The economic impact of the UK's New Approach Methodologies sector

A Cebr report for Animal Free Research UK

September 2021

Authorship and acknowledgements

This report has been produced by Cebr, an independent economics and business research consultancy established in 1992. The views expressed herein are those of the authors only and are based upon independent research by them.

London, September 2021

Contents

Foreword

Animal Free Research UK is Britain's leading medical research charity working for a world where human diseases are cured faster without animal suffering. As well as funding cutting-edge medical research that replaces animals and is much more relevant to humans, we work with policy makers and the public to drive forward powerful change that benefits people and animals.

We believe that medical research urgently needs to be modernised, replacing animal experiments with future-focused, human relevant techniques. These New Approach Methodologies (NAMs) include the use of human cells and tissues; artificial intelligence; and organ-on-a-chip technology. Since NAMs produce results that are directly applicable to humans, they do not encounter the pitfalls of extrapolating from one species to another. Species differences play a major role in holding back medical progress, with over 92 per cent of drugs that show promise in animal tests failing to reach the clinic and benefit patients.[1] Most of these failures are due to adverse effects and/or lack of efficacy in humans, which were not predicted by results in animal tests.

Alongside the ethical and scientific advantages of these cutting-edge techniques, the NAMs market has major economic potential. The following report provides powerful evidence of the valuable contribution that NAMs are already making to the British economy, and of the major opportunities provided by this growing sector. While this research focuses exclusively on the UK, it should be viewed in the context of a burgeoning global industry, in which Britain could play a leading role. For example, in September 2021, US-based organ-on-a-chip provider Emulate Inc. announced that it had raised almost $225 million in investment.[2]

This evidence comes at a vital moment, as the UK Government seeks to determine its strategic priorities for innovation. Some NAMs already align with the technology 'families' identified as priorities in the UK Innovation Strategy, such as artificial intelligence, bioinformatics and engineering biology. Indeed, the Strategy acknowledges the important role that some NAMs could play, stating 'advances in the coming decades are likely to come from exploiting new tools, such as (…) software for biology, and microfluidics'.[3]

CN Bio is one of the companies whose data is included in the report and provides a strong example of how Britain can show global leadership in the field of NAMs. The US Food and Drug Administration (FDA) has chosen to expand its collaboration with CN Bio to evaluate how its lung-on-a-chip model can be used in regulatory evaluations.[4] Since the Government's Innovation Strategy indicates that further prioritisation will be determined by factors such as future growth potential and current competitive advantage, there is a strong case for placing

1 Bio, Pharma Intelligence, QLS Advisors. 2020. Clinical Development Success Rates and Contributing Factors

2 Emulate. 2020. Emulate Closes $82 million Series E Financing to Scale Amid Rapid Growth in Organ-on-a-Chip Market

3 Department for Business, Energy and Industrial Strategy. 2021. UK Innovation Strategy: Leading the future by creating it

4 CN Bio. 2021. CN Bio FDA collaboration expanded

NAMs at the heart of the Government's scientific strategy. Additional NAMs, such as advanced cell-based techniques, should also benefit from this support.

With world-leading universities and a thriving life sciences sector, Britain could play a leading role in the growing NAMs industry. However, strong Government support will be essential, and we strongly suggest the following recommendations:

1. Modernising medical research should be included within the forthcoming Innovation Missions programme. This process of modernisation should involve the replacement of animal research with cutting-edge, human relevant techniques.
2. A concrete plan should be developed to implement this important transition, and a new ministerial position should be created to oversee and coordinate it.
3. The NAMs that fall within the 'technology families' that the Government has already identified (such as AI and bioinformatics) should be further prioritised and benefit from policy and funding support. Additional NAMs, such as advanced cell-based techniques, should also be given priority.
4. The Government should provide significant funding for the standardisation and uptake of existing NAMs, as well as the development of new NAMs. Approaches for doing so could include making specific grants available for this purpose and ensuring that R&D tax reliefs promote the development of NAMs.

If the Government seizes this opportunity to ensure that Britain plays a leading role in the growing NAMs industry, this will benefit the economy and help to secure our position as a global science superpower.

Carla Owen, Chief Executive, Animal Free Research UK
Dr Jarrod Bailey, Director of Science, Animal Free Research UK

Executive Summary

Report overview

- This is a Cebr report for Animal Free Research UK, assessing the **economic contributions made by New Approach Methodologies (NAMs) in the UK.**
- The report considers the direct economic contributions made by the UK NAMs sector during 2017-2019 as well as a forecast of its projected economic contribution up to 2026.

Methodology

- Our analysis relies on firm level data reported to Companies House by firms in the NAMs industry and the Annual Business Survey (ABS), published by the Office for National Statistics (ONS). Guidance was also provided by Animal Free Research UK.
- Firm level data is aggregated and used to calculate the economic contribution that the NAMs sector made to the UK economy for the three years through 2019. This is considered in terms of four key economic indicators; turnover, Gross Value Added (GVA), employment and employee compensation. Headline findings are presented for 2019, but our full results cover the period 2017-19.
- Following the computation of the baseline impacts, we forecast the industry's contribution to UK GDP, in terms of GVA, for the seven years through 2026. Upper and lower bounds of employee numbers were also forecast for the same period. Adjustments have been made to counter the effects of survival bias and the industry life cycle stage in which the NAMs industry is currently operating. More information on this is detailed further in section 2.2.
- The firms included in analyses operated using varying accounting periods. To harmonise the data, we have grouped financial reports into the calendar years in which the majority of their accounting period falls into. For example, 2018-19 data for a firm whose accounting period runs February to February will be included in the 2018 calendar year.

Direct economic contributions

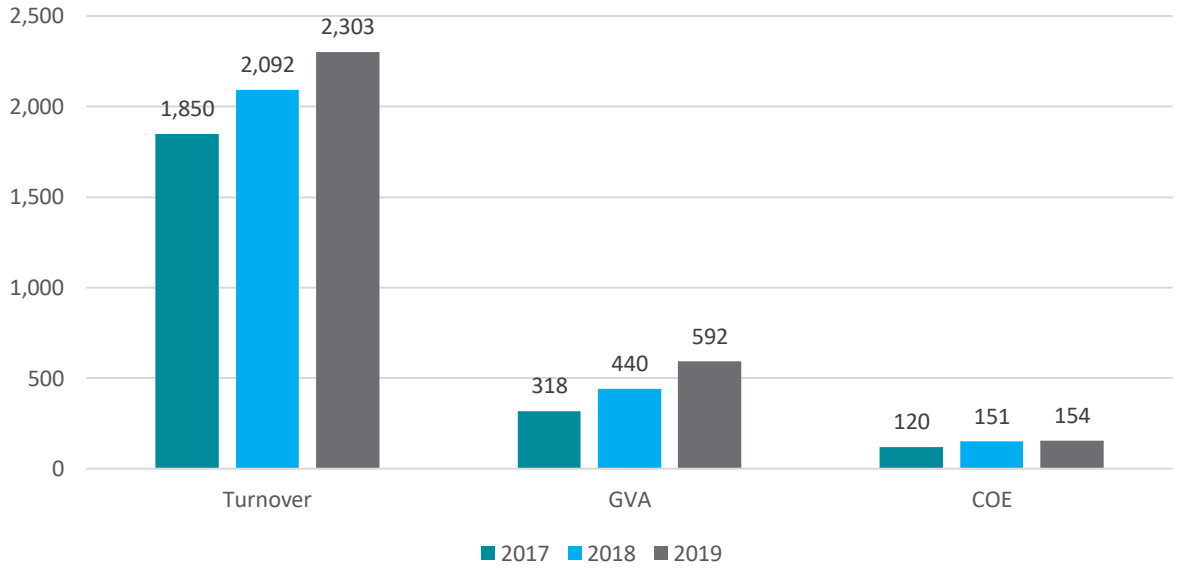
- In 2019, it is estimated that the UK NAMs industry directly contributed:

Fig A: Direct impacts 2019

Source: Companies House, ONS, Cebr analysis

- **The turnover, GVA, employment and employee compensation contributed by firms operating in the NAMs industry have all increased significantly from 2017 to 2019.**
- From 2017 to 2019, turnover, the number of workers employed by the industry and costs of employment increased at a similar rate, by 24.5%, 25.4% and 28.8% respectively. Conversely, industry GVA grew at a much faster pace, at 86.3% over the same period, reflecting the NAMs sector's growing contribution to UK GDP.
- The slight gap between the growth rates of industry costs of employment (28.8%) and average number of annual employees (25.4%) indicates that operators' costs have increased slightly in proportion to the average number of workers employed annually. This could indicate changing employment patterns as more full-time, as opposed to part-time, jobs are created. It could also signify an increase in annual salaries, due either to employees becoming more skilled and experienced, or to rising wages in the industry as NAMs related products and services become more widely used in the UK.
- In absolute terms, industry turnover grew by £452 million over the period, reflecting an uptake in demand for goods and services provided by the industry, as illustrated in Figure B.

Figure B: NAMs industry turnover, GVA and costs of employment, 2017-2019, £ million



Source: Companies House, ONS, Cebr analysis

- Labour productivity for firms operating in the NAMs sector increased sharply over the three years through 2019, by 48.6%. This is measured in GVA per employee and represents the economic contribution of each employee to UK GDP. Jobs supported by the industry grew by 436 from 2017 to 2019.
- The economic contribution of the UK NAMs sector, calculated in terms of GVA, is forecast to increase in every year from 2020 to 2026, reaching £2,543 million at the end of the period.
- Cebr forecasts that industry employment will continue to grow throughout every year of the forecast period through 2026, with a lower bound estimate of 6,872 and upper bound estimate reaching 9,254.

1. Introduction

Background and aims of the study

This is a report by the Centre for Economics and Business Research (Cebr), on behalf of Animal Free Research UK, estimating the current size and economic contribution of the New Approach Methodologies sector in the UK. Within this report, Cebr also forecasts the economic contribution of this sector to the UK economy through 2026.

Animal Free Research UK is Britain's leading medical research charity working for a world where human diseases are cured faster without animal suffering. The organisation was founded in 1970 when the British Union for the Abolition of Vivisection (BUAV, now Cruelty Free International) established the Dr Hadwen Trust for Humane Research and became a charity in its own right in 1980. Since its inception, Animal Free Research UK has awarded £10 million in grants to over 260 projects in areas such as cancer, Alzheimer's and diabetes research. The charity is creating a new generation of animal free researchers through its innovative Animal Replacement Centres of Excellence.

The research presented herein seeks to produce estimates for the economic contribution, size of and number of jobs supported by the UK's New Approach Methodologies sector, over the period 2017-20. Forecasts for the sector's economic contribution in addition to upper and lower bound estimates for the number of jobs supported by the industry up to 2026 are also included. The research relies on publicly accessible company level data, incorporating this into a bespoke forecasting model, with the support of Animal Free Research UK. Firms included in this research are also split into categories and analysed on this basis.

The Covid-19 pandemic is expected to have had a slight negative effect on overall industry growth rates, although specific individual firms received an increase in external investments owing to the increase in need for scientific and technological progress. The pandemic did not affect availability of data and therefore it was possible to conduct analyses through years impacted by Covid-19.

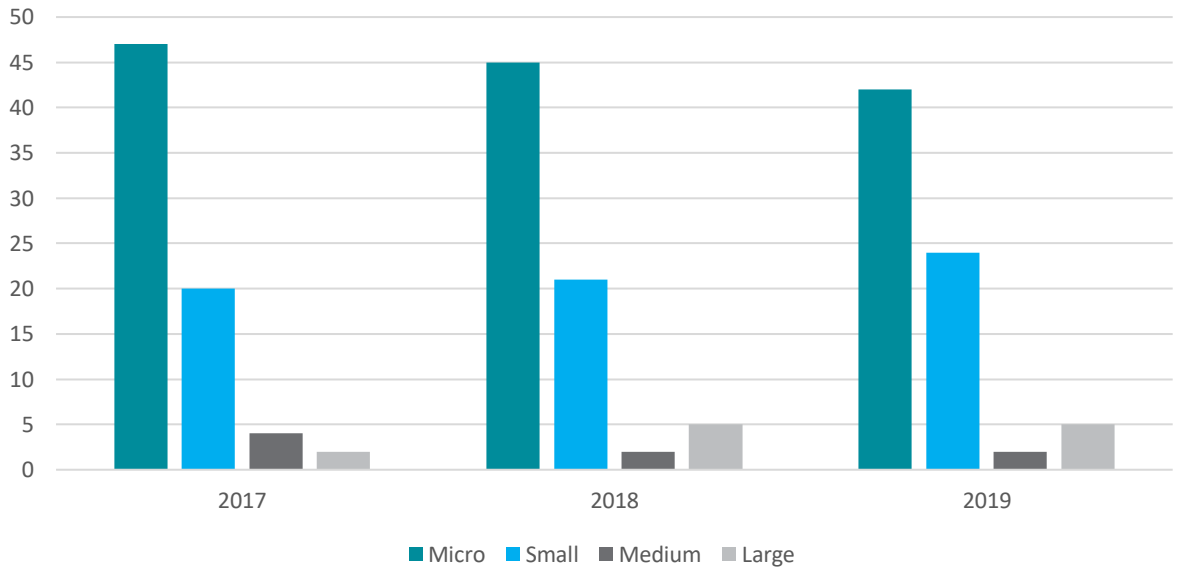
The analysis considers the contribution of firms employing and developing New Approach Methodologies, measured by macroeconomic indicators such as turnover, employment, gross value added (GVA) - a measure of economic output - and employee compensation. This is estimated at a national level, assessing the economic contribution of NAMs across the UK.

The overall aim is to provide individuals, organisations and stakeholders involved in the sector with a clear, robust, and evidence-based understanding of their ongoing economic contributions to the UK economy.

Background to New Approach Methodologies

New Approach Methodologies (NAMs) are 'new scientific approaches that focus on human biological processes to investigate disease and potential treatments, using human cells, tissues, organs and existing data'.[5] In recent years investments into NAMs have accelerated globally, with both governments and industry operators increasing efforts into their development and adoption. The need for progress towards reducing and replacing the use of animals in the testing of chemical substances has also been increasing in legal recognition for over a decade. In 2006, the Registration, Evaluation, Authorization and restriction of Chemicals (REACH) Regulation (EC No, 1907/2006) called for the use of NAMs where suitable, in assessing the toxicity of industrial chemicals, effective within the European Union.[6] While in the United States, the Toxic Substances Control Act and the Lautenberg Chemical Safety Act mandate efforts towards reducing animal testing in vertebrate animals and implementing NAMs.[7]

Figure 1: NAMs company size, 2017-2019, number of firms



Source: Companies House, Cebr analysis

The majority of UK firms which comprise the UK NAMs sector can be classed as micro entities, having both turnover of less than £632,000 per annum and fewer than an average of 10 employees annually, as specified by Companies House classifications.[8] Figure 1 displays the

5 The Alliance for Human Relevant Science. 2020. Accelerating the Growth of Human Relevant Life Sciences in the United Kingdom

6 The European Agency for Safety and Health at Work. 2021. Regulation (EC) No 1907/2006 - Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

7 United States Environmental Protection Agency. 2016. The Frank R. Lautenberg Chemical Safety for the 21st Century Act

8 Companies House. 2021. Company Accounts Guidance

number of firms in the NAMs sector classified by size. Small companies are defined as those whose annual turnover does not exceed £10.2 million and have no more than 50 average annual employees, while medium firms generate turnover of between £10.2 million and £22.8 million and employ between 50 and 250 persons annually.[9]

Data shows that over the three years from 2017 to 2019, the number of large companies increased from 2 to 5, while the number of micro entities declined from 47 to 42 over the same period. The number of small companies also grew from 20 to 24 over the three years. A small number of firms entered the industry over the period, however these firms all entered as micro companies. The decrease in the number of micro companies over the period is expected to be a result of individual company growth over the period as opposed to firms exiting the industry.

For reference, in 2019, 89.5% of firms in the UK were classified as micro businesses, 8.5% as small businesses 1.5% as medium sized business with the remaining 0.4% classified as large. In comparison, in the same year, only 58% of NAMs operators were classed as micro entities, 33% were small businesses, 3% were medium sized and 7% were large. This indicates that as assessed here, the composition of the NAMs industry is slightly more consolidated than is the average UK industry. Taken at face value, this could be reflective of large investments in research and development that are needed for firms to remain competitive in the NAMs industry. Alternatively, it may also be partially a function of difficulty in identifying micro firms within the industry, in the generation of the sample of NAM firms.

Many of the UK companies that either use or develop NAMs receive grants from both government and private sector grant giving funds, in addition to research and development tax credits. The largest known amount received by a firm in the UK NAMs sector was £1.2 million. This was distributed to Certara UK Limited in 2019, £582.7 thousand in the form of government grants and £658.8 thousand through a research and development tax credit.[10]

Types of NAMs Industry Operators

Firms operating in the New Approach Methodologies sector fall into several different categories depending on the type of their operations. The firms in the UK NAMs industry and their respective categories are summarised in Table 1, by the percentage of firms that belong in each category. The term ‘CRO’ refers to contract research organisations, which provide research related services on a contracted basis. The largest category of firm was ‘NAM Developers’ which represented 43.8% of all firms in the UK NAMs industry in 2019.

9 UK Public General Acts. 2006. Companies Act 2006, Section 348

10 Certara UK Limited. 2019. Annual Report and Financial Statements, Year ended December 2019

Table 1: Types of NAMs Industry Operators

NAM Developers	43.8%
CRO using NAMs	24.7%
CRO with own NAMs	12.3%
NAM Developer and CRO	11.0%
Firm using NAMs for drug discovery	6.8%
Fully animal free CRO	1.4%

Source: Animal Free Research UK

Structure of the report

The report is structured as follows:

- Section 2 sets out our methodology. This includes our methods for calculating the size, economic contribution, costs of employment and number of jobs supported by the UK's NAMs sector, as well as forecasts of economic impact and employee numbers.
- Section 3 sets out our initial findings on the economic impact of NAMs, in terms of turnover, GVA, employment, employee compensation using data reported by NAMs industry operators over the three years to 2019. This section also includes details of reported GVA and a Cebr forecast of industry GVA for 2020.
- Section 4 comprises of forecasts of the economic impact of NAMs through 2026 at a national level. An upper and lower bound of employment over the same period is also included in this section.

2. Methodology

2.1 Key performance indicators

Our starting point was to identify the contributions directly made by the development and usage of NAMs to the UK economy. Our initial analysis, covering 2017, 2018 and 2019 considered four key performance indicators:

- **Turnover** – This represents the business revenue generated by firms in the UK NAMs sector.
- **Gross Value Added (GVA)** – While turnover captures the entire cost of sales, GVA contributions represent the 'value-added' to the economy by NAMs related activity. It avoids double counting by subtracting intermediate consumption.[11] GVA is also commonly known as income from production and is distributed in three directions – to employees, to shareholders and to government.
- **Employment** – Refers to the number of workers employed by firms developing and using NAMs. These figures refer to all employees not only those working full time, or a full-time equivalence figure, due to a lack of data.
- **Costs of Employment** – Refers to the total compensation paid to employees in return for work done. This includes wages, benefits and employer pension and tax liabilities.

To compute the impacts above, we relied predominantly on primary financial data from a list of NAMs industry operators filed to Companies House, a government registrar containing publicly available information about companies in the UK. The list of 73 firms included in this analysis was provided by Animal Free Research UK. The main source of information for the list was the Government's Bioscience and health technology sector statistics 2019. The companies were selected by applying relevant filters to the data spreadsheet and visiting the companies' websites to ascertain whether they developed NAMs, or focused on using NAMs in the research services they offered. Companies were included if they fell into one of the categories outlined in Table 1. Further research was undertaken using internet searches and consulting with experts in order to identify any further companies that should be included.

With guidance from Animal Free Research UK, we excluded those companies for which an undetermined portion of activity is NAMs related, to obtain the most accurate results. Firms excluded were large CROs, such as Sygnature Discovery Limited, who last reported turnover of £31.4 million for the year through March 2020. Exclusion of such firms has meant that our figures are somewhat conservative. Performance indicators were aggregated and reported at the national level.

11 For the purposes of this report, we used the Income approach for GVA calculations, per the following equation: GVA = Operating Profit (before tax) + Employee Compensation

In 2019, 90.4% of firms comprising the UK NAMs industry were classified as small or micro entities. As such, subject to the Companies Act (2006) and the Small Companies (Micro Entities' Accounts) Regulations (2013), these firms were exempt from reporting certain aspects of their full financial accounts. Consequently, Cebr computed performance figures of turnover, GVA and employee compensation for these firms using key economic and accountancy ratios and information from firms in the industry for which full financial information was available. Employment figures were available for every company and taken straight from company accounts.

Further adjustments were made based upon data from the Annual Business Survey on the average costs of employment/average annual employment ratio for the relevant SIC code for each company. The term 'SIC' is an abbreviation of 'Standard Industrial Classification', the system by which the UK government classifies UK industries, with numerical codes used to represent different industries. 69.9% of the firms included in this study were classified under the SIC code 72110 (Research and experimental development on biotechnology). Details of other SIC codes referred to in the report are detailed in Figure 2 below.

Figure 2: SIC codes included with descriptions

SIC	Description
26511	Manufacture of electronic instruments and appliances for measuring, testing and navigation, except industrial process control equipment
58290	Other software publishing
63110	Data processing, hosting and related activities
64209	Activities of other holding companies (not including agricultural, production, construction, distribution and financial services holding companies)
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) not elsewhere classified
82990	Other business support service activities not elsewhere classified
86900	Other human health activities
96090	Other personal services not elsewhere classified

Source: Companies House, ONS

2.2 NAMs industry forecasting

Our forecasts for the economic impact of NAMs through 2026 have been calculated in terms of GVA. GVA growth forecasts for the wider sector have been used as a baseline forecast. Following this, adjustments were made based on data obtained from firm-level financial information of the companies involved in using and developing NAMs in the UK, aggregated

to a national scale. Data reported for 2020 to Companies House by firms operating in the UK NAMs sector was incomplete as not all industry operators had yet reported their 2020 financial data at the time of analyses and writing of this report. Consequently, we have included reported GVA for 2020 in addition to a Cebr 2020 forecast of industry GVA based on growth rates of companies who had already reported both 2019 and 2020 data.

Survival bias

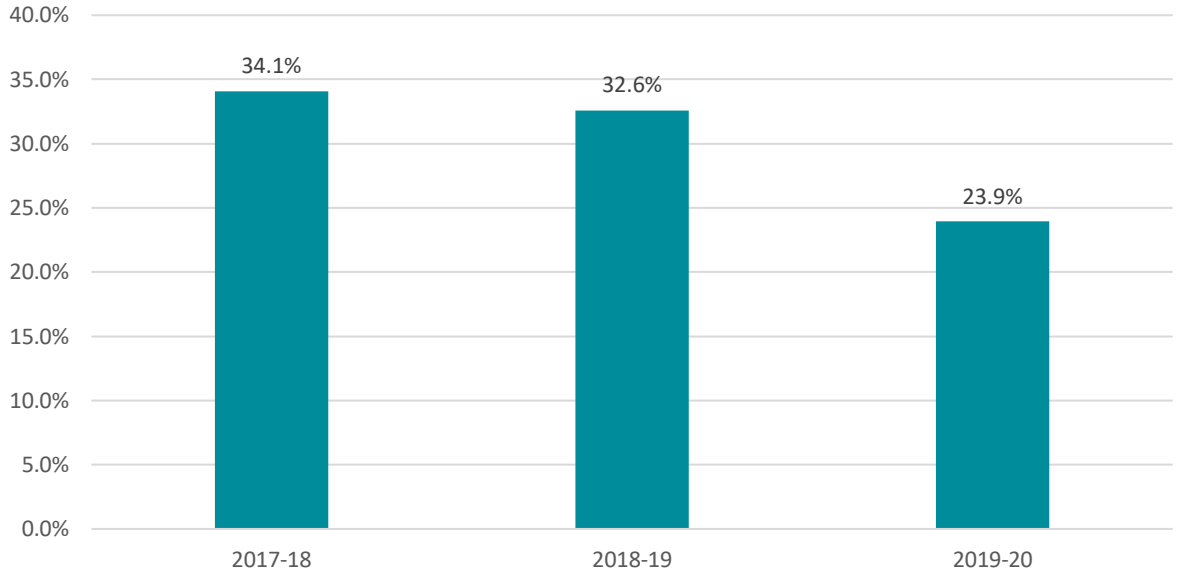
Survival bias refers to the phenomena whereby firms that fail and subsequently exit an industry are excluded from performance studies conducted after they have exited. Consequently, such performance studies contain bias, as firms included in analyses are only those which have survived in the industry and exclude those which have failed, causing performance indicators to be inflated. Cebr have made adjustments to the forecasts included in this report, to counter the effects of survival bias.

Life cycle forecasting

Economic literature suggests that industry level mean-reversion models improve accuracy of forecasts for firm growth.[12] This means that firm level growth forecasts which incorporate an expectation that growth rates tend towards average industry growth rates, are more reliable. For the three years through 2020, for which growth rate data for all firms used in this study was available, growth rates of firms in the NAMs sector were higher than the average of the industry they belong to. However, the difference between NAMs industry growth rates and the wider industry decreased in each year, at an increasing rate.

12 P. M. Fairfield, S. Ramnath, and T. L. Yohn. 2009. Do Industry-Level Analyses Improve Forecasts of Financial Performance? *Journal of Accounting Research* 47 (1):147-178.

Figure 3: Percentage by which NAMs industry growth rates exceeded growth rates of wider industry, %



Source: Companies House, Cebr analyses

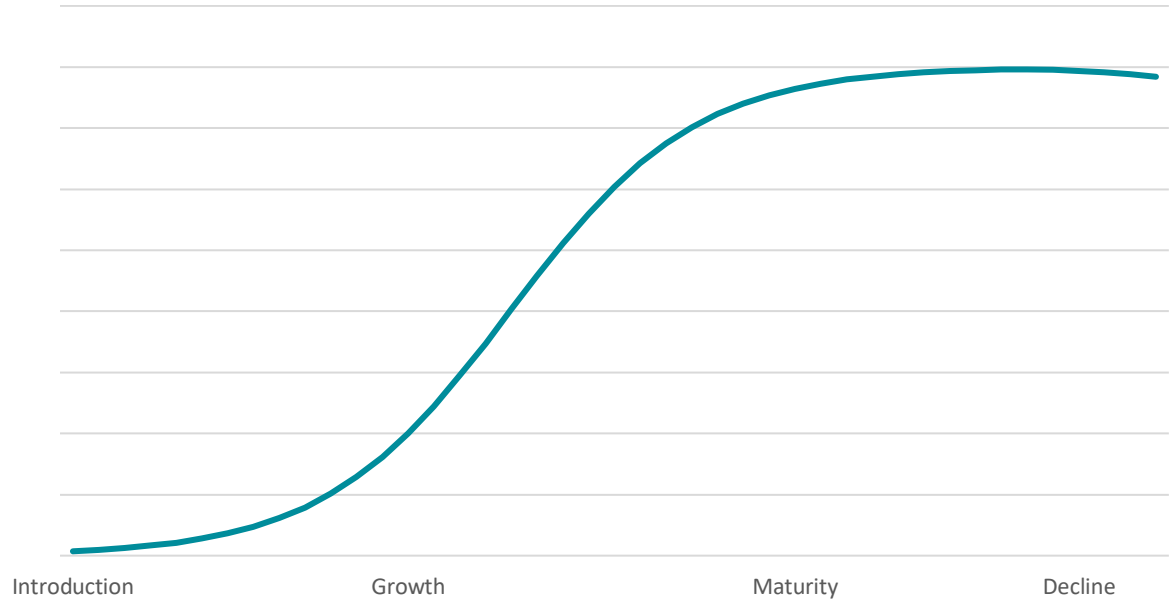
Further economic literature suggests that the underlying process behind the success of industry mean reversion models relates to factors pertaining to industry life cycle. A firm or industry's life cycle reflects its evolution over time, with evolvements driven by changes in both internal and external factors. The life cycle stage in which an industry or firm is operating has a substantial impact on decision making, profitability and growth.[13]

The most widely recognised model of industry life cycle was introduced in 1980, by M. Porter, which depicts an industry's life cycle as an S-shaped curve progressing through four phases, as depicted in Figure 4. Lengths of each respective phase vary widely between industries.[14]

13 P. Vorst, T. L. Yhon. 2018. Life Cycle Models and Forecasting Growth and Profitability *The Accounting Review* 93 (6): 357-381.

14 A. Sabol, M. Šander, D. FučKan. 2013. The Concept of Industry Life Cycle and Development of Business Strategies. Active Citizenship by Knowledge Management & Innovation: Proceedings of the Management, Knowledge and Learning International Conference

Figure 4: Industry life cycle phases



Source: M. Porter, 1980[15], Cebr adjustments

An industry's introduction phase can be characterised by a high rate of product innovation; however, customer preferences are ill defined, engendering slow growth. The growth phase arises as dominant product designs emerge, and functional and technical standards become better defined. Growth rates are highest during this phase, while innovation of production processes is high and automation increases. The maturity phase is characterised by low levels of both product and process innovations, standardised and undifferentiated products and a rigid and capital-intensive production process. As opportunities for growth diminish and the industry becomes saturated with firms, the industry enters the decline phase.[10]

Available data for firms in the NAMs sector indicate that the industry is in its growth phase, as the number of firms operating in the industry increases in each year for which data was complete, indicating a growing market with turnover opportunities, while turnover grew significantly, by 24.5%. Employee productivity in terms of GVA per worker increased by 48.6% from 2017 to 2019. According to the Enterprise Research Centre (ERC), two main factors drive employee productivity growth in the pharmaceutical industry: technological innovation and increased automation within the production process, both characteristics of an industry in its growth phase[16]. We estimate that this is a driving force behind the difference seen in the growth rates of firms in the NAMs sector and those of the wider industry.

Cebr has adjusted forecasts for the economic impact of NAMs to factor in issues of industry life cycle analyses and mean reversion by weighting GVA growth rates, with weights reflecting the significance of wider industry growth rates to NAMs growth rates in each year.

15 M. Porter. 1980. Competitive Strategy: Techniques for Analyzing Industries and Competitors. The Free Press.

16 Enterprise Research Centre. 2019. Understanding value added per employee in 6 UK sectors: The insider's view

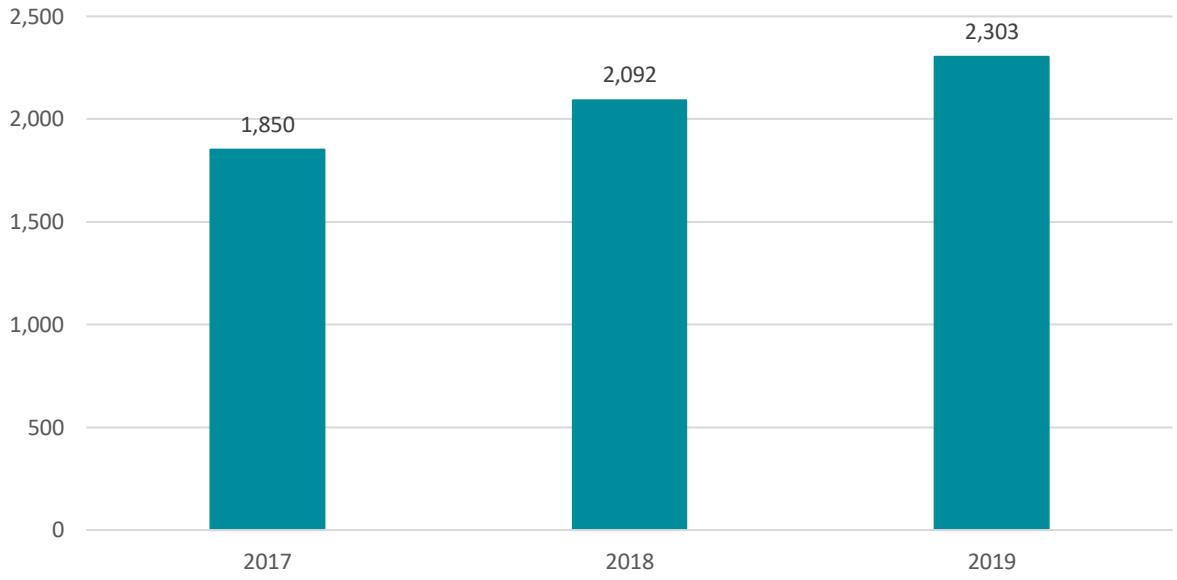
3. Economic impact of NAMs

This section details the direct impact of NAMs, across the UK. Our initial results are presented in terms of four key economic indicators, namely, turnover, gross value added (GVA), employment and employee compensation, for the three years through 2019. It also provides a forecast of GVA generated by firms operating in the NAMs industry for the years from 2020 to 2026.

3.1 Turnover

Figure 5 below illustrates the turnover generated by UK firms involved in the usage or development of NAMs between 2017 and 2019. This turnover can be thought of as the total income received by firms operating in the NAMs sector and is calculated by aggregating turnover per firm.

Figure 5: Direct Turnover of NAMs industry, 2017-2019. £ millions

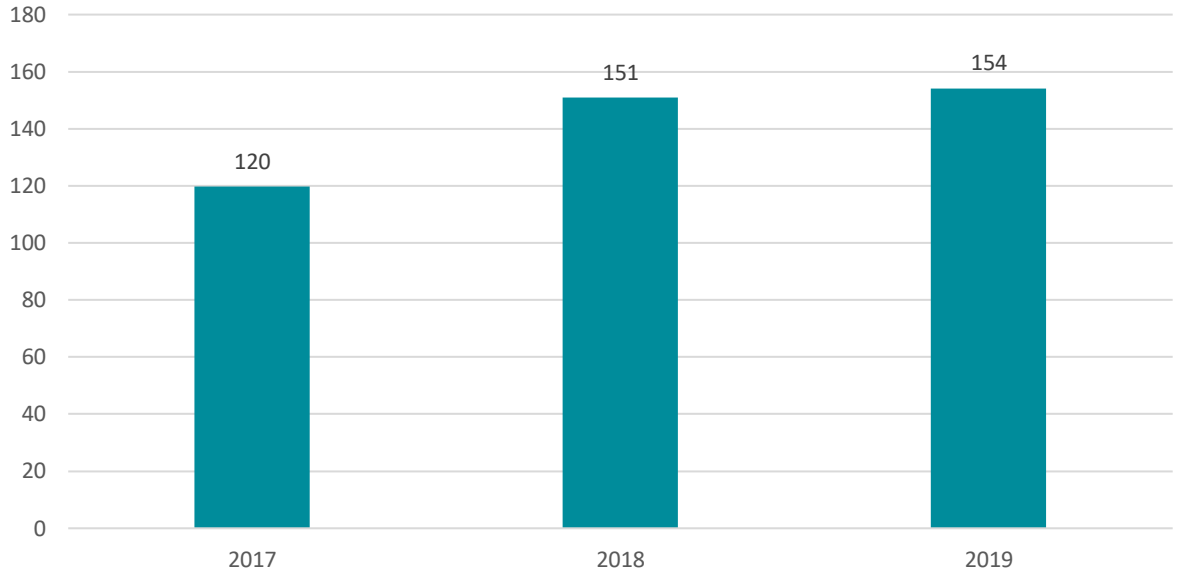


Source: Companies House, Cebr analysis

The direct turnover generated by industry firms increased consistently since 2017. Over the entire period, turnover increased by £452m (24.5%), from £1,850m to £2,303m. The greatest single year increase was from 2017 to 2018, when turnover increased by £242m (13.1%). The slight contraction in growth rates observed from 2018-19 (10%) can be partly explained by the industry moving towards a later stage in its growth phase. The year-on-year increase in industry turnover is expected to be largely owing to firms in the industry having increased in size during the period, as opposed to new entrants joining the market.

3.2 Employment and costs of employment

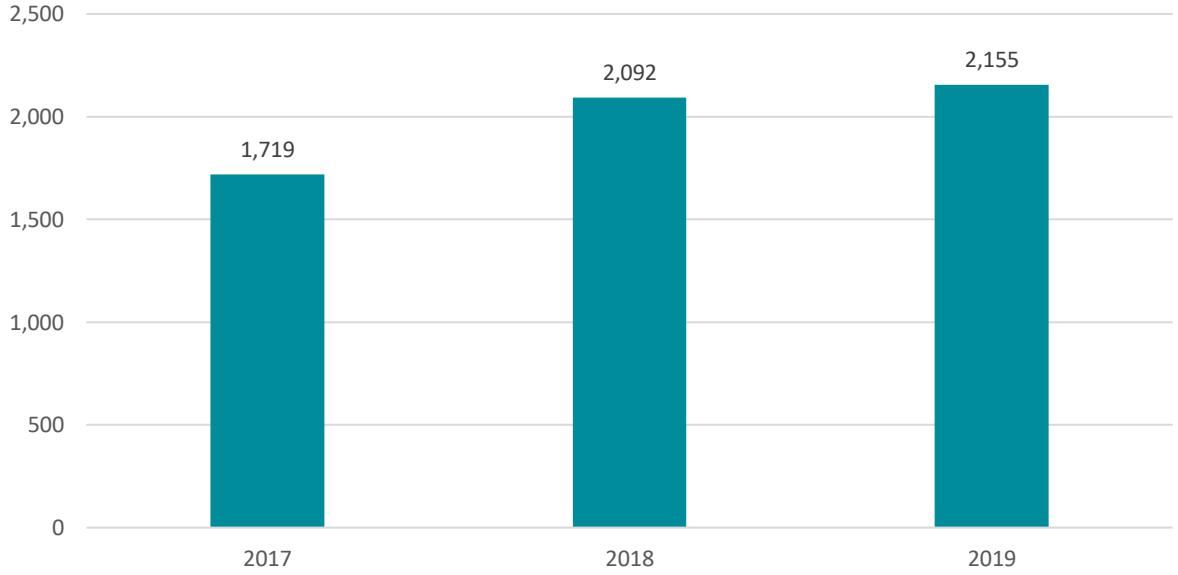
Figure 6: Costs of Employment, 2017-2019, £ millions



Source: Companies House, Cebr analysis

Industry costs of employment increased by a total of £34 million over the three years through 2019. Costs of employment have increased less evenly over the period than turnover, with the biggest increase occurring from 2017 to 2018 where costs of employment grew by £31 million (26%). Costs of employment refer to all costs incurred by firms from employing staff in each year. This includes provisions such as national insurance, annual salary, pension contributions and all similar items.

Figure 7: NAMs industry employment, 2017-2019, persons



Source: Companies House, Cebr analysis

Figure 7 displays the average number of people employed by firms in the UK NAMs industry over 2017, 2018 and 2019. Data was obtained from company accounts statements reported to Companies House. These numbers include persons employed both full and part time. Employment data over the three years follows a similar trend to both turnover and costs of employment, increasing over all three years, with growth rates peaking in 2017-18 (at 21.7%). Overall, the number of people employed by the industry grew by 436 people (25.4%) from 2017 to 2019.

Figure 8: COE per employee, 2017-2019, £

Year	2017	2018	2019
COE/Employee (£)	69,634	72,133	71,525

Figure 8 shows the average costs of employment each firm incurs per employee in each year. Costs per employee peaked in 2018 at £72,133, increasing by 3.6% from the previous year. This is expected to reflect increasing demand for workers and may be indicative of workers moving from part-time to full-time employment or an increase in average annual salaries as firms sought to exploit the sharp increase in revenue opportunities available in 2018. However, costs per employee are estimated to have remained broadly constant from 2018 to 2019, despite a small increase in overall employee numbers.

3.3 Gross value added

While the turnover contributions discussed in the previous section provide an indication of the size of NAMs industry operations in the UK it would be conceptually wrong to simply interpret these in their entirety as direct value-added contributions. To provide an example, part of the revenue raised is to cover utility costs and as such is paid to utility providers. This part of revenue in fact represents the value added to the economy by a part of the supply chain of NAMs industry firms rather than NAMs industry firms themselves.

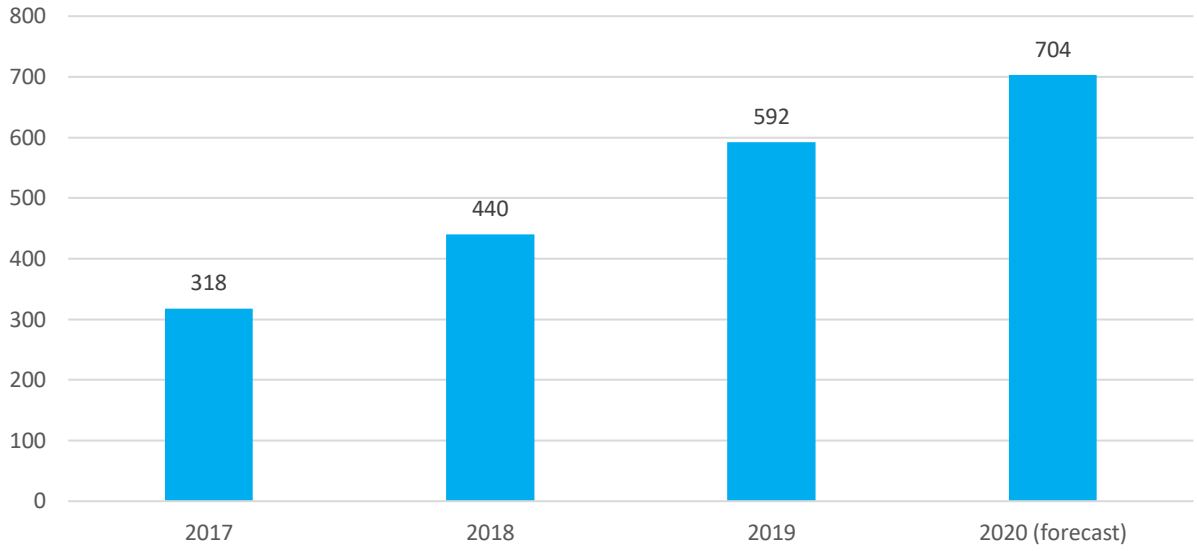
To account for this nuance, we use the concept of gross value added (GVA) when considering the 'value-added' by firms operating in the NAMs industry. In the simplest terms, GVA calculates the difference between total revenue and total intermediate expenditure. This intuitively represents the 'value-added' by NAMs industry operators and can be considered their contribution to UK GDP.[17]

Cebr has calculated the GVA growth rates for the firms which have reported their financial data to Companies House in both 2019 and 2020 and used this approximation to forecast the value of GVA for firms engaged in the production and usage of NAMs in 2020. The resulting

17 GVA is also commonly known as income from production and is distributed in three directions – to employees, to shareholders and to government.

GVA figure for 2020 amounted to £704 million, representing an 18.8% increase on GVA generated by the industry in the previous year.

Figure 9: GVA, 2017-2020, £ million



Source: Companies House, Cebr analysis

The largest year-on-year increase in NAMs industry GVA was seen from 2018 to 2019, where GVA grew by £152 million (34.5%). However, the largest proportional increase in GVA occurred from 2017 to 2018 through which GVA grew by 38.5% (£122 million). The NAMs industry GVA growth rate forecast for 2019-20 (18.8% increase) is much lower than the average NAMs industry year on year GVA growth rate observed in the years for which financial data for every relevant company were available (2017-19), which was 36.5%. This is expected to be partially owing to the effects of the Covid-19 pandemic, as the whole economy suffered, leading to a slower uptake of industry services. Despite this, some individual firms received an increase in funding during the year; for example DefiniGEN received £3.25 million in a November 2020 funding round, securing £2 million from the UK Investor BGF.[18]

In addition, GVA growth rates of the NAMs companies that did report financial data to Companies House in both 2019 and 2020 far exceeded that of the wider industry, classified as 'section M: Professional, Scientific and Technical Activities in the UK' according to the UK's standard industrial classification codes. GVA for the wider industry (section M) is expected to have contracted by 5.13% during 2020, whereas GVA of firms operating in the NAMs industry for which there was financial data grew by 18.8%.

18 DefiniGEN. 2020. DefiniGEN Secures £3.25 million in Funding to Fast-Track Growth.

4. NAMs economic impact forecast

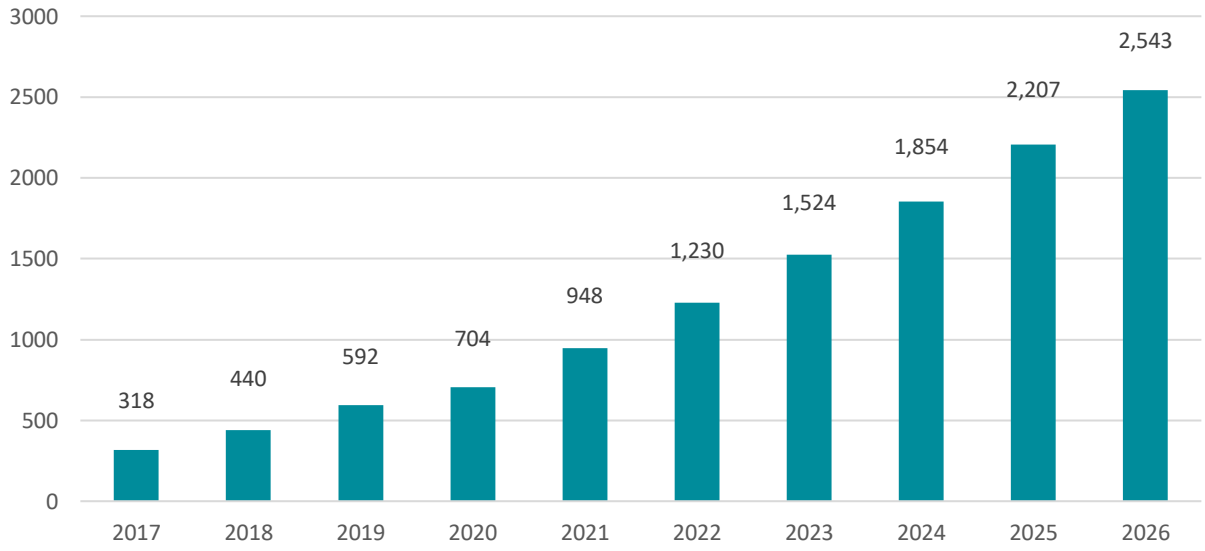
4.1 NAMs GVA forecast

The economic impact of the NAMs industry on the UK economy has been calculated in terms of GVA, which reflects the industry's contribution to national GDP.

Our forecast of NAMs industry GVA through 2026 has been calculated using financial accounts reported by firms operating in the NAMs industry, using 2019 as the baseline year from which the forecast is anchored and which further analysis builds upon. 2019 was chosen as the most recent year for which the financial data of all companies comprising the UK NAMs sector is known. It also has the added advantage of being unaffected by the Covid-19 pandemic, and thus providing insight into normal industry activity in a non-Covid year.

Year-on-year GVA growth rates of NAMs firms were aggregated and differenced from that of the wider industry under which NAMs industry firms fall in to. Average differences between NAMs industry GVA growth rates and that of the wider industry were used to create a baseline forecast for GVA generated by the NAMs sector through 2026. Adjustments were then made to prevent the forecast becoming skewed by survivorship bias. Further adjustments were made to exploit the accuracy and reliability of industry mean-reversion and industry life cycle models.

Figure 10: NAMs industry GVA, actual data 2017-2019, and forecasts 2020-2026, £ million



Source: Companies House, Cebr analysis

Figure 10 displays Cebr's forecast of GVA generated by firms in the UK NAMs industry through 2026. Over the whole period, including both the forecast period and years for which financial data was available, the NAMs industry's contribution to GDP is expected to increase by £2,225 million to £2,543 million (an increase of 700%). Throughout the forecast period, in the seven years through 2026, we estimate that NAMs industry GVA will grow by £1,839 million or 261%. From 2020 onwards, the value of GVA generated by the industry is expected to increase at a gradually slowing rate until 2026, when GVA is forecast to grow by £336 million (15.2% year-on-year growth). The largest absolute year-on-year increase in GVA is expected to occur from

2024 to 2025 (£353 million). However, in terms of growth rates, the largest forecast increases are seen at the beginning of the forecast period. From 2020 to 2021, aggregate GVA generated by firms in the NAMs industry is expected to increase by 34.7%, a year-on-year increase in the value of GVA of £244 million.

Figure 11: GVA forecast value, value of year-on-year GVA increase and percentage of year-on-year GVA increase, 2021-2026, £ million, %

Year	2021	2022	2023	2024	2025	2026
Forecast GVA (£ m)	948	1,230	1,524	1,854	2,207	2,543
Forecast GVA Increase (£ m)	244	282	294	330	353	336
Forecast GVA Increase (%)	34.7%	29.7%	23.9%	21.7%	19.0%	15.2%

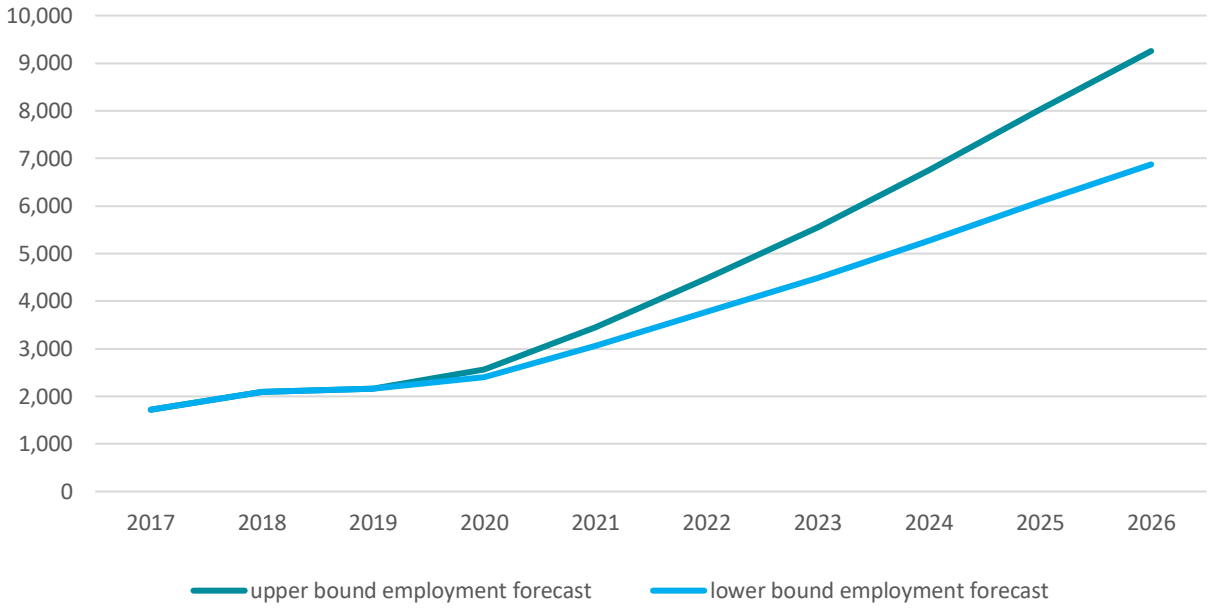
Source: Companies House, Cebr analysis

The steady decline in relative GVA growth rates forecast is reflective of the progress of the industry along its life cycle phase, as it tends towards maturity over the forecast period. As such the highest growth rates are typically recorded when the industry is still small in absolute terms. In fact, the overall highest year-on-year GVA growth rate is expected to have been achieved from 2017 to 2018, in which we have used firm level financial statements to calculate GVA growth of £122 million for the year (an increase of 38.5%).

4.2 NAMs industry employment forecast

In 2019, the most recent year for which full financial data reported by firms in the NAMs industry is available, the industry supported 2,155 jobs across the UK. This increased in each year for which data was available (2017, 2018 and 2019). To measure labour productivity, we used the metric of GVA per employee, which essentially calculates the average contribution of each employee engaged in the production or usage of NAMs, to the UK economy. Over the three years through 2019, GVA per employee increased sharply indicating high levels of labour productivity growth. GVA per employee growth was particularly high from 2018 to 2019, increasing by 30.6%. This steep level of growth is another indicator reflecting the NAMs industry's position in its industry life cycle as sharp increases in productivity are indicative of an industry operating in its growth phase.

Figure 12: Employment in the NAMs industry forecast, 2017 - 2026, persons



Source: Companies House, ONS, Cebr analysis

Figure 12 displays Cebr's upper and lower bound forecasts for NAMs industry employment through 2026. For 2020, the upper estimate shows an increase in industry employment of 405 persons (18.8%). Conversely the lower bound forecasts employment to rise by 248 persons from 2019 to 2020, an increase of 11.5%.

Upper and lower estimates for industry employment were calculated using different forecasts of GVA per employee for the seven years through 2026 in addition to Cebr's NAMs industry GVA forecasts, discussed in Section 4.1. The upper bound uses a constant GVA per employee ratio, calculated from reported firm-level financial information. The lower bound incorporates an estimate for labour productivity growth over the period, as the number of employees required to produce GVA would decrease if this materialises. Cebr's upper and lower bound NAMs industry employment forecasts for 2026 are 9,254 and 6,872 respectively. Materialisation of the upper bound employment forecast would bring about the creation of 7,099 jobs from 2019, the most recent year in which NAMs industry data was complete. The lower bound figure would cause NAMs industry employment figure to increase by 4,717 persons.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