribution of NAMs across the UK. Almost a third (31%) are located in the East of England, which may be expected given Cambridge’s prominence within life sciences. A further 19% are located in the South East, which may reflect the presence of Oxford in that region. 15% are in Scotland but just 4% in Wales. The remaining 32% are scattered across the rest of England, suggesting that strategic funding decisions must consider competing priorities of growth in already strong regions and addressing interregional inequalities.

Table 3: Nation or region of NAM companies registered office

<b>Nation or region</b>	<b>NAMs</b>
<b>East of England</b>	23
<b>South East</b>	14
<b>Scotland</b>	11
<b>London</b>	6
<b>East Midlands</b>	4
<b>North East</b>	4
<b>Yorkshire and the Humber</b>	4
<b>North West</b>	3
<b>Wales</b>	3
<b>South West</b>	2
<b>West Midlands</b>	1

With regard to size of NAMs, we used a definition based on employee numbers as these were reported by all companies. 2023 is the latest year in which accounts are available for all companies. To avoid bias in reporting, we therefore use 2021-23 numbers in Figures 1 and 2, below. While the number of companies was relatively stable overall, there were indications of an increase between 2021, when there were 69 companies, and 2023, when there were 74, shown in Figure 1. Meanwhile, in Figure 2, there were also some indications of growth in the size of companies. The proportion of small companies increased from 26.1% to 36.5%, while the proportion of micro companies reduced from 49.3% to 37.8%. This may be a promising sign that companies are moving past their initial establishment stage and into a more resilient growth phase.

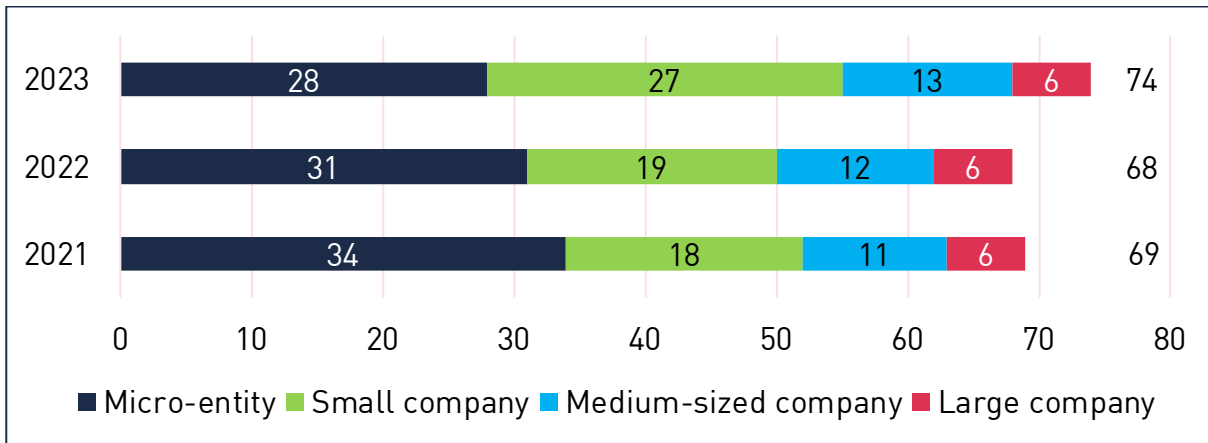


Figure 1: Number of NAM companies by size (2021-23). **Notes:** Micro-entity – less than/equal to 10 employees; small – less than/equal to 50 employees; medium – less than/equal to 250 employees; large – greater than 250 employees.

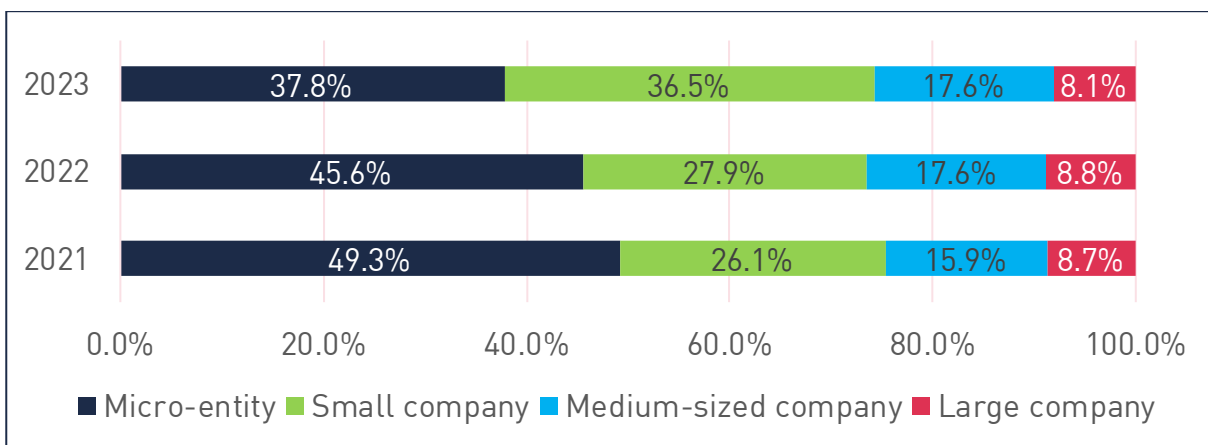


Figure 2: NAM companies by size as a proportion of the total (2021-23)

This growth is reflected in core NAM financial figures in Table 4. Note that we include 2024 in the following tables and figures as we estimated missing data based on the method shown in the ‘6.4: Imputation of missing data’ subsection in the ‘Appendix’.

- Turnover (from £947 million to £1.24 billion) and GVA (from £212 to £277 million) both grew by the equivalent of 9.4% per year.
- Employee numbers grew by 12.8% per year (CAGR), from 4,209 to 6,037.
- Cost of employment overall grew by 8.4% per year, from £374 to £477 million.

Interestingly, the 2021 Cebr report estimated that the NAM sector in 2019 had turnover of £2.3 billion, GVA of £592 million, employment of 2,155 and costs of employment of £154 million. This may indicate significant changes between 2019 and 2021, given the Covid-19 pandemic period, but it is more likely that methods, including the list of NAMs, differ. We include Sygnature Discovery Limited, a major CRO which Cebr excluded from their list. However, excluding it from our analysis would reduce our estimates, whereas Cebr’s are significantly larger for turnover and GVA (almost double) and less than half for costs of employment. In the companies for which we have accounts, the ratio between costs of employment and turnover is somewhere around 38%. In the ABS data for SIC 72.11 this is around the same for 2015-20 and a bit higher in 2023. As such, we believe that our turnover-to-costs-of-employment estimates are likely more accurate.

Table 4: NAM companies turnover, GVA, employees and overall cost of employment (2021-24)

	Turnover (£m)	GVA (£m)	Employees	Cost of employment (£m)
<b>2021</b>	946.9	211.5	4,209	374.3
<b>2022</b>	1,062.7	237.4	5,076	406.5
<b>2023</b>	1,147.5	256.3	5,934	466.6
<b>2024</b>	1,238.4	276.6	6,037	476.8
<b>Growth rate (CAGR)</b>	9.4%	9.4%	12.8%	8.4%

For 2021-23, 17 NAM companies reported turnover data. Of these, 66.7% exceeded the average growth rate for their SIC code based on ABS data,<sup>4</sup> although there is some potential bias with regard to the size of the companies reporting turnover compared to the SIC code as a whole.

The regional breakdown in Table 5, below, confirms the findings in Table 3 of an uneven distribution of NAM economic activity by location of registered office, although Wales has a much larger footprint than the number of companies located there might suggest. These regional results are calculated using a similar method to those in Table 4, but imputing missing data at the regional level leads to slightly different total estimates which the results below correct for. Activity is concentrated in the East of England (2024 – GVA, turnover: 38.3%; employment: 36.1%) and South East (GVA, turnover: 34.7%; employment: 20.5%). Again, note that the office registered with Companies House may not reflect where NAM, or even broader productive activity, is being undertaken. For example, Certara UK Limited is registered in London but has offices in Glasgow, Oxford and Sheffield.

Table 5: NAM companies turnover, GVA, employment and costs of employment by region of registered office as a percentage of UK total (2021-24)

	2021	2022	2023	2024
<b>North East</b>				
<b>Turnover</b>	0.0%	0.0%	0.0%	0.0%
<b>GVA</b>	0.0%	0.0%	0.0%	0.0%
<b>Employment</b>	1.4%	1.4%	1.3%	1.3%
<b>Cost of employment</b>	0.0%	0.0%	0.0%	0.0%
<b>North West</b>				
<b>Turnover</b>	0.1%	0.0%	0.0%	0.0%
<b>GVA</b>	0.1%	0.0%	0.0%	0.0%
<b>Employment</b>	1.1%	0.6%	0.5%	0.5%
<b>Cost of employment</b>	0.9%	0.8%	0.6%	0.5%
<b>Yorkshire and the Humber</b>				
<b>Turnover</b>	2.1%	2.0%	1.8%	1.7%
<b>GVA</b>	2.1%	2.0%	1.8%	1.7%
<b>Employment</b>	4.0%	3.4%	3.4%	3.4%
<b>Cost of employment</b>	3.9%	3.3%	2.7%	3.2%
<b>East Midlands</b>				

	2021	2022	2023	2024
<b>Turnover</b>	9.6%	9.8%	8.8%	7.7%
<b>GVA</b>	9.6%	9.8%	8.8%	7.7%
<b>Employment</b>	18.4%	17.8%	16.8%	16.8%
<b>Cost of employment</b>	11.2%	11.7%	10.8%	9.9%
<b>West Midlands</b>				
<b>Turnover</b>	0.0%	0.0%	0.0%	0.0%
<b>GVA</b>	0.0%	0.0%	0.0%	0.0%
<b>Employment</b>	0.0%	0.0%	0.0%	0.0%
<b>Cost of employment</b>	0.0%	0.0%	0.0%	0.0%
<b>East of England</b>				
<b>Turnover</b>	43.8%	30.7%	33.2%	38.3%
<b>GVA</b>	43.8%	30.7%	33.2%	38.3%
<b>Employment</b>	35.0%	31.9%	36.1%	36.1%
<b>Cost of employment</b>	32.1%	33.4%	36.3%	38.7%
<b>London</b>				
<b>Turnover</b>	6.8%	7.0%	6.5%	6.4%
<b>GVA</b>	6.8%	7.0%	6.5%	6.4%
<b>Employment</b>	6.5%	6.8%	6.4%	6.4%
<b>Cost of employment</b>	8.6%	9.1%	8.9%	7.7%
<b>South East</b>				
<b>Turnover</b>	24.4%	36.0%	35.6%	34.7%
<b>GVA</b>	24.4%	36.0%	35.6%	34.7%
<b>Employment</b>	18.5%	23.9%	20.5%	20.5%
<b>Cost of employment</b>	33.9%	29.3%	27.6%	26.9%
<b>South West</b>				
<b>Turnover</b>	0.0%	0.0%	0.0%	0.0%
<b>GVA</b>	0.0%	0.0%	0.0%	0.0%
<b>Employment</b>	0.1%	0.1%	0.1%	0.1%
<b>Cost of employment</b>	0.0%	0.0%	0.0%	0.0%
<b>Scotland</b>				
<b>Turnover</b>	2.6%	2.3%	2.5%	2.0%
<b>GVA</b>	2.6%	2.3%	2.5%	2.0%
<b>Employment</b>	4.1%	3.5%	4.0%	4.0%
<b>Cost of employment</b>	0.0%	2.5%	3.2%	2.5%
<b>Wales</b>				
<b>Turnover</b>	10.7%	12.2%	11.6%	9.3%
<b>GVA</b>	10.7%	12.2%	11.6%	9.3%
<b>Employment</b>	11.0%	10.5%	10.7%	10.7%
<b>Cost of employment</b>	9.4%	9.9%	9.9%	10.5%

Figures 3 and 4, below, show existing figures to 2024 and projections under the current growth rate to 2030 for turnover and GVA. Both increase by almost three quarters (+71.1%) from 2024-30, with turnover rising to £2.12 billion and GVA to £473 million.

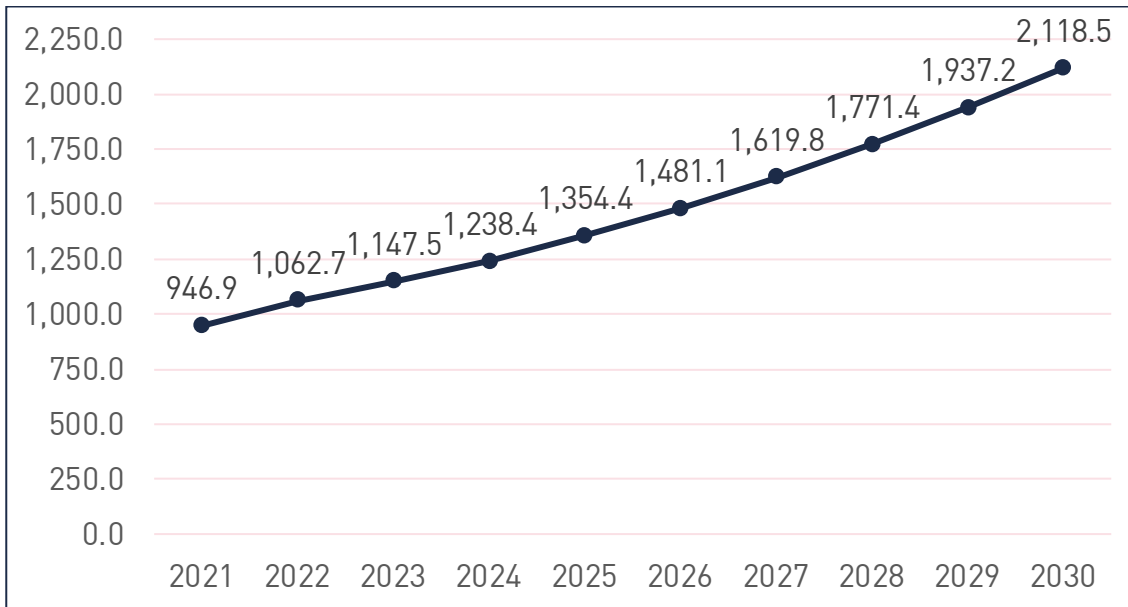


Figure 3: NAM companies turnover in £m (2021-30)

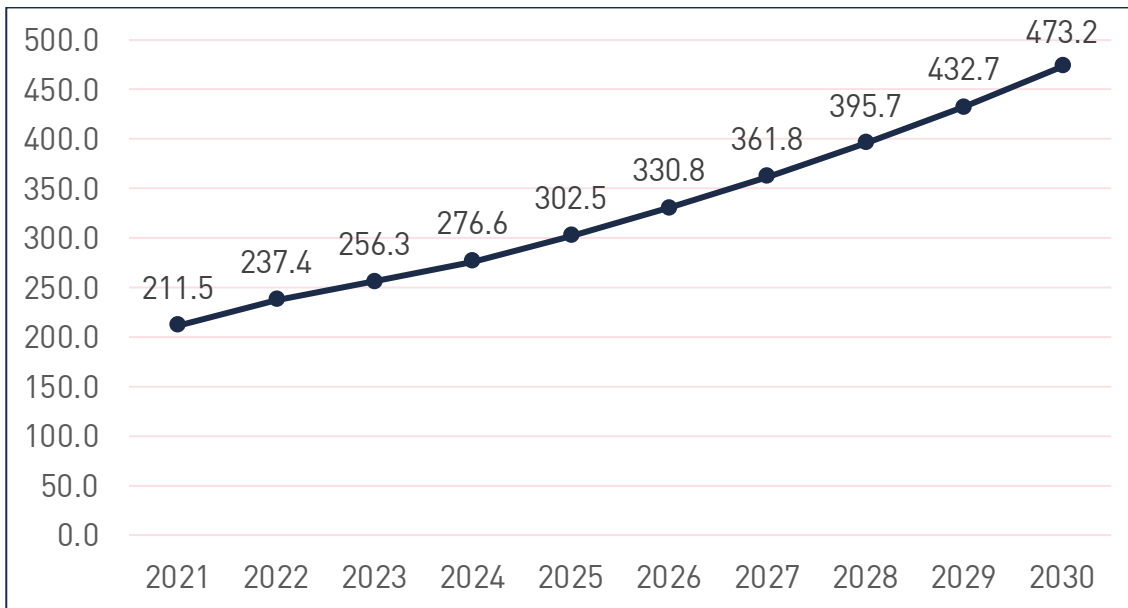


Figure 4: NAM companies GVA in £m (2021-30)

While Figure 4 uses the current Compound Annual Growth Rate (CAGR) of 9.4%, Figure 5, below, uses estimates for GVA growth based on NAM-sector specific figures in other contexts. The middle assumption of 12.9% based on Market Data Forecast's 2024-33 CAGR projection for Europe's in-vitro cultured mammalian cells or bacteria market,<sup>29</sup> would result in the sector's GVA reaching £534.4 million in 2030. Under the upper assumption of 35.1%, based on Grand View Research's 2025-2030 projection for the worldwide organ-on-a-chip market, GVA could reach £1.36 billion. The UK's and EU's REACH regulations (see Section 4.2) cover some 22,600 chemicals, out of around 100,000, with annual production or import of one tonne or more.<sup>30</sup> As approximately nine in 10 of the 100,000 are deemed to have either limited or poor characterisation of their hazards and exposures<sup>8,30</sup> and are therefore likely to require testing and re-testing, there is good reason to consider the existing growth trend to be conservative should the UK's NAM sector be supported by the Government to secure a large market share. The US Environmental Protection Agency's

ToxCast programme demonstrated the cost and time savings possible from using in-vitro tests rather than traditional animal testing<sup>31</sup> (Section 4.2), and the growth in markets such as organ-on-a-chip, from which the upper growth estimate is derived, demonstrates this.

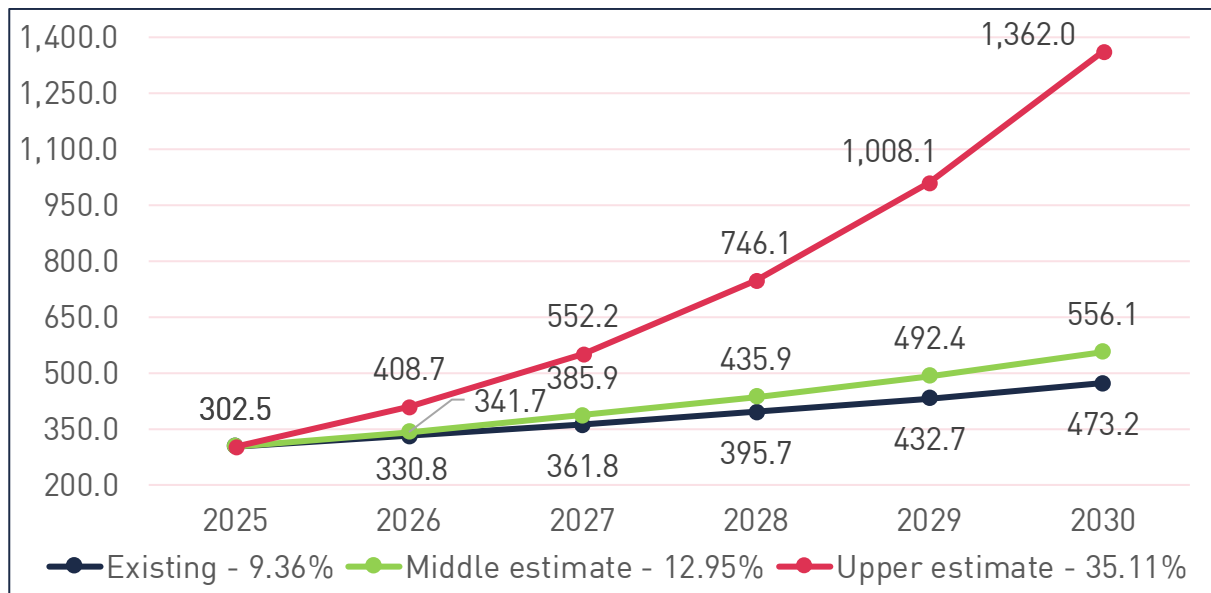


Figure 5: Projected NAM sector growth in £m under existing, middle and upper assumptions (2025-30). **Notes:** Existing CAGR growth = 9.36%; Middle growth assumption: 2024-33 Europe in-vitro cultured mammalian cells or bacteria CAGR growth projection = 12.95%<sup>29</sup>; Upper growth assumption: 2025-30 worldwide organ-on-a-chip market CAGR growth projection = 35.11%.<sup>6</sup>

As shown in Figure 6, below, the existing growth in turnover and GVA from 2024-30 would be supported by employee numbers more than doubling (+105.7%) from 6,037 to 12,419.

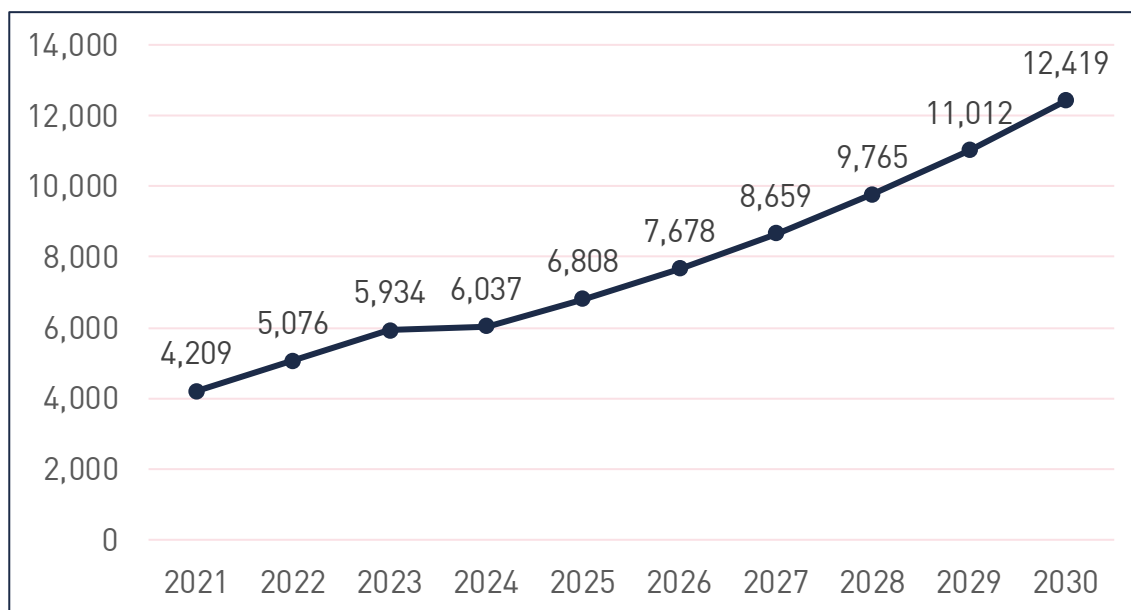


Figure 6: NAM number of employees (2021-30)

While Figure 7 indicates that based on the current trend of 8.4% CAGR, overall employment costs will rise from £476.8 million in 2024 to £773.7 million in 2030, the cost

per employee, shown in Figure 8, is projected to fall by more than a fifth (-21.1%) from £88,922 to £62,299 as companies grow and become more productive.

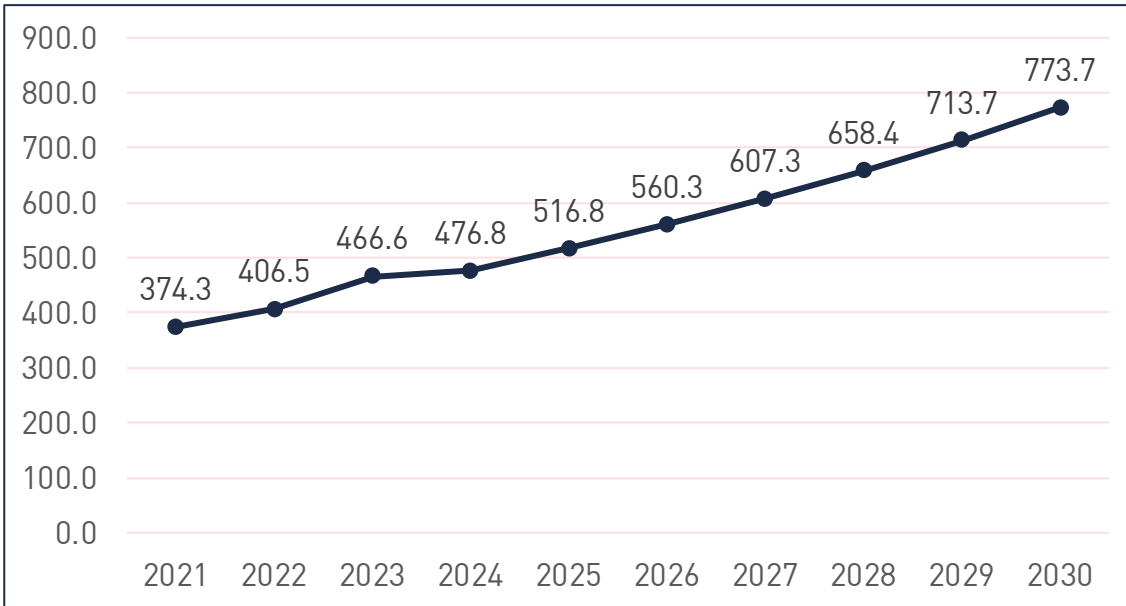


Figure 7: NAM costs of employment overall in £m (2021-30)

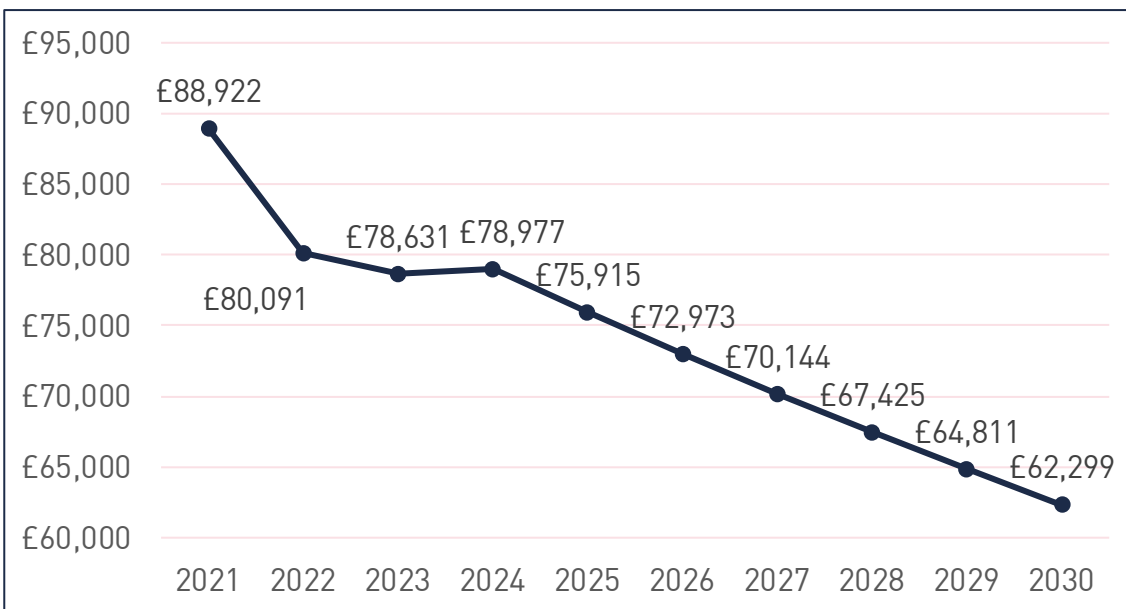


Figure 8: NAM costs of employment per employee (2021-30)

The existing trajectories indicate that the sector is experiencing significant and sustained growth and that there is substantial opportunity to support commercial NAM companies to increase that growth further. The following section explores the potential for further public funding of NAMs, specific opportunities for growth and supporting growth and areas of substantial cost savings.

## 4.0 Analysis and opportunities

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### 4.1 Prospective economic return on investment

The Department for Science, Innovation and Technology's (DSIT) October 2025 review of the economic returns from public research and development (R&D) investment found that £1 of public R&D investment generates £8 in net economic benefits for the UK over the long term in terms of direct productivity gains, leveraged additional private investment and gains from that additional investment.<sup>32</sup> Even greater social benefit is anticipated if health, national security, environmental and quality of life improvements are taken into account.<sup>32</sup> Given the prospective benefit of NAMs to health, the social benefit may be even greater than that anticipated for broader R&D investment. The review identifies a sustained productivity gain of 40p per £1 of public investment each year after 6 years but acknowledges much higher estimates. Again, although the review highlights estimates, DSIT indicates that £2 is likely to be leveraged in private investment for every £1 of public investment as a conservative figure.<sup>32</sup> The review suggests 20p in direct annual returns and 20p for the wider economy from the private investment.

Although the growth demonstrated by NAMs so far indicates that the benefit could be even greater, this provides a baseline for potential return on investment (ROI). In estimating potential tax take, we use the average tax-to-GDP ratio of 40%.<sup>33</sup>

**Were the Government to invest an additional £100 million specifically in NAMs with the spending multipliers identified above, they could anticipate an annual increase in productivity after six years of £80 million, with £32 million each year returning to the treasury via channels like Corporation Tax, Capital Gains, Income Tax and National Insurance as well as business rates. This means that 100% of the initial investment could be returned to the government in a little over three tax years, even if it does not take a direct shareholding interest in the businesses. Indeed, as productivity gains below the peak are likely to occur before the sixth year, they may even gain that return as profit to spend on other national priorities.**

For example, Innovation Caucus' review found an immediate increase of 68p in Gross Value Added (GVA) per £1 of investment in R&D, and 73p per £1 received from Innovate UK grants specifically, with the business adding a further 34p of investment translating into an additional 14p in GVA.<sup>34</sup> Over 7 years, the study estimates total returns including indirect effects on other businesses in the supply chain and increases in household income of £6.21 in GVA.<sup>34</sup> Using these figures, the Government's £100 million investment would see an almost immediate productivity multiplier of £82 million, and a potential increased tax take of £248 million over the first 7 years.

Even higher returns are possible given the potential for NAMs to improve health and the relatively early stage that many NAM companies are in their growth lifecycle. UCL's Institute for Innovation and Public Purpose found that public R&D spending in the US resulted in a peak increase in GDP of around \$20.87 per \$1 invested.<sup>35</sup> Although this is significantly higher than UK estimates and may reflect the outlying economic characteristics of the US tech sector, the UK's life sciences sector demonstrates particularly strong productivity characteristics compared to the rest of the economy. Office

for Life Sciences data indicates that 304,200 life sciences workers generate £108.1 billion turnover, twice the productivity per worker of the UK average.<sup>36</sup>

DSIT's June 2025 announcement of an £86 billion boost in investment into science and technology to 'turbocharge the economy' demonstrates the Government's recognition of R&D's importance as an opportunity for economic growth.<sup>37</sup> Within this context, NAMs represent a particularly high-potential investment area given their alignment with the Government's overall priority of economic growth and specific priority of supporting engineering biology as one of the 'technologies which are most critical to the UK'.<sup>38</sup> Demonstrating the UK's strength in this area and the potential for leveraged private investment, the BioIndustry Association reported that the UK biotech sector raised £3.5 billion in 2024, a 94% increase from the previous year, with a large proportion of venture capital investors coming from North America (26%) and Europe (15%).<sup>39</sup>

In November 2025, the Government recommitted to working towards phasing out animal testing as a long-term goal, but specific 2030 and 2035 targets were reasonably cautious.<sup>1</sup> In terms of investment, £60 million in new funding was committed. Among other things, this will set up a preclinical translational models hub to 'bring together data, technology and expertise to promote collaboration between researchers and a separate new centre to make the path to regulatory approval for new alternatives as straightforward as possible.' It will also establish a UK Centre for Validation of Alternative Methods (UKCVAM) that will create a 'hub and spokes' network of university, contract research organisation (CRO), government, and industry laboratories. The strategy also announced £15.9 million of funding from the Medical Research Council (MRC), Innovate UK and the Wellcome Trust for five teams that will 'focus on human in-vitro disease models of the liver, brain, cancer, pain and blood vessels'.<sup>40</sup> The strategy also seeks to establish foundational 3Rs training for all PhD students beginning in the 2026 funding cycle.<sup>1,40</sup> The multipliers above highlight the benefits of a substantial increase in this investment.

Prior to this, the UK's National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs) received £30.3 million core public funding for the period 2022-24<sup>41</sup> to invest in non-animal NAM research, with an additional £4.85 million in 2024 which was primarily disbursed via 11 short-term infrastructure awards.<sup>42</sup> NC3Rs has funded nearly 550 research projects and early career awards since 2004, with approximately three quarters focused on replacement research and method development.<sup>1</sup> Queen Mary University of London opened one of Europe's largest organ-on-a-chip facilities in 2025, supported by NC3Rs and industry funding.<sup>43</sup> The Engineering and Physical Sciences Research Council (EPSRC) also invested £7 million in a Centre for Doctoral Training at QMUL to train 60 PhD students over eight years in the technology.<sup>43</sup> This builds on the Queen Mary-led UK Organ-on-a-Chip Technologies Network which ran from 2018-22.<sup>44</sup> From 2012-24, the Lush Prize has given £2.94 million to 140 winners in 36 countries

The organ-on-a-chip market represents one of the fastest-growing NAMs segments, with market research industry analysts indicating a global market valuation in 2024 of \$123-157 million, increasing to expanding to around \$1 billion by 2030 at Compound Annual Growth Rates (CAGR) of above 30%.<sup>6,45,46</sup> For example, Grand View Research projects a 35.11% CAGR between 2024 and 2030.<sup>6</sup> AI in drug discovery is also a very substantial

opportunity, with a Global Market Insights estimated value in 2024 of \$3.6 billion (\$876.7 million in Europe) and a projected growth rate per year of 30.1% to 2034, reaching \$49.5 billion.<sup>47</sup>

The importance of moving early is demonstrated by Grand View Research's estimate that, in 2023, Europe had an approximately 37% share of the cruelty-free cosmetics market,<sup>48</sup> which they estimated to have a global value of \$14.8 billion and a projected annual growth rate of 6.8% to \$23.5 billion by 2030.<sup>21</sup> Grand View Research estimated the value of the broader in-vitro toxicology testing market to be \$31.0 billion in 2023, with projected growth of 11.1% leading to a value in 2030 of \$64.8 billion.<sup>49</sup> Ram,<sup>8</sup> and Ram and Harrison<sup>7</sup> have highlighted the opportunities for UK regulatory leadership and the means of achieving it, and the value of securing a share of the global market that this could facilitate are, as the figures above show, very substantial. Indeed, literature from elsewhere in the world does suggest that the UK is, or has been, perceived as leading efforts to replace animal testing.<sup>50,51</sup>

Looking at a very broad level, the opportunities for NAMs to replace animal testing are very substantial. The Business Research Company estimated that the value of the global animal testing market was \$10.74 billion in 2019 and projected a growth rate of 1.03% per year from 2023-28.<sup>52</sup> In contrast, the non-animal market was estimated at £1.11 billion in 2019 and projected to grow by 6.39% per year from 2023-28.

However, despite the nation's having a Gross Domestic Product (GDP) one third the size of the UK's,<sup>53</sup> the Netherlands has allocated €124.5 million through its National Growth Fund for the Ombion Centre for Animal-Free Biomedical Translation for a total budget of €245 million from 2025-34.<sup>15,16</sup> The Government should seek to match this scale of investment if it is to avoid falling behind comparable nations.

## 4.2 Pharmaceutical and chemical testing underpinned by regulatory leadership

The need for largescale investment is highlighted by around nine in 10 new drug candidates failing during clinical trials despite having passed the preclinical, often animal-testing-dependent, stages.<sup>8,9</sup> The financial and social costs associated with these issues are enormous, with a 2024 study<sup>11</sup> of the cost of drug development in the US between 2000 and 2018 identifying a mean figure of \$173 million including postmarketing studies, which increased to \$516 million when accounting for failures and \$879 million when including capital opportunity costs at the same risk level as the investment in the drug candidate. At the beginning of 2025, worldwide there were 12,704 drugs in preclinical stages, 3,954 in Phase I, 3,586 in Phase II and 1,358 in Phase III.<sup>54</sup> In the UK, the Association of the British Pharmaceutical Industry (ABPI) reported that 578 industry clinical trials were initiated 2024, with 94 in Phase I, 222 in Phase II and 262 in Phase III.<sup>12</sup> These costs are particularly of relevant to the UK given the NHS' role as a nationalised health system that purchases and uses medications on a very large scale and provides clinical trial services. Early analysis suggests that Artificial Intelligence identified molecules have a 90% success rate in Phase I trials, and around 40% in Phase II with a small sample size. This represents a significant improvement over traditional methods of discovery.<sup>10</sup>

According to Government figures, in 2022 the value of pharmaceutical R&D performed by UK industry was £9.0 billion while in 2021, the Government's budget for health R&D was £2.9 billion (0.13% of GDP down from 0.15% in 2020), placing it second behind the US (0.18%) using 2022 data.<sup>55</sup> However, the UK Government performed a much lower proportion of R&D compared to comparators (UK: 0.01%; Spain: 0.08%) while the private non-profit sector rank was approximately in the middle. In 2022, almost four fifths (79%) of expenditure on pharmaceutical R&D performed by UK businesses in 2022 was self-funded, with overseas companies and investors funding 19% and the Government just over 1%. There is scope for the Government to play a much more active role in a large and growing sector with potential to produce significant cost savings for the NHS.

In addition to failures in drug development inflating the cost of individual medications, adverse drug reactions (ADRs) impose a substantial burden on NHS resources. Osanlou and colleagues<sup>56</sup> estimated costs in 2018-19 from hospital admissions of £2.21 billion, with 39.4% of the ADRs avoidable or potentially avoidable. NAMs may mitigate this by more accurately predicting toxicity than animal models, including for compounds that have already been licenced for decades.<sup>57</sup> For example, Liver-Chips correctly identified 87% of drugs that caused liver injury in patients, beating conventional methods.<sup>58</sup>

Indeed, organ-on-chip systems that are personalised using patient samples could facilitate more accurate and effective assessment of drug efficacy and safety as part of a broader shift to personalised and precision medicine.<sup>59,60</sup>

The UK's Health and Safety Executive describes the aims of the UK REACH (standing for registration, evaluation, authorisation and restriction of chemicals) regulation, derived from the EU's own REACH regulation, as follows:

- provide a high level of protection of human health and the environment from the use of chemicals
- make the people who place chemicals on the market (manufacturers and importers) responsible for understanding and managing the risks associated with their use
- promote the use of alternative methods for the assessment of the hazardous properties of substances - for example quantitative structure-activity relationships (QSAR) and read across

The regulations cover some 22,600 chemicals which are manufactured or imported in quantities of one tonne or more per year.<sup>30</sup> Of the approximately 100,000 chemicals on the market, nine in 10 are deemed to have either limited or poor characterisation of their hazards and exposures.<sup>8,30</sup> Although Ram and Harrison identify some (perceived or real) barriers that may lead manufacturers to favour animal over NAM testing, including for re-testing prompted by REACH, they also identify key means of addressing them.<sup>7</sup> Crucially, while data are patchy and often outdated, there is evidence that *in vitro* testing costs are reducing while *in vivo* are increasing and that the former are already significantly lower in cost than the latter.<sup>61,62</sup> For example, Humane Society International reported in 2012 that for skin corrosion testing, a Draize rabbit skin test cost \$1,800 while an EpiDerm™ human skin model test cost \$850.<sup>61</sup> Demonstrating the potential resource savings, the US Environmental Protection Agency's ToxCast programme was reported in 2014 to have tested 300 chemicals using 600 automated in-vitro tests in approximately five years with

equal or greater predictive value to what had been achieved by traditional animal testing in 30 years and \$2 billion.<sup>31</sup> By 2023, the Tox21 Collaboration reported that it had screened thousands of chemicals using more than 100 high-throughput assays.<sup>63</sup> It is essential that policymakers consider both the stimulus effects of testing and re-testing of chemicals and the cost savings that are possible using NAMs, which can then be reinvested into further research and development or into other areas of the economy.

In 2024, the Government's Hazardous Substances Advisory Committee (HSAC) indicated that the UK is 'well positioned to emerge as the global leader, and to achieve substantial economic benefits and high standards of human and environmental protection, in using NAMs to obtain findings that are useful for assessing and, when appropriate, regulating chemical exposures'.<sup>64</sup> The UK Centre for Validation of Alternative Methods (UKCVAM)<sup>1</sup> should go some way in supporting this aim, but there is a case for even greater investment given the approaches taken by comparable nations if the UK is to benefit directly and optimally from testing and re-testing.

The Government estimates that in 2024 in the UK, 2.64 million scientific procedures involving animals protected under the Animals (Scientific Procedures) Act 1986 (ASPA) were carried out. The number, which is higher than the number of animals used since multiple tests may be carried on one animal, has been declining over the past decade and is now at its lowest since 2001.<sup>1</sup> Taylor and Alvarez estimated that in 2015, 192.1 million animals worldwide were used for scientific purposes.<sup>65</sup> Groff and colleagues<sup>31</sup> indicate some of the prospective environmental impacts of animal testing compared with alternatives, and highlight additional energy use, waste production and pollution (including from incineration of animal carcasses). Although estimating the scale and costs of these is beyond the scope of this report, these impacts are important when considering the prospective cost-benefit of NAMs.

### 4.3 Regional development opportunities

Office for National Statistics' data<sup>66</sup> on GDP output<sup>67</sup> and employment by industry<sup>68,69</sup> demonstrates that life sciences and biotechnology show particularly strong growth potential for regional economies, with higher-than-average productivity gains when supported by appropriate investment. The Government's July 2025 *Life Sciences Sector Plan* stated that 'unleashing the full potential of our city regions and clusters is a core objective of our modern Industrial Strategy'.<sup>14</sup> Specifically, the Government committed to establishing Regional Health Innovation Zones and continued investment in 15 Health Innovation Networks across England. They also committed to investment in specific health-focused R&D organisations across the country. An example of an existing £160 million investment that was recommitted to is Liverpool City Region's 10-year Life Sciences Innovation Zone, a collaboration between government, business and Higher Education Institutions in the area which aims to stimulate £800 million of Government and private investment and create 8,000 jobs. It includes three Innovation Zone tax sites at St Helens, Sci-Tech Daresbury and Maghull Health Discovery Park that offer relief from five years of business rate relief and three years of employer National Insurance Contributions, and exemption from Stamp Duty Land Tax.<sup>70</sup> West Yorkshire's HealthTech zone may also be of particular interest to NAM companies.

This plan followed, but appears to have fallen short of, the Northern Health Sciences Alliance's call in 2024 for the next Government to establish and invest in a Northern Life Sciences Supercluster to complement the existing one in the South East and create an 'additional 64,600 jobs and triple the sector's GVA from £5.17 billion to £16.52 billion over the next 20 years'.<sup>71</sup>

The Science Industry Partnership's Life Sciences 2030 Skills Strategy projected a 133,000 skilled-worker shortfall by 2030, including 77,500 additional workers and 55,000 to replace retiring workers.<sup>72</sup> Given the scale of the need for skilled workers including research and development scientists, data science and informatics, bioprocessing specialists, regulatory professionals and clinical experts,<sup>17</sup> there is a need to ensure that development is encouraged in all regions.

## 5.0 Conclusion

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The Government is in a strong position to build on its *Life Sciences Sector Plan*<sup>14</sup> and *Replacing animals in science: A strategy to support the development, validation and uptake of alternative methods*<sup>1</sup> by increasing investment further specifically in Non-Animal New Approach Methodologies (NAMs) to deliver economic, health and broader social benefits. Increased investment is likely to return to the Exchequer in the form of taxation within several years through growth in GDP.

While regulatory modernisation may still be required to fully unlock the sector's potential, the UK is not alone in seeking to undertake this work. In the US, the FDA has published a roadmap to reducing animal testing in preclinical safety studies,<sup>73</sup> and the Interagency Coordinating Committee on the Validation of Alternative Methods (ICCVAM) is currently developing a central database for validated NAMs called CAMERA.<sup>74</sup> In July 2025, the Government of Canada released its own strategy to replace, reduce or refine vertebrate animal testing under the Canadian Environmental Protection Act, 1999 (CEPA).<sup>75</sup> The European Commission intends to publish its own roadmap towards phasing out animal testing in the first quarter of 2026.<sup>76</sup>

The UK possesses some significant advantages in terms of its existing and planned NAM infrastructure, the reputation and expertise of its universities, its large pharmaceutical sector, the leverage that the NHS provides, and its independent regulatory role outside of but closely aligned with the EU.

The commercial NAM sector has grown significantly between 2021-24 and appears to be demonstrating resilience despite the broader economic challenges that the UK has faced in recently years. It should be noted that the main assumptions in our calculations are based on tracking existing sector growth. However, as indicated above, we know that government policy in the US, EU, UK and many other nations is rapidly moving in the direction of phasing out animal testing and requiring that NAMs take its place.<sup>77</sup> It is also worth noting that this transition is necessarily creating a fast-growing prospective export markets for UK NAMs companies. Although we cannot put a number on the likely impact of this regulatory change, it does mean that even our upper estimates could be conservative.

However, to establish a world-leading position, the Government must further prioritise NAMs as a potential driver of economic growth.

## 6.0 Appendix

### 6.1 List of NAM industry companies

Table S1: List of NAM companies with identification details (2021-24)

Name	CRN	SIC	Website	Category	Confidence	Justification
Apeikon Therapeutics Ltd	13057597	72110	apeikon.co.uk	Firm using NAMs for drug discovery	Medium	Develops nanoparticle-based targeted drug delivery for cancer using MR imaging and focused ultrasound; uses in vitro models but primary focus is drug delivery technology.
Aquila Biomedical Limited	SC393914	72110	aquila-bm.com	CRO using NAMs	High	Edinburgh CRO providing immunology, immuno-oncology, and neuroscience contract research services with in vitro and in vivo models.
Astellas Engineered Small Molecules U.K. Limited	08328823	74909	astellas.com	Firm using NAMs for drug discovery	Medium	Drug discovery company focused on female reproductive health; uses in vitro models but limited public detail.
Atelerix Ltd	10803595	72110	atelerix.co.uk	NAM Developer	High	Newcastle University spinout developing hypothermic hydrogel technology for ambient temperature cell preservation and shipping, enabling NAM logistics.
Avatrial Ltd	12362882	72110	avatrial.life	NAM Developer and CRO	High	Cambridge spinout developing patient-derived organoids for cancer drug testing and provides contract research services. Licensed by Human Tissue Authority.
Axol Bioscience Ltd	08340031	72110	axolbio.com	NAM Developer and CRO	High	Leading provider of iPSC-derived cells (neurons, cardiomyocytes) and offers contract services including disease modelling, compound screening, and assay development.
Bioascent Discovery Limited	SC442915	72110	bioascent.com	CRO using NAMs	Medium	Integrated drug discovery CRO offering medicinal chemistry, biosciences, and compound management; uses in vitro assays but primary focus is chemistry services.
Biosceptre (UK) Limited	08365743	72110	biosceptre.com	Firm using NAMs for drug discovery	High	Develops nfP2X7-targeted cancer immunotherapies using in vitro cell models and CAR-T technology for internal drug discovery pipeline.
Bit Bio Ltd	10466798	72190	bit.bio	NAM Developer and CRO	High	Cambridge-based synthetic biology company using proprietary opti-ox technology to reprogram iPSCs into any human cell type with unprecedented consistency. Provides ioCells for drug discovery.

Brainwave-Discovery Limited	SC330430	72110	brainwave-discovery.com	CRO using NAMs	High	CRO using humanised transgenic Drosophila models for CNS drug screening as alternative to mammalian models. Edinburgh/Glasgow spinout.
Cell Guidance Systems Limited	07122793	72110	cellgs.com	NAM Developer	High	Develops PODS sustained-release growth factors, PeptiGel synthetic hydrogels for 3D culture, and exosome products - key NAM enabling technologies.
Cellcentric Limited	04948632	72110	cellcentric.com	Firm using NAMs for drug discovery	Medium	Develops epigenetic cancer therapies; uses cell-based assays in drug discovery but limited public detail on specific NAM platforms.
Collected Limited	13529184	72110	collected.com	NAM Developer	Medium	Cell selection technology company; limited public information available on specific products.
Cellese Limited	08484947	72110	cellese.com	NAM Developer and CRO	High	Cardiff-based company specialising in scalable patient-derived organoid (PDO) production for cancer drug discovery using patented bioprocess technology.
Cellomatics Biosciences Limited	09782496	72110	cellomaticsbio.com	CRO using NAMs	High	CRO specialising in cell-based assays, flow cytometry, and immunological services for drug discovery.
Cellrx Limited	12686418	72110	cellrxbio.com	NAM Developer	High	Manufactures growth factors (Short AE-IGF-1) for cell culture and bioprocessing applications - enables NAM development.
Censo Biotechnologies Ltd	SC348293	72110	censobio.com	NAM Developer and CRO	High	iPSC technology company providing cells and contract research services for drug discovery and toxicity testing.
Certara UK Limited	04217235	72200 (also 63110)	certara.com	NAM Developer	High	Previously Simcyp Limited, a spin-off from University of Sheffield, that specialises in virtual population-based pharmacokinetic modelling and simulation. Develops Simcyp PBPK Simulator for in silico prediction of drug behaviour in virtual populations, replacing certain animal and human trials. Certara launched the Non-Animal Navigator (NAM) – an artificial intelligence platform designed to help pharmaceutical companies replace or reduce animal testing.
Charles River Discovery Research Services Uk Limited	04622227	72110	criver.com	CRO using NAMs	High	Major CRO with AMAP initiative integrating in vitro methods; offers organ-on-chip, 3D models, and iPSC services alongside traditional testing.

Cn Bio Innovations Limited	06517359	26511	cn-bio.com	NAM Developer and CRO	High	Develops PhysioMimix organ-on-chip platforms and provides contract research services using their proprietary microphysiological systems.
Concept Life Sciences Integrated Discovery & Development Services Limited	02345676	72190	conceptlifesciences.com	CRO using NAMs	High	Integrated drug discovery CRO offering in vitro biology, DMPK, and toxicology services; parent company of Aquila Biomedical.
Consoneai Ltd	12706787	72110	consoneai.com	NAM Developer	High	TechBio company developing AI platform (DioScor) to predict chemical toxicity, explicitly aimed at reducing animal testing and supporting 3Rs.
Copner Biotech Ltd	12712930	72110	copnerbiotech.com	NAM Developer	Medium	Wales-based 3D bioprinting company developing GRAPE technology for precise bioprinting of scaffolds and microarchitectures for 3D cell culture. MediWales Innovation Award winner.
Cytomos Limited	SC401416	74909	cytomos.com	NAM Developer	Medium	Develops cell analysis technology; limited public information on specific NAM applications.
Depixus Uk Ltd	11849021	72110	depixus.com	NAM Developer	Medium	Single-molecule analysis technology for genomics; enables advanced cell characterisation but not direct NAM development.
Domainex Limited	04336899	72110	domainex.co.uk	CRO using NAMs	High	Drug discovery CRO with in vitro assay capabilities including neuroinflammation models, microglial assays, and CNS-focused screening cascades.
Enhanc3d Genomics Ltd	12423696	72110	enhanc3dgenomics.com	NAM Developer	Medium	Chromatin conformation technology for gene regulation analysis; enables research but not direct NAM platform.
Epicombi.Ai Limited	10455248	72110	epicombi.ai	NAM Developer	Low	AI platform company; limited public information available on specific NAM applications.
Evotec (Uk) Limited	02674265	72110	evotec.com	CRO with own NAMs	High	Major CRO with proprietary E.iPSC platform (→20 cell types), organoids, and multilineage cultures developed in-house.
Fabrx Ltd	09166556	82990	fabrx.co.uk	NAM Developer	Medium	Kent-based 3D bioprinting company manufacturing pharmaceutical 3D printers (M3DIMAKER) for personalised medicine applications; founded 2014.
Fibrofind Ltd	11694429	72190	fibrofind.com	NAM Developer and CRO	High	Develops 3D human tissue models (precision-cut tissue slices) for fibrosis and provides contract drug testing services to pharma/biotech.

Generon Limited	04307717	82990	generon.co.uk	NAM Developer	Medium	Antibody and protein reagent supplier; enables NAM development but limited direct NAM platform information.
Heptares Therapeutics Limited	06267989	72110	sosei.com/heptares	Firm using NAMs for drug discovery	High	GPCR-focused drug discovery company (now Sosei Heptares) using structure-based approaches and in vitro screening for internal pipeline.
Histologix Limited	05466753	72110	histologix.co.uk	CRO using NAMs	High	Histopathology CRO providing tissue analysis services supporting in vitro and ex vivo studies.
Ibitech Ltd	13598139	72110	ibitech.co.uk	NAM Developer	Low	Limited public information available on company activities.
Immunocore Limited	06456207	72190	immunocore.com	Firm using NAMs for drug discovery	High	TCR-based immunotherapy company using cell-based assays and in vitro models for internal drug discovery (TEBENTAFUSP approved).
Jellagen Ltd	SC451036	72110	jellagen.co.uk	NAM Developer	Medium	UK biotechnology company developing medical-grade jellyfish collagen for tissue engineering, regenerative medicine, and 3D cell culture applications.
Jetbio Ltd	14744212	72110	N/A (new spinout)	NAM Developer	Medium	Newcastle University spinout (2024) commercialising Reactive Jet Impingement (ReJI) 3D bioprinting technology for drug discovery and tissue engineering.
Kinomica Limited	10405843	72110	kinomica.com	NAM Developer	Medium	Phosphoproteomics services for drug discovery; analytical platform supporting NAM-based research.
Kirkstall Limited	04112948	72200	kirkstall.com	NAM Developer	High	Develops Quasi Vivo organ-on-chip and multi-organ microphysiological systems for in vitro drug testing.
Lateral Dx Ltd	SC621648	72110	lateraldx.com	NAM Developer	Low	Diagnostics company; limited public information on NAM-specific activities.
Lgc Genomics Limited	07686158	72110	lgcgroup.com	CRO using NAMs	Medium	Genomics and analytical services company; provides services supporting NAM-based research but broad portfolio.
Lhasa Limited	01765239	72190	lhasalimited.org	NAM Developer	High	Leeds-based not-for-profit developing in silico toxicology prediction software (Derek Nexus, Meteor Nexus, Sarah Nexus) for 30+ years. FDA-recommended tool for reducing animal testing.
Lightcast Discovery Ltd	11830666	72110	lightcastdiscovery.com	NAM Developer	Medium	Optogenetics-based screening platform; enables novel in vitro approaches but limited public detail.
Manchester Biogel Ltd	10114420	82990	manchesterbiogel.com	NAM Developer	High	Global leader in synthetic self-assembling peptide hydrogels (PeptiGels) for 3D cell culture, bioprinting, and tissue engineering.

						100% animal-free and chemically defined.
Melbourn Scientific Limited	02358299	72110	melbournscientific.com	CRO using NAMs	Medium	Contract laboratory services; limited specific information on NAM capabilities.
Multiplai Health Ltd	12869546	72190	multiplaihealth.com	NAM Developer	Low	AI/digital health company; limited public information on specific NAM applications.
Mycoplasma Experience Limited	02289379	72110	mycoplasma-exp.com	CRO using NAMs	Medium	Mycoplasma testing services supporting cell culture quality; enables NAM development indirectly.
Neovac Ltd	13606487	72110	neovac.co.uk	NAM Developer	Low	Limited public information available on company activities.
Neurexpert Limited	07627743	72110	neurexpert.com	CRO using NAMs	High	Neuroscience CRO offering in vitro and ex vivo electrophysiology, imaging, and behavioural assays for CNS drug discovery.
Newcells Biotech Limited	09389592	72110	newcellsbiotech.co.uk	NAM Developer and CRO	High	Develops approximate kidney proximal tubule models and provides contract testing services for nephrotoxicity assessment.
Novai Ltd	12457690	72110	novai.co.uk	NAM Developer	Low	Limited public information available on company activities.
Novogene (UK) Company Limited	09353226	72110	en.novogene.com	CRO using NAMs	Medium	Genomics services company; supports NAM-based research through sequencing but not direct NAM developer.
Nucleome Therapeutics Limited	12109297	72110	nucleome.com	NAM Developer	Medium	3D genomics platform for drug discovery; computational/analytical approach supporting NAM development.
Omass Therapeutics Limited	10028228	72110	omasstx.com	Firm using NAMs for drug discovery	Medium	Native mass spectrometry-based drug discovery; uses advanced in vitro methods but focus is on analytical platform.
Oxartis Limited	13065922	72190	oxartis.co.uk	NAM Developer	High	Develops tissue scaffolds for dermal reconstruction and wound healing; received Innovate UK funding for regenerative dermal scaffold development.
Oxford Mestar Ltd	08751331	72110	oxfordmestar.com	NAM Developer	Medium	Oxford University spinout developing 3D bioprinting technology (OMEFlex) for rapid fabrication of human tissues using hydrogel/cell dispensing systems.
Pharmaron UK Limited	08755111	72110	pharmaron.com	CRO using NAMs	High	Major integrated CRO offering in vitro ADMET, cell-based assays, and safety pharmacology services.
Pharmatics Limited	SC394102	72190	pharmaticslimited.com	CRO using NAMs	Medium	Pharmaceutical development services; limited specific information on NAM capabilities.

Plasticell Limited	04549890	82990	plasticell.co.uk	NAM Developer and CRO	High	Develops stem cell differentiation protocols using combinatorial screening and provides contract services for cell therapy development.
Precision For Medicine (Uk) Limited	10687625	72110	precisionmedicine.com	CRO using NAMs	Medium	Biomarker and precision medicine CRO; supports NAM-based research but broad service portfolio.
Psivac Limited	11835441	72110	psivac.com	NAM Developer	Low	Limited public information available on company activities.
Qkine Ltd	10470662	32990	qkine.com	NAM Developer	High	Cambridge-based manufacturer of high-purity, animal-free growth factors and cytokines for stem cell, organoid, and regenerative medicine applications. University of Cambridge spinout (2016).
Reprocell Uk Ltd	SC231284	71200	reprocell.com	NAM Developer and CRO	High	UK subsidiary providing bioengineered 3D human skin models (REPROSKIN), Alvetex scaffolds, and contract research services for drug testing.
Rinri Therapeutics Limited	11680455	72110	rinritx.com	Firm using NAMs for drug discovery	Medium	Cell therapy company for hearing loss; uses stem cell technology but focus is on therapeutic development.
Screenin3d Limited	SC614453	72110	screenin3d.com	NAM Developer	High	3D cell culture and spheroid screening platform developer for drug discovery applications.
Sistemic Scotland Limited	SC335158	72110	sistemicbio.com	NAM Developer	High	Develops extracellular vesicle/exosome analysis technology for cell communication research and drug delivery.
Stemcell Technologies Uk Ltd	08916044	72110	stemcell.com	NAM Developer	High	Major supplier of stem cell culture media, reagents, and tools enabling iPSC and organoid research globally.
Stemnovate Ltd	10140603	72110	stemnovate.co.uk	NAM Developer and CRO	High	Cambridge-based company providing iPSC reprogramming services, iPSC-derived cells (hepatocytes, cardiomyocytes, neurons), and disease modelling platforms for drug discovery.
Stratosvir Limited	13099988	72110	stratosvir.com	Firm using NAMs for drug discovery	Low	Antiviral drug discovery; limited public information on specific NAM usage.
Sygnature Discovery Limited	05210563	72110	sygnaturediscovery.com	CRO using NAMs	High	Major integrated drug discovery CRO with extensive in vitro biology capabilities including iPSC-derived cells, 3D models, and phenotypic screening.
Tissue Click Ltd	07875242	72110	tissueclick.com	NAM Developer	Medium	Tissue engineering technology; limited public information on specific products.

Transition Bio Limited	12747523	72110	transiobio.com	NAM Developer	Medium	Stem cell technology company; limited public information on specific NAM applications.
Xcellr8 Limited	06489519	74909	x-cellr8.com	Fully animal free CRO	High	World's first GLP-accredited 100% animal-product-free contract testing laboratory; exclusively uses human cell-based NAMs.
Zetta Genomics Limited	11475418	72110	zettagenomics.com	NAM Developer	Medium	Genomics/bioinformatics company; supports NAM research but limited direct NAM platform development.

**Notes:** CRN = Company Registration Number with Companies House.

Standard Industrial Classification (SIC) code descriptions are: 26511: Manufacture of electronic instruments and appliances for measuring, testing, and navigation, except industrial process control equipment; 32990: Other manufacturing n.e.c.; 71200: Technical testing and analysis; 72110: Research and experimental development on biotechnology; 72190: Other research and experimental development on natural sciences and engineering; 72200: Research and experimental development on social sciences and humanities; 74909: Other professional, scientific and technical activities (not including environmental consultancy or quantity surveying) n.e.c.; 82990: Other business support service activities n.e.c.

## 6.2 Claude for Education Opus 4.1 Government Life Sciences 2021/22 dataset detailed method

The following initial prompt was used. The 'attached .xlsx file' is the Government's 'Bioscience and health technology sector statistics 2021 to 2022: life sciences sites'<sup>27</sup> dataset, which was the latest dataset available that was comparable to the one used by Cebr. More recent versions no longer include site-level data.<sup>28</sup> The 'attached report PDF' is the original Cebr report<sup>26</sup>:

Identify a list of companies/firms in the attached .xlsx file which are most likely to be involved in New Approach Methodologies (NAMs). They may fall into groups of NAM Developers, Contract Research Organisations (CROs) using NAMs, CRO with own NAMs, NAM Developer and CRO, Firm using NAMs for drug discovery, Fully animal free CRO. The list should include fewer than 100 companies. This is part of trying to replicate the methodology in the attached report PDF with updated data.

Claude described the following method:

### 1. Primary SIC Code Filtering

First, I prioritized companies with specific SIC codes that align with NAM activities:

- **72110:** Research and experimental development on biotechnology (highest priority)
- **72190:** Other research and experimental development on natural sciences
- **26511:** Manufacture of electronic instruments (for analytical equipment)
- **86900:** Other human health activities

### 2. Keyword Analysis

I searched multiple fields (Business\_Name, Segment\_Description, Sector\_Description) for NAM-relevant keywords:

#### **Direct NAM Technology Keywords:**

- **3D Cell Culture:** "3d", "spheroid", "organoid", "three dimensional"
- **Organ-on-chip:** "organ chip", "microfluid", "lab on chip", "microphysiological"
- **Tissue Engineering:** "tissue", "scaffold", "biomaterial", "bioprint", "extracellular matrix"
- **Cell Technologies:** "cell line", "stem cell", "ipsc", "primary cell", "cell culture", "cell based"

#### **In Vitro/Alternative Methods Keywords:**

- "in vitro", "invitro", "alternative", "replacement", "animal free", "non-animal"
- "cell assay", "cytotox", "genotox", "cell based assay"

#### **Computational/AI Keywords:**

- "artificial intelligence", "ai", "machine learning", "computational model"
- "in silico", "silico", "predictive", "qsar", "pbpk", "systems biology"
- "bioinformat", "data science", "algorithm"

#### **Service/CRO Keywords:**

- "contract research", "cro", "preclinical service"
- "drug discovery service", "screening service"
- "analytical service", "assay development"

#### **Application Area Keywords:**

- **Toxicology:** "toxicolog", "safety assess", "safety test", "ecotox"
- **Drug Discovery:** "drug discovery", "screening", "high throughput", "lead optimization"
- **Analytical:** "analytical", "assay", "bioanalytical", "characterization"

### **3. Business Segment Analysis**

I gave high scores to companies in these segments from your dataset:

- Blood & Tissue Products
- Cell Therapy
- Tissue and Biomass
- Contract Manufacturing/Research Organisation
- Analytical Services
- Assay developer
- In vitro diagnostic technology (only if combined with research/preclinical keywords)

### **4. R&D Activity Filter**

Companies with "R&D - In House" in the RandD\_Activity field received additional weight, as NAM development typically requires significant R&D investment.

### **5. Scoring System**

Each company received points based on:

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#### **Non-Animal New Approach Methodologies (NAMs):**

More effective, more ethical and more economically productive

- **5 points:** Direct NAM technology indicators (organ-on-chip, 3D culture in name)
- **4 points:** Tissue engineering, in silico modelling, AI drug discovery
- **3 points:** In vitro testing, toxicology, cell-based technologies, SIC 72110
- **2 points:** CRO services, drug discovery, analytical services, SIC 72190
- **1 point:** R&D activity, relevant business segment

Companies needed a minimum score of 4-5 to be included in the final list.

## 6. Exclusion Criteria

I excluded companies that were:

- Pure diagnostic companies without research/preclinical focus
- Medical device companies without biological components
- Pure manufacturing without R&D
- Clinical-stage only (not preclinical)
- IT/software companies without specific life science applications

## 7. Categorization Logic

- After identification, I categorized companies based on their primary characteristics:
- **NAM Developer:** Companies developing new technologies (highest keyword matches for 3D, tissue, cell, organ-chip)
- **CRO using NAMs:** Contract research organizations with preclinical/analytical services
- **NAM Developer and CRO:** Companies with both technology development and service offerings
- **CRO with own NAMs:** CROs that have developed proprietary NAM technologies
- **Firms using NAMs for drug discovery:** Pharmaceutical companies applying NAMs
- **Fully animal-free CRO:** CROs explicitly stating animal-free approaches (rare in dataset)

## 8. Manual Refinement

For the top 40 companies, I performed additional checks:

- Company names suggesting cutting-edge technologies (e.g., "3D" in SCREENIN3D LIMITED)
- AI/ML companies in biopharma space (e.g., MULTIPLAI HEALTH LTD)
- Known major CROs with NAM capabilities (e.g., Charles River)

### Example Application:

**SCREENIN3D LIMITED** scored highly because:

- Name contains "3D" (+5 points)
- Likely in Contract Research segment (+2 points)
- Probable R&D activity (+1 point)
- Total: 8 points → High confidence NAM company

## 6.3 Literature review detailed method

We used the following prompt with Claude for Education's Opus 4.5 model to generate an initial rough draft of the literature review, primarily to identify some key sources:

Create a 3000-word fully referenced literature review as part of a business case for ending animal testing in the UK and diverting funding to Non-Animal New Approach Methodologies (NAMs) and with a primary audience of the Government and MPs. Please output as a .docx file with Zotero references using Vancouver (superscript) citation style.

It should seek to cover the following:

1. An estimated economic productivity multiplier for non-animal NAMs to enable government understanding of the potential for public investment to provide a return for the economy and in tax yield. The Government's own estimate for Research & Development (R&D) is a multiplier of 7.5. This is not specific to non-animal NAMs, so we will select the most appropriate estimate from a range.
2. Current UK and EU markets and potential for expansion.
3. Potential opportunities for regions and left-behind areas of the UK, drawing on sector analysis and, potentially, comparator cases like TV production in Salford.
4. Opportunities based on consumer preferences and purchase habits with regard to animal welfare.
5. Opportunities to innovate and stabilise funding for Higher Education.
6. Opportunities to innovate, reduce costs, improve health and provide income for the NHS.
7. Drug discovery and development produced in the UK.
8. Environmental impacts and knock-on effects on economy and wellbeing.
9. Cost effectiveness of non-animal NAMs compared with animal testing.
10. Benefits of regulatory changes to improve development pipelines.

Claude requested clarifications, with the following parameters the result:

- Timeframe: Post-2015 literature prioritised, with older sources where necessary
- NAMs scope: Full spectrum (organ-on-chip, in silico, 3D tissue models, AI-driven approaches, etc.)
- Regional focus: Left-behind and socioeconomically disadvantaged areas, identifying promising regions based on skills gaps

We then heavily revised the output, checking all sources, revising claims, reordering the text and adding further analysis.

## 6.4 Imputation of missing data

We used the full sample of NAM companies for 2021-23, with 2023 as the most recent year in which all companies had reported accounts. We then impute data on employment, turnover and cost of employment for 2024 based on the growth rate of these variables for all the firms in the subsample with complete returns for 2024 as well as 2021-23.

However, because the majority of companies are not required to report turnover or employment cost data, the employment cost and turnover results are scaled up using data on the proportion of firms (by employment) who have complete data on turnover and

employment costs. This is about 88% of companies in each case. Although the proportion of companies with incomplete data by count is high, the proportion with incomplete data weighted by employment is much lower because the companies with missing turnover/cost data are those small companies that have lower reporting requirements. Because Companies House accounts do not report a straightforward GVA figure, we use the ratio of GVA to turnover in the most relevant SIC code from Annual Business Survey data to impute GVA based on the turnover data.

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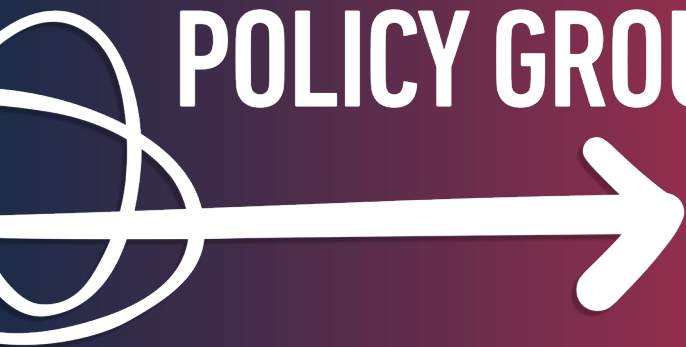
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