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Powering Ideas to Innovation:

The significance, structure and dynamics of the UK university spinout ecosystem

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This report was developed by the team at UCI, Research England's national knowledge exchange (KE) metrics advisers, to provide expert advice as part of Research England's work programme to develop better data and metrics for KE.

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About UCI

The Policy Evidence Unit for University Commercialisation and Innovation (UCI) is based at the University of Cambridge and aims to support governments and university leaders in delivering a step change in the contributions universities make to innovation and economic prosperity – nationally and locally – through their commercialisation and other innovation-focused knowledge exchange activities and partnerships.

UCI seeks to improve the evidence base and tools available to key decision makers in public policy and university practice as they develop new approaches for strengthening university research-to-innovation pathways, with a particular focus on commercialisation. To do so, it draws on the latest advances and insights from both academic research and policy practice, as well as lessons learned from experiences in the UK and internationally.

UCI is funded through a generous grant from Research England to work in close partnership with them, as their national KE metrics advisers, to develop next generation data and metrics able to better capture the nature, health and performance of university knowledge exchange.

Find more about our work on our website and follow us on LinkedIn for updates.

Acknowledgements

We would like to thank our key partners, Research England, and the Higher Education Statistics Agency (HESA, part of Jisc), with whom we have worked closely to provide expertise on the design and development of the UK university Spinout Register. We are grateful to both organisations for considering and implementing much of the expertise we have offered and, in particular, for granting us early access to the data underpinning the Spinout Register, allowing us to understand and demonstrate how to further curate the data in order to unleash the value of having detailed information on UK spinouts. This has enabled the timely publication of this flagship report following HESA's publication of the Spinout Register. We would also like to thank current and former UCI colleagues, including, but not least, Zoi Roupakia and Frieder Mitsch, for their significant contributions to our support of the design and development of the Spinout Register and to our understanding and insights at UCI on spinouts more generally.

We would like to especially acknowledge Research England for their continued guidance and support in helping us to jointly deliver their national knowledge exchange metrics programme, of which of this work forms part. This includes the generous financial support they provide our unit to enable us to develop next-generation data, evidence and metrics able to better capture the nature, health and performance of university knowledge exchange.

Finally, we also wish to extend our appreciation to universities and their innovation/technology transfer offices for their significant efforts in collecting and returning complete and comprehensive information about their spinout portfolios – over several years, and in many cases, decades. Without this, it would not have been possible to unlock the detailed insights we present in this report on the importance of university spinouts to the UK's entrepreneurial engine, and on the structure, dynamics, and outcomes of UK university spinout ecosystems. We recognise the scale and complexity of the data collection, and we hope this report demonstrates the considerable value that such data now brings us and the sector.

Disclaimer

The views and arguments expressed in this report are of the authors and do not represent the positions of organisations or expert groups of which the authors are currently, or were previously, members, nor of organisations that fund UCI.

Within our analysis, we leverage data from PitchBook Data, Inc. The cited data has not been reviewed by PitchBook analysts and may be inconsistent with PitchBook methodology.

Contents

Foreword 6

Executive Summary 8

1 Introduction 16

2 About the data 19

2.1 Understanding the data behind the Spinout Register 19

2.2 Leveraging and linking to other datasets 21

2.3 Building the UCI dataset – further cleaning and curation processes 22

2.4 From the Spinout Register to the UCI dataset 27

3 Exploring the structure and trends of the UK spinout ecosystem 30

3.1 The scale of spinout activity in the UK 30

3.2 Sector-level spinout production trends 31

3.3 Research origins and sectoral applications of spinouts 32

3.4 Social enterprise spinouts 36

4 The universities producing spinouts 40

4.1 About the UK university base producing spinouts 41

4.2 Trends in spinout production across UK universities 44

4.3 Collaborative spinouts 53

4.4 Nature of relationships between universities and their spinouts 55

5 The significance of university spinouts for the UK 61

5.1 Identifying an appropriate counterfactual 61

5.2 The prevalence of university spinouts in the UK start-up population 62

5.3 The importance of spinouts in driving UK entrepreneurial success 64

6 Investment trends and spinout outcomes 69

6.1 Investment trends 69

6.2 Spinout outcomes and survival 83

7 Concluding remarks and moving forwards 89

References 91

Annex A: KE Clusters 93

Annex B: Interpreting Boxplots 94

Foreword

Professor Dame Jessica Corner
Executive Chair for Research England

University spinout companies are one of the most visible and dynamic outcomes of the UK's world-class research base. They play a crucial role in driving innovation, improving UK productivity, and are an integral part to the Government's mission to kickstart economic growth. These businesses translate academic discovery into real-world impact, generating new products, services, jobs and investment across the economy. Yet until now, our ability to understand the scale, nature and trajectory of spinouts across the UK has been limited, with a need for more nuanced and complete national data.

The Spinout Register, and the analysis in this report, marks a step-change towards being able to do this. Developed in response to the Independent Review of University Spinouts (2023), the Register is a novel and world-leading dataset, bringing together consistent company-level data on all UK university spinout companies for the first time. We now have a transparent, official list of these important companies, enabling high-quality evidence to support decision-making by universities, policymakers, investors, and funders – including Research England.

To that end, I welcome this flagship analytical report from our national KE metrics advisors at the Policy Evidence Unit for University Commercialisation and Innovation, as a first demonstration of insights that the Register is capable of unlocking – both from the data held in the Register itself, and through data-linking to other datasets. It provides detailed, data-led insights into the current UK spinout ecosystem – its scale, performance, geography and the nature of the relationship between universities and their spinouts. Importantly, it also highlights for Research England and others, areas where there are further opportunities for how the Register can be used to better understand highly complex areas, such as investment dynamics.

Even this emerging analysis highlights valuable insights about the richness of the relationship between universities. The report uncovers that although the majority of companies at foundation had an arrangement with their university involving equity or licence, 10% of companies had another type of contractual arrangement such as continued access to specialist facilities or academic expertise. The findings also confirm with greater rigour that spinning out remains a highly concentrated activity, and for the first time show a concentration of 89% of companies emerging from STEM disciplines. It is encouraging to see that while spinout production has historically been concentrated within the largest research universities of the UK, in recent years spinout activity from a wider group of large research-intensive universities has grown, and that this expansion appears to be translating into investment success. Spinouts from this group of institutions now capture much more pre-seed/seed and early-

stage VC investments. This suggests positive developments in, and maturation of, these university spinout ecosystems.

This report provides not only a rich source of insights for policymakers and analysts, but also as an invitation to the wider sector. The Spinout Register is a public resource, and its value will grow as more stakeholders engage with it, using it to track trends, evaluate impact, inform strategy and shape the future of UK innovation.

The Policy Evidence Unit for University Commercialisation and Innovation has begun to demonstrate through this report what can be done by linking the Register to other datasets and the value this can bring. Over the course of the next year, we will be exploring how to further increase this value, towards fulfilling Research England's ambition to use this data in our funding and policy approaches.

My thanks go out to all the institutions and individuals who contributed data and insight. In particular, I want to recognise that the task for universities to provide historical records of their companies has been significant, but it lays the important foundations for lighter and simpler processes in future years. Lastly, thank you to our partners at the Policy Evidence Unit for University Commercialisation and Innovation and the Higher Education Statistics Agency for their expertise and contributions towards designing, curating and analysing this novel national dataset.

Executive Summary

Our report *Powering Ideas to Innovation: The significance, structure and dynamics of the UK university spinout ecosystem* presents the first flagship analysis of the data underlying the newly released UK university Spinout Register. Developed by the Higher Education Statistics Agency (HESA, part of Jisc) with expertise from Research England and the Policy Evidence Unit for University Commercialisation and Innovation (UCI), the Register makes every effort to capture, for the first time, the full population of university spinout companies founded to commercialise intellectual property (IP) emerging from all UK Higher Education Providers (HEPs). This report aims to showcase how, through further curation, data linking, and analysis, we can leverage the information provided by the Spinout Register to create a powerful dataset able to unlock new insights; here on the significance of university spinouts for the UK economy, the structure and dynamics of the spinout ecosystem, and the scale of success.

University spinouts have an important role to play in driving science and innovation-led economic growth and national competitiveness, strengthening national security, and in delivering solutions to some of the world's most pressing societal challenges. Their growing importance is reflected in the efforts governments around the world are making to strengthen university spinout ecosystems. As the UK government seeks to kickstart economic growth, develop its Industrial Strategy and strengthen our national security and resilience, it is important that we understand better the contributions that university spinouts can make to these agendas.

The new dataset and analyses presented in the report make key contributions in this respect, allowing us to better understand how different university spinout ecosystems – across the nations and regions of the UK, and across different types of university types – vary in their ability to produce spinouts that are able to develop and thrive for the benefit of the UK and their local communities. We can also now more robustly and systematically investigate the importance of university spinouts in helping to deliver vibrant and dynamic entrepreneurial ecosystems in key sectors of the economy, and examine the ability of these companies to emerge, develop, and grow.

To develop insights on these important topics, we took the data underpinning the new UK university Spinout Register as *our baseline* and further curated and cleaned it, linking in additional information from a range of other data sources. This process led us to additionally exclude a small number of companies that appear on the public Register which we felt, based on the evidence, were materially different from the core spinout. All our decisions, and the process we took are set out clearly in section 2 of this report. While we endeavoured to be complete and thorough, it is possible that we may have made a small number of errors in interpreting the data.

The numbers we report using UCI's spinout dataset developed from the data behind the Spinout Register may therefore differ slightly from any analysis published based on the raw data available through the public Spinout Register.

Furthermore, we believe HEPs responded very well to the data collection. However, as is typical with any new data collection exercise, it can take time for reporting organisations to adjust to the new definitions and guidelines. It is therefore possible that the community identifies a few spinouts that

may have been missed, or other anomalies. The incredible value of making information on spinouts public is that these issues can be surfaced rapidly, and we hope rectified in future iterations of the Register to further improve the quality of the dataset.

Key findings emerging from our in-depth analyses are captured below.

The Spinout Register data brings to the fore the scale, breadth and diversity of the spinout landscape of the UK

In total, as of 2024, following our further curation of the Spinout Register, we have identified 2,111 unique spinouts that were founded primarily to commercialise university intellectual property (IP). These companies emerged from HEPs based across the breadth of the UK's nations and regions, with the distribution of spinout activity broadly similar to the distribution of research funding across the UK.

Many spinouts are commercialising ideas and technologies in life science sectors, and in software, artificial intelligence (AI) and machine learning (ML). Others are operating in areas including semiconductors, computer hardware, advanced manufacturing, clean and climate technologies, and agricultural technologies. There are also spinouts – albeit not in large numbers – working in areas such as supply chain technologies, educational technologies, gaming, and consumer markets.

Regarding the disciplinary origins, the vast majority of spinouts emerged from engineering and physical sciences and life science disciplines (89% of spinouts), with 8% of ventures linked to the arts, humanities and social sciences (AHSS). The remaining 3% involved contributions from both science and engineering and AHSS. Furthermore, while most spinouts are for-profit companies, 115 (5% of all spinouts) operate as social enterprises. Social enterprises are particularly prevalent amongst AHSS spinouts.

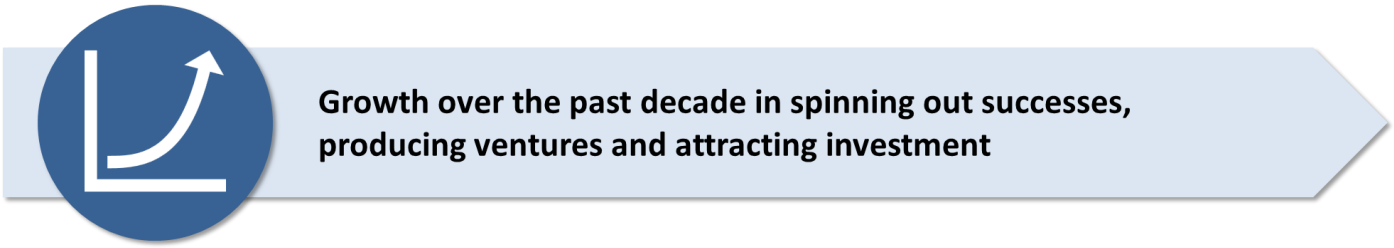
Spinouts play a vital role in driving entrepreneurial activity in strategically important sectors of the UK's economy

University spinouts are not like typical start-ups. Many are seeking to develop and commercialise what is sometimes referred to as 'deep tech' or 'tough tech', where their development journeys are characterised by high levels of both technical and market risks, and often require significant investments of money and effort to convert the ideas into commercially viable and scalable applications. While only a small proportion of university staff will typically become engaged in spinning out a new venture, our analysis reveals the importance these companies play in being the driving force

of entrepreneurial activity in strategically important sectors for the UK economy that is resulting in technologies, products and services valued by investors.

For example, in pharmaceuticals and biotechnology, 42% of all start-ups founded during 2019 – 2024 that raised some level of venture capital (VC) funding to drive their development were UK university spinouts. In healthcare devices, this proportion was 31%, while in the market vertical of advanced manufacturing and 3D printing, 26% of UK start-ups were university spinouts. In semiconductors, 40% of the relatively small number of start-ups founded in this critically and strategically important technology were UK university spinouts. By contrast, in the rapidly growing and strategically important area of AI/ML, just 6% of UK start-ups in this space were university spinouts.

The success and importance of university spinouts in strategically important sectors for the UK becomes even more apparent when looking at the top performing start-ups based on the cumulative amount of VC investment raised. Our analysis shows that 70% of the top 20 pharmaceuticals and biotechnology start-ups (and 60% of the top 50) ranked by cumulative VC investment raised were university spinouts. Similarly high proportions of the top performing start-ups in healthcare devices and semiconductors were also university spinouts; and 40% of the top 20 start-ups in advanced manufacturing and 3D printing were spinouts. Also striking was that, while university spinouts were just 5% of the AI/ML start-up population during the period 2013 – 2024, a much higher proportion (20%) of the top 20 performing AI/ML start-ups (by VC investment raised) over this period were spinouts.



Growth over the past decade in spinning out successes, producing ventures and attracting investment

UK HEPs produced an average of 167 spinouts per year over the period 2019 – 2024. This has increased from an average of 130 spinouts per year during 2013 – 2018.

UK university spinouts raised £2.8 billion in VC investments in 2024, a level that remains significantly higher than levels seen pre-pandemic. This accounted for approximately 17% of all venture capital invested into UK companies that year. Of particular note, pre-seed/seed stage investments – critical for the emergence and initial development of many spinouts - reached £193 million, increasing from around £100 million in 2019. Later stage VC investments have also grown significantly over the past five years and, except for 2023, have been relatively stable since 2021 at between £1.9 - £2.2 billion.

Furthermore, of the total 2,111 companies in UCI's spinout dataset developed from the data underlying the Spinout Register, 170 have been acquired, 45 have listed on a stock exchange, and 53 raised more than £100 million in VC funding (10 over £250 million).

But, a worrying post-pandemic weakening in production levels and early-stage venture capital investment requires further investigation and monitoring

However, the averages mask some important dynamics in recent trends. The COVID-19 pandemic clearly led to an uptick in spinout activity from UK HEPs, with spinout production reaching a peak 193 in 2021 and remaining high in 2022. The number of spinouts founded has since fallen, with the latest data for 2024 suggesting a declining, albeit only very slightly, trend in production rates once the Covid-bounce has been accounted for. This should be further investigated to understand drivers of change, and be closely monitored in future years.

Worryingly too, we also observe a decline in early-stage VC investments. Following a significant jump in the scale of investment at this stage during the Covid-19 pandemic, reaching a peak of £1.1 billion in 2021, it has now fallen back to levels below those seen in 2019 and 2020. While this reflects trends in the UK VC investment landscape beyond spinouts, it is important to further understand the drivers and consequences of these trends for the development and scaling of spinout companies for the benefit of the UK.

Spinout activity is heavily concentrated in larger research intensive HEPs, yet once normalised by research scale, production rates are broadly similar across the university sector

Spinout activity is heavily concentrated in larger, more research-intensive HEPs: 70% of spinouts founded between 2013 and 2024 emerged from just 20 HEPs; the largest 6 research universities (with research bases of over £300 million) produced 39%.

Spinout production is strongly correlated with the scale of research activity once a certain threshold of research scale has been reached (around £100 million). Above this level, HEPs produce on average almost 2 spinouts per £100 million of research income. By contrast, the median spinout production rate for smaller research HEPs (with research bases between £10 million to £100 million) is between 1.1-1.3 spinouts per £100 million. There are inevitably HEPs within each of these groups that produce relatively more than the median, while others produce fewer. Indeed, some smaller research HEPs produce more spinouts per £100 million of research income than the average for their larger counterparts. This raises an important question of whether there are critical mass thresholds for spinout production, above which it becomes relatively easier to produce, support and nurture additional spinouts.

University spinout ecosystems are strengthening beyond the traditional spinout heartlands of the UK's largest research universities

The evidence presented in this report suggests a growing strengthening of university spinout ecosystems outside the largest research universities that are traditionally celebrated for the scale and success of their entrepreneurial activity. This strengthening is particularly evident for the group of HEPs with the next largest scale of research base (between £100 million and £300 million). This group of HEPs has seen their production rate of spinouts (when normalised by research income) jump from levels previously similar to smaller research HEPs (around 1.1 per £100 million) to levels similar to the six largest research universities at 1.8. Their spinouts have also seen significant growth in the average size of investment raised at the pre-seed/seed and early VC stages. Their spinouts now capture 32% of all pre-seed/seed stage VC investment into UK spinouts, and 34% of early-stage VC investments, compared with just 13-14% during 2013 – 2018.

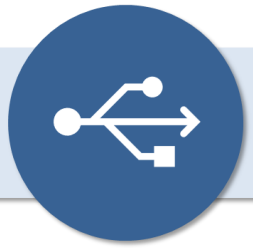
Furthermore, HEPs with the next largest research base (£50 million – £100 million) also saw their median spinout production rate grow from 1.0 to 1.3, a level slightly higher than where the group of HEPs with research bases of £100 million-£300 million were in 2013 – 2018.

A number of factors could be driving these changes, not least an overall maturing of university ecosystems beyond the so-called Golden Triangle of Oxford, Cambridge and London to support spinouts; efforts by these HEPs to strengthen their incentives and support for spinout founders; proactive investment by funding bodies, such as Research England, in these HEPs to enable them to provide more dedicated resources to support spinout development and attract investment (for example through the commercialisation-focused Connecting Capability Funds); and the introduction of dedicated investment funds such as Northern Gritstone, helping to increase the availability of investment capital for spinouts based in HEPs outside Golden Triangle.

Growing attention to the opportunities and potential of spinouts emerging from the arts, humanities and social sciences

Recent years has seen growing attention by research and innovation funders, universities and others to the opportunities and potential for building ventures based on ideas emerging from the arts, humanities and social sciences (AHSS). Of the 2,111 unique spinouts we identified, 137 (6%) had their origins in the social sciences, and 97 (5%) in arts and humanities. Overall, 163 spinouts were founded based solely on ideas and insights from AHSS disciplines; while a further 62 involved collaborations between AHSS and science, technology, engineering and maths (STEM) disciplines. Considering levels of investment raised, AHSS-only spinouts raise less than their STEM counterparts at each stage of the

investment journey. This may reflect that these ventures may require much less investment to develop; that they emerge and grow through different pathways that do not require venture capital; or the relative immaturity of the spinout and investment ecosystems available to support and nurture these ventures.



Powering ideas to innovation is a portfolio game, with a few spinouts delivering significant impacts while others struggle to gain traction and grow

Investing in spinouts – like many knowledge and technology-driven start-ups, and particularly those focused on commercialising deep tech – is a portfolio game. Some will succeed, and a few will deliver game-changing innovations that shape markets and societies. Many, however, while perhaps not failing outright, will struggle to develop, scale and deliver widespread impacts. This portfolio nature of spinouts is seen clearly in the investment data, with the top 10% of spinouts (ranked by investment raised) raising significantly more at each stage of their journey than the median spinout. At the pre-seed/seed stage, the average deal size for the top 10% was 8 times larger than the that for the median company; at the early VC stage, this ratio jumps to 30. This portfolio-nature of spinouts is also seen when looking at outcomes. For spinouts founded between 2013 – 2018, 12% of companies had been acquired or were listed on a stock exchange, and, of the rest, 5% had raised more than £50 million; 27% had failed.

When looking at spinout outcomes and successes, it is also very important to recognise that spinouts may grow and develop through different pathways (not just through equity-backed venture capital investment leading to acquisition or public listing) and realise success in delivering different balances of economic and societal contributions, not just through scaling to become 'unicorns' and large employers. While the latter are clearly important for driving economic growth and prosperity in the UK, some spinouts may emerge to provide niche, yet critically important, products and services to strategically important industries nationally and regionally (including for national security), or may provide enabling services that, while not employing large numbers of people, may help other companies to become more productive and competitive. The role and importance of these types of spinouts is hard to identify and capture in aggregate analyses of spinout outcomes, and is an area where further work is urgently needed.

Moving forward

The Spinout Register has transformed our ability to understand the significance, structure and dynamics of the UK spinout ecosystem. Through further careful curation of the data behind the Register and integration of additional information on each spinout available from other data sources, we have been able to create a powerful dataset able to provide detailed insights on the origins, development and outcomes of spinout companies emerging from UK universities. This creates a basis for many valuable insight to be generated. Furthermore, given the population coverage of the

Register, it also makes it much easier to compare spinout journeys and performance with other groups of companies allowing us to better investigate and understand their significance in driving entrepreneurial activity and success in the UK.

Nevertheless, there is much more that we need to, and can now do, as a result of having the UK university Spinout Register. This includes:

- Further leveraging the data we exploit in this study to better understand the employment effects of spinouts at different stages of their development, and how spinouts move across the UK and internationally as they emerge, develop and grow.
- Beginning to link other datasets to the Spinout Register, such as research and innovation funding data and patent data, building out the information we have already curated, as part of this study, on spinouts' development journeys.
- Better understanding the investor landscape for UK university spinouts and how this has been shifting, with implications for universities.
- Making advances in better classifying the technology and industrial focus of spinouts across the full population of companies, given clear limitations of Standard Industrial Classification (SIC) codes and many spinouts still not being captured in data platforms that provide more relevant classifications.

Moving forwards, we hope the Spinout Register can help us and many others to leverage the increased information available to find ways of building the ecosystems across the breadth of the UK that are needed to seed, nurture and grow spinouts, and better support these companies to grow, thrive and scale for the benefit of the UK and the world.

1

1 Introduction

This report presents the first, flagship analysis of the data behind the newly released UK university Spinout Register. Developed by the Higher Education Statistics Agency (HESA, part of Jisc) with expertise from Research England and the Policy Evidence Unit for University Commercialisation and Innovation (UCI), the Register makes every effort to capture, for the first time, the full population of UK university spinouts, with information available at the company-level. Through careful further curation, data linking and analysis of the data behind the Register, UCI have developed a powerful new dataset to provide detailed assessments of the significance of university spinouts for the UK economy, the structure and dynamics of the UK spinout ecosystem, and the scale of success.

University spinouts have an important role to play in driving science and innovation-led economic growth and national competitiveness, strengthening national security, and in delivering solutions to some of the world's most pressing societal challenges. They provide an important vehicle to further develop and commercialise breakthrough ideas and technologies emerging from within the university base, and deliver impacts on the economy and society at scale. They can open up new wealth-creating opportunities in existing industries, help to seed new markets, and provide solutions to help other organisations innovate, raise productivity and build resilience. Once a critical mass of activity is reached, university spinouts can also help to drive the entrepreneurial dynamism of a local cluster.

Their growing importance is reflected in the efforts governments around the world are making to strengthen university spinout ecosystems. Attention is also now shifting to the ability of nations to not just produce spinouts, which creates the seeds of potential value, but to enable them to scale, anchoring and capturing more of the value realised for the benefit of domestic populations. Furthermore, with rising geopolitical tensions, there is increasing attention on the role and importance of university spinouts in strengthening national security and resilience.

As the UK government seeks to kickstart economic growth, develop its Industrial Strategy and strengthen our national security and resilience, it is important that we understand better the contributions that university spinouts can make to these agendas, and ensure the ecosystems around them (influenced not least by policy, IP and legal frameworks, investment landscapes, infrastructure, talent, access to markets and development partners, and advice and support) are able nurture, scale and transform them to fully unleash their potential for the benefit of the UK and the world.

Prior to now, developing a complete understanding about the health, performance and functioning of the UK university spinout ecosystem

What is a university spinout?

For this study, we adopt definitions used by HESA in the data collection for the Spinout Register: *"Firms founded primarily to commercialise the intellectual property (including ideas, information, and knowledge) created by university staff, where:*

- *the IP either belongs to the university under general law or under the terms of the contract of employment; or,*
- *the member of staff has assigned the IP to the university to enable it to be commercialised; or,*
- *where significant university resources (e.g. funding, facilities) were used to generate the IP."*

was not straightforward. Previous evidence studies from UCI have taken significant steps forward to address gaps, through surveying and collecting spinout-level data from samples of university innovation/technology transfer offices.[1] However, a lack of comprehensive data at the system level to capture the population of university spinouts, coupled with inconsistent definitions across data sources meant there was no common baseline to work from. This made it much harder to assess the health, performance and impacts of university spinout ecosystems on the economy and society, and the benefits they bring to the UK as they seek to develop and scale, in a robust and comparable way.

In pursuit of developing better data and metrics on university knowledge exchange (KE), UCI, working in partnership with Research England as their national KE metrics advisors, established a vision for a Spinout Register[2]: a line by line publicly available dataset of identifying information and additional characteristics making every effort to cover the whole population of university spinout companies in the UK. This aligned closely with recommendations for improved data and transparency from the Tracey-Williamson Review of Spinouts in 2023[3].

With the publication of the new UK university Spinout Register[4] by HESA, we now have, for the first time, information on the population of spinout companies founded to commercialise intellectual property (IP) emerging from every UK university. Collected to a common definition, we took the data behind the Register as our baseline, further curated and cleaned it, and linked in additional information on each spinout, to create a dataset able to drive our analyses of the significance of university spinouts for the UK, the structure and dynamics of the spinout ecosystem, and insights on the scale of success.

We hope this report, alongside the publication of the Spinout Register will kickstart efforts by many others interested in spinouts, enabling them to leverage the new data to drive insights and analyses tailored to their unique interests and needs.

The structure of this report continues as follows:

Section 2: Provides further detail on the data that underpins our analyses, including information about the data behind the Spinout Register and how we further curated and cleaned it, and linked in information from other data sources.

Section 3: Explores the UK spinout ecosystem, including trends in spinout production and the types of spinouts being produced.

Section 4: Analyses the university-level trends and patterns in producing spinouts and the relationships they have to their spinouts.

Section 5: Examines the significance of university spinouts compared with a comparable group of start-ups in driving entrepreneurial activity and impact in key sectors for the UK economy.

Section 6: Investigates investment patterns, trends and successes for UK university spinouts, and examines spinout survival and key spinout outcomes.

Section 7: Provides some concluding reflections on the importance of the UK university Spinout Register and how we might move forward from here.

[1] See Ulrichsen and Roupakia (2024) and Ulrichsen, Roupakia, and Kelleher (2022)
[2] Miller, Ulrichsen, and Bamford (2024)
[3] Tracey and Williamson (2023)
[4] The Spinout Register is available from: https://www.hesa.ac.uk/data-and-analysis/business-community/spin-out-register

2

2 About the data

Before diving into what the newly released UK university Spinout Register can tell us about the UK university spinout ecosystem, it is important to first understand the data that underpins our analyses. As part of UCI's role in the development of the Spinout Register, we were granted early-access to the raw data HESA collected from Higher Education Providers (HEPs)[5], to provide expertise to HESA on how to prepare the Spinout Register publication and to Research England on how the Register could be leveraged to inform funding and policy priorities in this area.

In this section, we present background and contextual information about the development and collection of the data behind the Spinout Register. We explain how UCI additionally cleaned, further curated, and developed the data behind the Register to create a powerful dataset able to deliver insights on the importance, structure, dynamics and successes of spinout ecosystem across the UK. In cleaning, curating and preparing the data for the analysis, we had to make many choices around the methods used. By providing a detailed discussion, we hope others may learn from our experiences when seeking to use and leverage the Spinout Register to explore their own objectives.

A deliberate design feature of the Spinout Register was its ability to be linked with other datasets. In this study, we leverage this feature by integrating secondary datasets to further enrich the insights that can be derived from the Register's data. Further detail on the secondary datasets and their coverage of the spinouts in the Register is also covered in this section.

2.1 Understanding the data behind the Spinout Register

The Spinout Register provides a curated list of spinouts emerging from UK HEPs. The data behind it provides the starting point for datasets we developed to drive the analyses in this report. Developed and published by HESA (part of Jisc) with expertise from Research England and UCI, and collecting information to a common set of definitions, the Register provides the first publicly available list of UK spinouts, making every effort to cover the full population. In addition, it includes some further company-level information on these spinouts.

To develop the first iteration of the Spinout Register, data was collected from all UK HEPs through HESA's annual Higher Education Business and Community Interaction (HEBCI) Survey in Autumn 2024. Data was collected in reference to the 2023/24 reporting year (henceforth referred to as 2024).

Using HESA years:

HESA captures information annual from HEPs, including through HEBCI, covering the period 1st August to 31st July. In this report, for ease of naming, we use 2024 to represent the 2023/24 HEBCI reporting year (representing the period from 1 August 2023 to 31 July 2024). The same convention applies for all HESA years.

[5] The term Higher Education Provider (HEP) is used by HESA to refer to institutions that provide higher education in the UK. Most, but not all, HEPs have university status. In this report we use the term HEP and university interchangeably.

To develop the first iteration of the Spinout Register, a one-off backfilling exercise - the Spinout Census – was undertaken. In the Spinout Census, HEPs were required to submit data on **both**:

1. Spinout companies founded between 1st August 2012 and 31st July 2024 (the end of the reporting year), regardless of whether companies were still active.
2. Spinout companies founded prior to 1st August 2012, *only if* companies were still active.

The coverage of the data collection, therefore, includes the total active population of spinouts as of the reporting year 2024, *and* spinouts (founded after 1st August 2012) that are no longer active. The former group allows for analysis of the development trajectories and socio-economic impacts of spinouts. Capturing the latter group of companies no longer active has important uses too – it means we do not have to wait many years before we can develop time series analyses of spinout production and survival, and makes it easier to explore drivers of spinout performance.

A range of fields were chosen to be collected from HEPs, to ensure unique identification of the spinout companies is possible, and capture key characteristics of the company which may be pertinent to its development trajectory. These fields were:

- Company Name
- Company registration numbers – including UK Companies House CRN, alternative reference numbers (e.g. charity numbers) and overseas registration numbers
- Other identifying information - including incorporation and foundation dates, company websites, country of registration
- Indication of whether the spinout is a social enterprise
- Indications about the originating discipline of the spinout (proxied using REF Main Panels)
- Nature of key contractual relationships to the HEP – for example if the HEP holds shareholding in the company, a licence or another form of relationship. These fields were replicated for several key milestones in the spinout's trajectory
    - at foundation of the company
    - in the 2023/24 reporting year
    - for inactive firms only, when the HEP-spinout relationships ceased
- Additional notes about the company – a free-text field for HEPs to add further notes about the company e.g. about the company's origins, acquisitions and mergers
- Indication of whether the spinout was in stealth mode[6]

Overall, HEPs responded very well to the data collection. However, understandably, as is typical with new datasets and methods of collection for HEPs to adjust to, in a small number of cases, we identified anomalies and omissions in the data collected that needed to be rectified and cleaned. Over time, as identified anomalies are verified and updated with HEPs involved, we would expect the quality of the data to improve further.

[6] Spinouts operating in stealth mode operate in a non-disclosive manner to avoid compromising market chances. For reasons of commercial confidentiality and ensure they are not identifiable, they are suppressed the public Spinout Register.

2.2 Leveraging and linking to other datasets

A key aim of the Spinout Register was to provide a dataset that could be linked to other sources of information to unlock significant additional value and insight[7] . The ambition to data link guided the rationale behind many of the fields collected. A set of core identifiers about the company, HEP and region are collected together in the Register allowing for further data, at the company-, HEP-, and regional- level, to be linked to it.

For this study, linking to other sources has supported UCI in building its own dataset necessary to drive the analysis, in several ways:

i. Verification and curation of primary data collected from HEPs, where this is also collected by secondary data providers.
ii. Extension of the spinout identifiers to capture related companies, for example, tracing back data to the original company, where spinouts have been merged/acquired and only the resulting merged/acquiring company was reported by HEPs (see section 2.3).
iii. Expansion of the data available on university spinouts, appending new data fields to the dataset that were not collected at source (e.g. on HEP characteristics, investment and company status) to unlock analyses and insights to be developed in specific areas, such as the structure, performance and successes of the UK spinout ecosystem.

Specifically, for this study, we linked the data behind the Register to other HEP-level data collected by HESA, including research income and the number of academics, as well as the region of HEP and KE cluster (for English HEPs only)[8]. This allowed us to further segment our sample in ways to enable us to explore and better understand how different university spinout ecosystems – across the nations and regions of the UK, and across different types of HEP – vary in their ability to produce spinouts (see section 4).

We were also able to identify most spinout companies within three commercial datasets (Table 1).

Moody's FAME and Orbis databases are aggregators of private company information drawing primarily from official sources like Companies House for UK firms and international registries for overseas firms. We primarily used FAME, which presents information for UK-registered firms only and covers 96% of spinouts in the Register (100% of all UK-registered spinouts in the Register). This was supplemented with data from Orbis, which includes both UK and overseas-registered firms (99.6% of firms in the Register). However, the breadth of the data for overseas companies in Orbis tends to be more limited than for UK companies.

We also used PitchBook - a commercial investment-focused database that tracks deals (e.g. venture capital, private equity and M&A activity), company information, and performance - to extract sector classifications and investment deal data at the company level. PitchBook focuses more heavily on tracking companies that are likely to attract external investment to drive their growth. Our analysis of the coverage of spinouts in our dataset in PitchBook is consistent with this, finding that the 71.7% of spinouts identified in PitchBook are more likely to be companies growing through equity-based deals and/or those with high growth potential that attract investor interest. For example, spinouts emerging

[7] Miller, Ulrichsen and Bamford (2024)
[8] English HEPs were grouped into knowledge exchange (KE) clusters as part of the Knowledge Exchange Framework (KEF) process. For further details on the KE clusters, see section 4.1.1 and Annex A.

from the arts, humanities and social sciences (AHSS), are much less likely to be identified in Pitchbook compared with their more IP-rich, investment-driven counterparts emerging from science, technology, engineering and maths (STEM) disciplines. This has the potential to introduce a degree of selection bias in the types of spinouts represented amongst the evidence developed in analytical studies.

Table 1 Coverage of university spinouts in commercial datasets

Database	Description of coverage	Coverage rate (%) across all spinouts in Spinout Register
Moody's FAME	UK-registered companies	96.0
Moody's ORBIS	UK and overseas-registered companies	99.6
PitchBook	Companies that are likely to attract venture capital or other form of private investment to drive their growth	71.7

Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register, Moody's FAME and ORBIS databases, and data from PitchBook Data, Inc.

2.3 Building the UCI dataset – further cleaning and curation processes

To drive the analyses presented in this report (on the structure, scale and dynamics of UK spinouts), UCI started with the data underlying the Spinout Register as our baseline, linked in additional information on each company from other datasets (see section 2.2), and further curated and cleaned the data to create a powerful dataset able to provide insights on our key areas of focus: the significance, structure and dynamics of the UK university spinout ecosystem. During this process, we had to make a number of decisions, some subjective, about how to develop the sample to ensure its suitability for our specific analytical purposes. For complete transparency and clarity, we outline this process and the choices we made below.

2.3.1 Imputation following verification of fields in secondary data

By design, some fields in the Spinout Register can be externally verified by secondary sources through data linking. For example, we were able to cross-check CRNs and incorporation dates against Companies House data. Where there were obvious typos or clear suggestions that an edit should be made to the data, for example, CRNs missing particular digits, we made these imputations and corrections to the data.

2.3.2 Identifying and tracing spinout origins – tracking and recording multiple IDs

The process of setting up a university spinout company to commercialise IP can vary between HEPs. This includes the point at which the venture is formally incorporated as a company[9]. Previous studies have shown that in many cases, the spinout company was legally created at the point at which the knowledge / IP was transferred in. However, in other cases, the researchers themselves legally

[9] Ulrichsen and Roupakia (2024)

incorporates a company – possibly speculatively – while continuing to work on the technology. They then approach the HEP to acquire the IP (typically via a license or assignation) to further develop and commercialise it within the company. In the former case, the point at which the spinout company is legally registered (for example at Companies House) will be the same as the point at which it begins its journey to commercialise the IP. However, in the latter case, the spinout journey only begins once the knowledge/IP is transferred into the venture, and hence the *foundation date* is after its legal *incorporation date*. HEPs were asked to submit both of these dates to the Spinout Register. Note that there is not always a formal or contractual marker for the foundation milestone, which can introduce difficulties in identifying it precisely for some companies.

Incorporation and foundation dates: an important distinction

The distinction between incorporation and foundation dates within the data represents two different milestones concerning the spinouts origin. The incorporation date refers to the legal date the company was established and/or registered. This may differ from the foundation date, which refers to the date when the IP is transferred into the firm (for example through a licence or assignment), in other words, representing the point at which the company becomes a spinout.

Within the Register, we observed a few examples that demonstrate oddities, which reflect not least the very different journeys spinouts experience following their foundation. For example, the legal entity through which the IP is exploited can change as the company undergoes major milestones such as an Initial Public Offering (IPO), or significant expansion during which they create a new holding company or overseas subsidiary. How these realities are reported in datasets can vary, and there is no single approach to capturing this. In some datasets, these companies can be reported as distinct entities; in others they are merged together.

Nevertheless, it is important to be able to report these spinouts journeys clearly and accurately in data, so that any analysis reflects these journeys comprehensively. For our later analysis of investment (see section 6), we found that the entity under which investment deals are reported can vary company-by-company, so we aimed to collect the complete set of entities for all spinouts in the Register to ensure a full picture of the investment landscape, and no deals are missed.

To do this, we undertook an extensive “spinout track and trace” exercise, involving recording multiple identifiers for the original spinout including primary, secondary, and – in a minor number of cases – tertiary unique company identifiers, referencing all the identified legal vehicles we identified that relate to a single spinout. While we endeavoured to be as complete as possible in our track and trace efforts, we will inevitably have missed some cases.

We found a (small number of) examples where we believe information on the incorporation and/or foundation dates to be referencing a major milestone event, such as the date of IPO or creation of the new holding company, and a few cases where the foundation date appears to be incorrect compared with the incorporation date (e.g. the foundation date is set as before legal incorporation). However, absent of a systematic route to verify these dates with external data, we were not able to clean these unusual cases. Over time, as identified anomalies, like those we have outlined, are verified and updated, we would expect the quality of the data to improve further.

One implication of these issues is that they will affect the year in which the spinout can start to be accounted for, both in analyses of spinout production rates (section 3) and analyses of spinout investment trends and spinout outcomes (section 6). For the time being, these annual figures should be treated sensitively and may be subject to revisions over time.

2.3.3 Identifying multiple entries and developing a company-level dataset

With data on spinouts submitted to HESA by individual HEPs, the Spinout Register is effectively a university *x* company-level dataset, and it is entirely feasible – and indeed likely – for a spinout to appear multiple times. To avoid double counting of companies in our analysis, the final major cleaning step was to identify companies with multiple entries in our dataset and develop a company-level version, where each row represents a unique company.

This marks a key advantage of maintaining a national-level register, over seeking aggregate totals from individual HEPs. By identifying and accounting for multiple entries, we can more robustly and accurately track the dynamics and trends within the spinout ecosystem, avoiding the risk of double counting effects.

To do this, we first analysed the data underlying the Spinout Register to identify identical CRNs and same / similar names. We also gathered information from a range of sources, including company ownership structures through FAME and Orbis, information from PitchBook and Companies House, and targeted searches for further publicly available information on specific companies from the internet. Combining these data points, we identified a number of spinouts which appeared multiple times in the Register data.

Through this process, we identified two types of cases. The first of these are *collaborative spinouts*, in other words spinouts that have been developed with IP originating from more than one 'parent' HEP, and would therefore be returned in the data collection by all contributing HEPs.[10] Clearly, these have a legitimate case to be in the university-company-level dataset more than once to reflect each HEP's contribution. However, to develop a company-level dataset, we needed to de-duplicate the data and reconcile any differences, where parent HEPs submit different values for fields that are fixed at a company-level (for example, social enterprise status).[11]

The second case of multiple entries occurred where a HEP submitted multiple company entities that appear to relate to the same spinout, such as holding companies and subsidiaries. In this case, we spent time attempting to determine whether these entities were indeed different unique spinout companies or referred to the same spinout. In making decisions, we were guided by the unique company identifiers provided, information online (e.g. the company websites, press releases of mergers and acquisitions), and information available through FAME, Orbis, PitchBook and Companies House. We made our best efforts to assess whether each entry was a unique and distinct venture or

[10] Section 4.3 provides an analysis of these collaborative spinouts.

[11] In the case of fields that are fixed company characteristics where parent HEPs offered differing data, we attempted as far as possible to reconcile differences using secondary data, where available, to validate the correct entry. The reconciliation process was slightly different for fields where the variable could legitimately differ depending on the parent HEP (for example REF Main Panel and Relationship back to HEP). Differences in contributions to the spinout between parent HEPs would feasibly result in differences in data submissions. To reconcile differences for these binary variables, we simply applied the Boolean OR operator, returning true (1) if at least one of the entries from a parent HEP was true. In other words, the field in the company-level data indicated some contribution (of whichever form) had occurred across all of the parent HEPs.

appeared to be referring to the same spinout. Decisions were then made regarding how to de-duplicate any data to create a single entry for these companies. We recognise that this process required a degree of judgement on our part, and it is possible that we have mis-classified some entries. In time, we hope these cases could be verified with HEPs to further improve the quality of data.

2.3.4 Exceptional cases identified during cleaning and curation

During the curation steps outlined above, we identified several types of company that had been returned to the Spinout Census by HEPs, but which, on the surface, did not appear to reflect what may be considered a 'typical' spinout or spinout journey. For these exceptional cases, subjective judgements - guided by the definitions of a 'spinout' and 'IP' as set out in the guidance document that accompanied the Spinout Register data collection effort[12] - were required to decide upon whether these cases provided rationale for inclusion or exclusion in the core analyses presented in this report. In Table 2 below, we explain these cases and their prevalence in turn, as they provide interesting commentary about the types of ventures that relate to universities – spinouts or not. We hope these insights can inform the future strengthening of the guidance provided to HEPs to improve ongoing efforts to standardise data collection in this area.

How do we define IP?

Adopting definitions used by HESA in the Spinout Census, IP includes various types of information that may have potential value (including ideas, inventions, designs, data, results, and software) and can protected by establishing legal rights e.g. patents, trademarks, copyright, database rights, design registration. Know-how, which is protected as confidential information, is also included.

Table 2 Exceptional cases identified in the returns to the Spinout Census

Case	Explanation	Inclusion decision for this study
Spinouts of Spinouts	Ventures that originate from being spun out of an existing university spinout, rather than directly from a HEP. These types of ventures were only identifiable systematically through additional notes provided in the data submission by the HEP.	**INCLUDE** – we determined there was not enough grounds to exclude, without knowing whether the new venture is commercialising the IP that which originated from the HEP, or perhaps acquired new IP from the HEP, or is focusing solely on IP developed within the university spinout that it spun out from.
Spin-Ins	Existing companies external to the HEP "spin-in" to the institution to access and develop IP jointly, with this ultimately transferred back to the company. The existing company is reported on the Spinout Register and were only identifiable systematically through additional notes provided in the data submission by the HEP.	**INCLUDE** – we determined there was not enough grounds to exclude, absent of knowledge as to whether the underlying IP of the company moving forward is primarily that which originated from their joint activity with the HEP or original IP of the company.

[12] See: HESA (2024). 'HE-BCI Part C Census 2023/24 record – Definitions'. Available from: https://www.hesa.ac.uk/collection/c23036/definitions [Last accessed: 27 May 2025]

'Double-take' ventures	Spinouts that fail or are acquired early on in their development, and are subsequently followed by the establishment of a new spinout (usually of similar name) emerging to take on the IP and try again. In our efforts to develop a company-level dataset and remove multiple entries, we were interested in these cases where both spinouts were reported. We considered different approaches for accounting for these companies in the data (e.g. whether these should both be included, merged or just the latter included).	**INCLUDE BOTH AS UNIQUE SPINOUTS** – While these companies could be reflected in the dataset as one company (as part of the deduplication step to create a company-level dataset), we treat them separately to capture the outcome (be it successful or unsuccessful) of the first venture.
Stealth companies	Spinouts may deliberately operate in stealth mode, during their early stages, to protect their IP and work on developing their products and/or services without exposure to competitors and wider market scrutiny. In the data collection, HEPs were asked to identify whether the spinout was operating in stealth mode, and were provided assurances from HESA that these companies would be supressed and not included in the public Register for a period of time. There were 23 spinouts (~1%) identified as stealth companies in the raw data.	**EXCLUDE** - We have excluded these stealth companies from our analyses to avoid all possibility of them being identifiable in the analysis and ensure compliance with the commitments made by HESA to HEPs regarding suppression.
Investment vehicles into spinouts	Organisations established to invest in spinout companies. We have seen recently examples of university-linked investment funds that have been formed in partnership with (potentially more than one) HEP. We identified 2 investment vehicles in the raw data.	**EXCLUDE** – While these companies invest in spinout companies and may have been established with/by HEP consortia, we do not believe they are spinouts themselves based on the definitions provided by HESA. Hence, we exclude.
Wholly owned companies	Companies which are 100% owned by the HEP returning them. Where information on shareholders and their shareholdings was available in Companies House filings, we were able to identify companies which were wholly owned. We identified 59 entries that were wholly owned subsidiaries, in total. These included companies set up by HEPs to provide commercial means for operating, such as consultancy services vehicles and overseas educational establishments. We could not see any intention for these companies to spin out of the HEP to become an independent entity.	**EXCLUDE** - We do not believe these companies are consistent with the definition of a spinout, as they do not appear to have intention to spin out adjacent to the HEP. Hence, we have excluded these companies from our analyses.

Ventures not meeting the time period criteria as set out in the data collection guidance document	The data collection guidance requested spinout companies to be returned if they had (1) been *founded* between 1st August 2012 and 31st July 2024 regardless of whether they are still active; and (2) any spinout founded prior to this period that is still active. We identified 85 entries where ventures were submitted to the Register that fell outside these two criteria. Most of these entries were founded prior to 1st August 2012 but, based on information gathered through our data linking exercise appear to no longer be active. There were also a small number of companies that had not been founded by the end of the reporting period. Note that the foundation date – not the incorporation date – is defined in the data collection guidance as the point at which a venture becomes a spinout.	**EXCLUDE** – While potentially interesting cases, to enable fair comparisons across different HEPs, we exclude these companies.

Source: UCI analysis based on further curation of the data behind HESA's Spinout Register

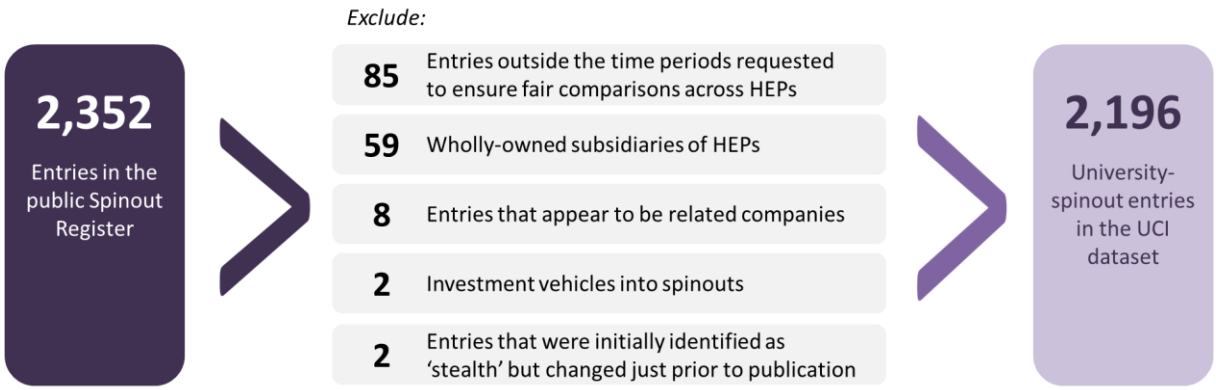
2.3.5 Adjusting for inflation

Many of the analyses that follow in this report look at trends in monetary variables such as research income secured by HEPs and investment secured by their spinout companies. In analysing trends over time, it is important to adjust for the effects of inflation. To do so, we deflate all monetary variables using the UK HM Treasury GDP deflators updated on 28th March 2025. This results in the variables being adjusted to constant 2024 price-levels.

2.4 From the Spinout Register to the UCI dataset

This section summarises the outcome of the steps we took to *further* curate, clean and link the data behind Spinout Register, to develop a powerful dataset for exploring our topics of interest concerning the significance, structure and dynamics of UK university spinout ecosystems. **The further curation UCI has undertaken means that the sample of spinouts we use to underpin and drive our analyses will differ slightly from the published data available through the Spinout Register.**

Figure 1 Building UCI's dataset from the Spinout Register

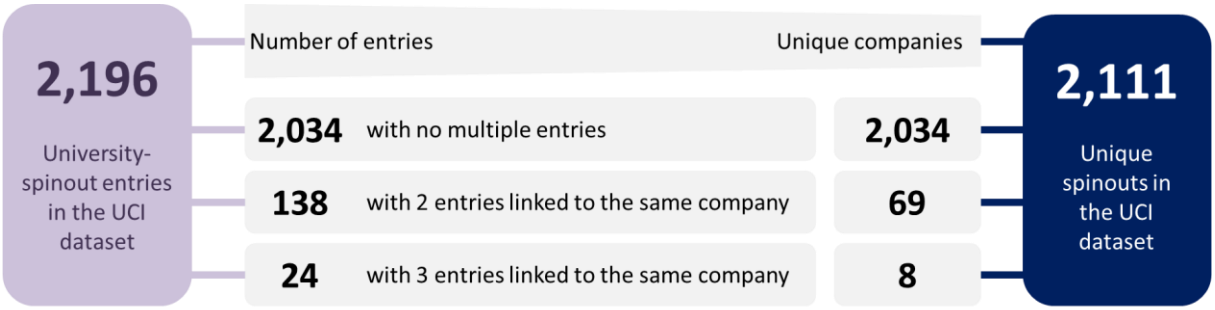


Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

Figure 1 shows how we move from the 2,352 university *x* company entries reported in the published Spinout Register to the dataset we use to drive our analyses. This sees us further exclude 156 entries for the reasons set out in this figure.

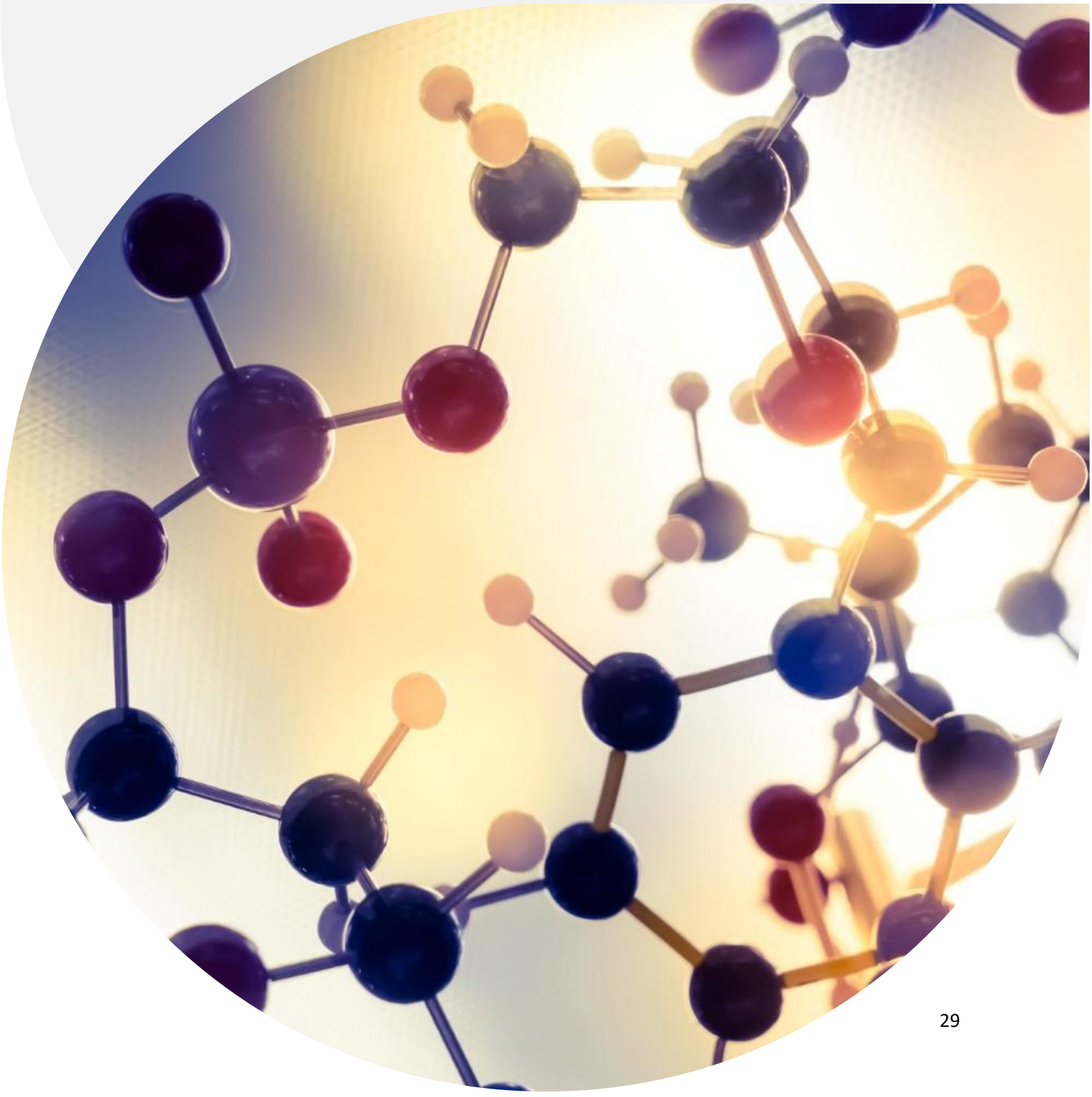
Figure 2 sets out how we then moved from our university x company-level dataset with 2,196 entries to develop a dataset of unique spinout companies. Through our data linking and extensive review and interrogation of the companies, we were also able to identify a few more cases where we believed companies to be related than are identified in the published register. In total, we identified 2,111 unique spinouts in our dataset.

Figure 2 Moving from a university x company dataset to a unique spinout-level dataset



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

3



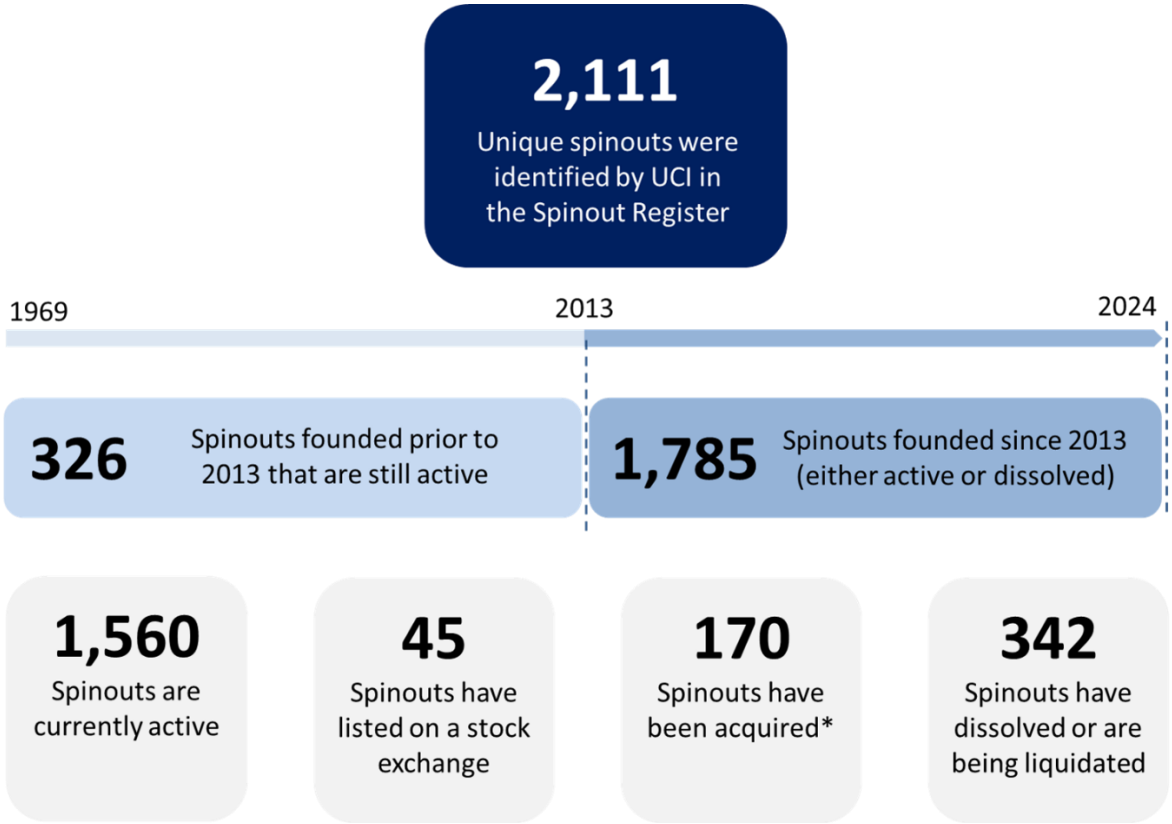
3 Exploring the structure and trends of the UK spinout ecosystem

This section leverages the dataset we built based on the newly available data from the Spinout Register on the full population of spinout companies emerging from UK HEPs to explore the structure and dynamics of the UK university spinout system. It presents the scale of spinout activity in the UK across the higher education sector and trends in spinout production. It then considers the breadth of spinout activity by looking into the origins of these companies from different research disciplines and their application to specific sectors, as well as those that operate as social enterprises.

3.1 The scale of spinout activity in the UK

We identified over 2,100 unique spinout companies in the data underlying the Spinout Register. These include 1,785 spinout companies founded between 2013 and 2024, and an additional 326 companies founded prior to 2013 (that remained active in the reporting year 2024). The oldest spinout recorded in the Register dates back to foundation in 1969.

Figure 3 Scale of spinout activity in the UK



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

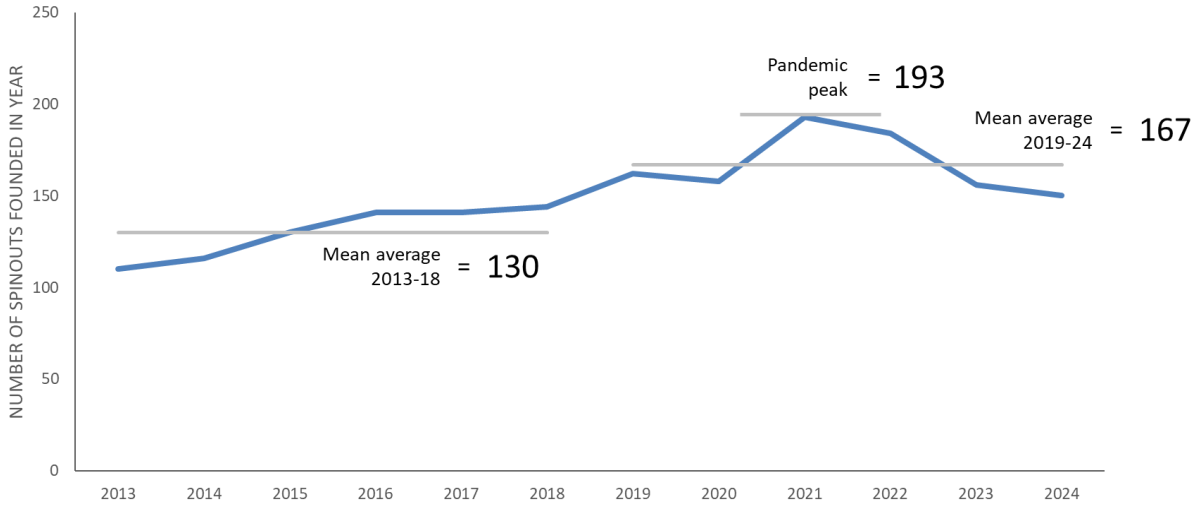
Of the 2,111 spinouts, 1,560 are currently active and remain independent ventures, 45 have listed on a stock exchange (in the UK or overseas), 170 have been acquired (including those that did so following a public listing), and 342 have dissolved or are in the process of being liquidated.

3.2 Sector-level spinout production trends

The number of spinouts coming out of UK HEPs is a valuable indicator of the health of the research commercialisation pipeline, although it is important to use this metric as part of a suite of metrics that captures the value potential or quality of these companies.

To measure changes in production over time, we used the foundation dates provided by HEPs to signify the point at which the spinout is 'born' and the reference point at which we started counting the company as a spinout. Limiting the sample to include only those spinouts founded since 2013 (1,785 spinouts)[13], Figure 4 shows the trend in annual spinout production of *unique* spinout companies by all UK HEPs. **For the time being, annual spinout production numbers should be treated sensitively** and may be subject to revisions over time, given the (small) number of issues regarding spinout eligibility in the population and correctly identifying foundation dates, as set out in section 2.3.

Figure 4 Annual production levels of spinouts



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

Over the long term, annual production has increased, with the mean number of spinouts produced annually between 2019-2024 increasing to 167, from 130 between 2013-2018. From 2013, there was a steady year on year increase in production right through to 2019. Since then, average production has flattened out somewhat. We see a clear effect of the Covid-19 pandemic, with production levels much higher in 2021 (193) and 2022 (184) following prolonged periods of lockdown, when much research activity was halted due to laboratory and office closures. With only two data points following the pandemic spike, it is very difficult to make concrete assertions on the direction of the trend going forward. Ignoring the pandemic spike, the two most recent data points may suggest that production

[13] In the data collection to develop the Spinout Register, HEPs were asked to submit all spinouts, whether currently active or not, for those founded from 1st August 2012 to the current reporting year. Prior to 1st August 2012, HEPs were only asked to submit any spinouts that remained active during 2024. Because they were not asked to submit spinouts during this earlier period that are no longer active, we can only reliably calculate spinout production rates from 2013 onwards.

may be starting to fall below pre-pandemic levels. The 2025 datapoint in this series, once available, will therefore be crucial to identify whether this levelling off of spinout production appears to be persisting.

3.3 Research origins and sectoral applications of spinouts

Spinouts commercialising different types of IP face differing pressures, development journeys and needs.[14] Likewise, different types of technologies and industries operate within different policy, regulatory and legal environments and place different demands on levels of investment. Accounting for these structural differences is important because they shape the pathways, challenges, and opportunities that spinouts encounter, influencing their growth trajectories, funding requirements and long-term outcomes. In this section, we examine the disciplinary origins and sectoral applications, using data collected in the Register and through linking in sectoral information about these companies from PitchBook.

3.3.1 Disciplinary origins

To understand more about the knowledge base underpinning the spinouts and capture key differences between them, the data collected by HESA that underpins the Spinout Register included information on the REF Main Panel(s) of the spinout's founding team. We recognise that is not a perfect proxy of the knowledge disciplines underpinning the ideas and IP being commercialised, and there are more granular classification taxonomies available, not least the REF Unit of Assessments. However, the collection of this information represents an important first step in characterising the knowledge base underpinning the IP being commercialised by the university spinout.

Table 3 and Table 4 summarise two types of categorisations of the disciplinary information collected. The first summarises the REF Main Panel data for the 2,111 spinouts, and enables distinctions between four broad discipline areas: Life Sciences, Engineering and Physical Sciences, Social Sciences, and Arts and Humanities. It is important to note that 10% of spinouts were identified as multi-disciplinary (i.e. originating from more than one REF Main Panel), hence totals do not sum to the total spinout population.

Table 3 Originating disciplines of spinouts, REF Main Panels

Originating discipline: REF Main Panel	All Spinouts in Register	
	#	%
Panel A: Life Sciences	841	40
Panel B: Engineering and Physical Sciences	1,256	59
Panel C: Social Sciences	137	6
Panel D: Arts and Humanities	97	5

Note: REF Main Panel categorisation do not sum to total number of spinouts as a single spinout could be identified as having multiple REF Panels.
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

[14] Ulrichsen and Roupakia (2024)

The second, higher-level categorisation is constructed from the REF Main Panel fields. This treats STEM (represented by spinouts from Main Panel A and/or B only) and AHSS disciplines (represented by Main Panel C and/or D only) distinctly. But a spinout could also be classed as interdisciplinary where both STEM and AHSS Panels were jointly chosen. Since each spinout can only be assigned one grouping, this categorisation sums to the total population.

Table 4 Originating disciplines of spinouts, STEM & AHSS

Originating discipline groups	All Spinouts in Register	
	#	%
Science and engineering (STEM) disciplines only	1,886	89
Arts, humanities and social science (AHSS) disciplines only	163	8
STEM and AHSS collaborations	62	3
Total spinouts	**2,111**	**100**

Science and engineering only: REF Panels A and B but no involvement of REF Panels C and D; Arts, humanities and social sciences only: REF Panels C and D but no involvement of REF Panels A and B. STEM and AHSS collaborations: Involvement of at least one of REF Panels A or B and at least one of REF Panels C or D.
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

Unsurprisingly, spinouts emerging from only science and engineering disciplines make up the majority of the spinout population (89%, Table 4), with slightly greater prominence of Engineering and Physical Sciences spinouts over Life Sciences spinouts (Table 3). Compared to the distribution of academics[15] (see further detail in Figure 9, page 42), we see that academics in Life Science disciplines and Engineering and Physical Sciences are disproportionally using university spinouts as the route to commercialise. AHSS spinouts make up a smaller, but not insignificant, proportion (8%, plus an additional 3% of STEM and AHSS collaborations). This reflects growing attention by research and innovation funders, universities and others to the opportunities and potential for building venture based on ideas emerging from AHSS disciplines

3.3.2 Sectoral composition of spinouts

Alongside presenting information on the disciplinary origins, it is important to also understand the focus of application of the IP and where it seeks to make its contribution to the world. One proxy for this – albeit only partial – is to look at the economic sectors within which they are operating. The application space is also important as it will shape the commercialisation pathway, as well as the challenges and opportunities, facing the spinout (for example the regulatory environment, availability of finance and enabling infrastructure, and availability and access to development partners and initial markets).

When undertaking any sectoral analysis, the most widespread sectoral classification system available in the UK is the Standard Industrial Classification (SIC) system. However, it is important to consider the significant limitations of using this system to examine university spinouts. While useful in some circumstances, among other limitations, it really struggles to appropriately capture the areas where university spinouts are likely to contribute most to the innovation and the economy, not least because

[15] 34% of academics are linked to life sciences disciplines, 23% to engineering and physical sciences, 30% to the social sciences, and 13% to the arts and humanities. Source: HESA Staff Record

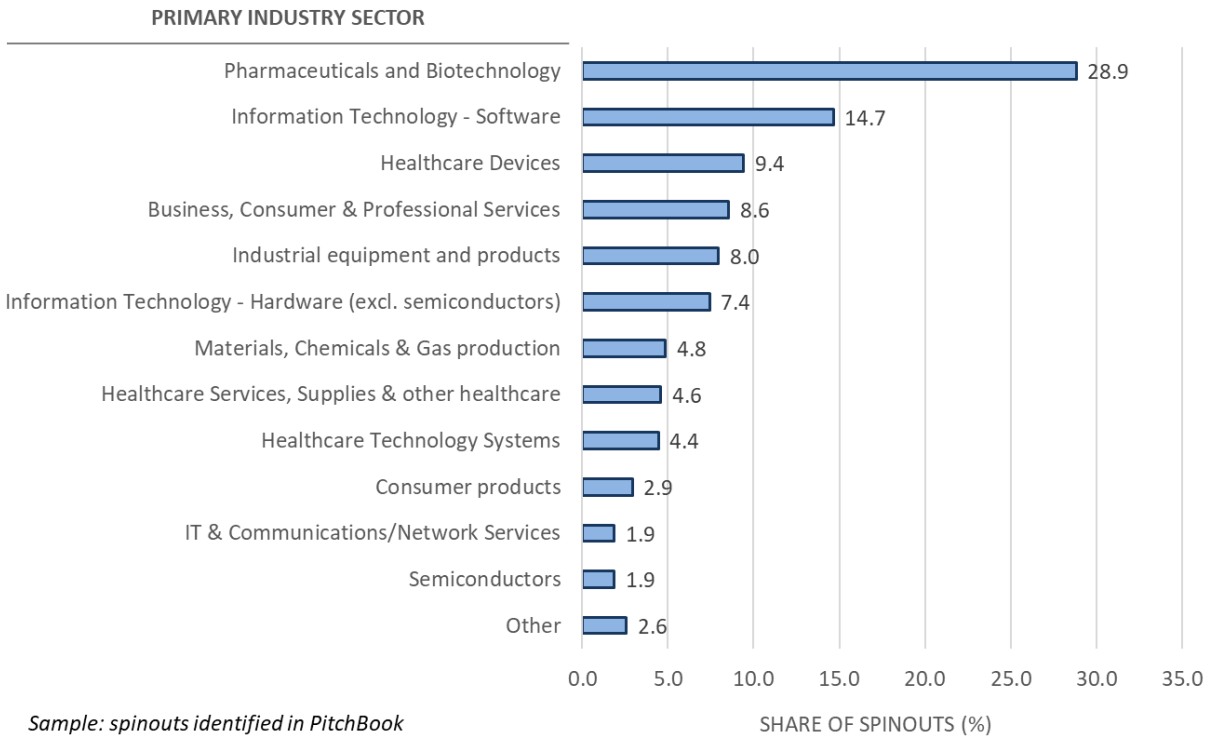
spinouts are typically commercialising nascent and novel technologies and may be working to seed new sectors and areas of economic activity. [16]

In an attempt to move beyond the SIC system, we leveraged information from the investor-driven data platform, PitchBook, to identify the industrial sectors and markets within which spinouts are seeking to operate and impact. While still imperfect, it provides a more responsive and relevant set of sectors that speak to the emergent nature of spinouts.

One limitation of this approach is that, while 72% of spinouts in UCI's dataset (developed from the data underlying the Spinout Register) were identifiable in PitchBook's data platform, the remaining companies were not, many of which emerged from AHSS disciplines. This introduces some limitations to our sector-driven analysis. Further work is needed to investigate whether the spinouts where sector information is not available through PitchBook, differ fundamentally in composition to those with such information. If not the case, then the estimates provided below, using the sample we have, are an accurate reflection of the population. However, if they do indeed differ, we may see some change in the sectoral composition of the UK's spinouts from that shown here.

Noting these caveats, Figure 5 presents the sectoral composition for the spinouts identified in PitchBook and where sector information is available (1,507 spinouts).

Figure 5 Sectoral composition of spinouts in the Register



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

Within this sample, spinouts operating in the pharmaceutical and biotechnology space dominate (28.9%). Other life science-related sectors e.g. healthcare devices (9.4%), healthcare systems (4.4%)

[16] Ulrichsen and Roupakia (2024)

and healthcare services (4.6%) also represent a large share of the sample. There are also considerable numbers of spinouts in key strategically important sectors, for instance: software-focused spinouts (14.7%); IT hardware (7.4%); semiconductor spinouts (1.9%); and spinouts in the materials, chemicals and gases sectors (4.8%).

Further sectoral analysis on the significance of university spinouts (relative to other UK start-ups) to key sectors is presented in Section 5.

3.3.3 Understanding the mapping between research discipline and sectors

To better understand how research translates into commercial application, we combine data on the disciplinary origins of spinouts with their sectoral classification. Table 5 shows the proportion of spinouts emerging from a particular discipline in each industrial sector - for instance, 42% of life sciences spinouts in our dataset are in the Pharmaceutical and Biotechnology sector.

Table 5 Sectoral composition, by originating discipline

Primary Industry Sector	% of spinouts emerging from discipline area operating in sector			
	Life Sciences	Engineering & Physical Sciences	Social Sciences	Arts and Humanities
Pharmaceuticals and Biotechnology	42.1	10.5	3.6	0.0
Information Technology - Software	2.1	15.4	8.0	15.5
Healthcare Devices	10.2	6.7	0.7	0.0
Business, Consumer & Professional Services	3.0	6.2	19.7	7.2
Information Technology - Hardware (excl. semiconductors)	0.6	8.6	1.5	0.0
Industrial equipment and products	1.3	8.8	0.7	0.0
Materials, Chemicals & Gas production	0.8	5.3	0.7	2.1
Healthcare Technology Systems	5.5	2.7	0.0	0.0
Healthcare Services, Supplies & other healthcare	6.3	2.5	0.7	0.0
Consumer products	1.9	1.9	2.2	4.1
Semiconductors	0.1	2.1	0.0	0.0
IT & Communications/Network Services	0.2	1.9	1.5	2.1
Other	1.2	2.1	2.2	4.1
Not known	24.6	25.2	58.4	64.9
Total (%)	100	100	100	100
Total Spinouts	***841***	***1,256***	***137***	***97***

Note: A spinout could be recorded as being underpinned by multiple REF disciplines, hence this table double counts unique multi-disciplinary spinouts across the columns.
Source: Analysis of UCI's spinout dataset developed from the data behind the Spinout Register and data from PitchBook Data, Inc.

There are a range of sectors associated with each discipline, particularly Engineering and Physical Sciences, where their spinouts are operating across many sectors. A large proportion of Life Sciences spinouts, unsurprisingly, are in life-science sectors, in particular pharmaceuticals and biotechnology (42%) and healthcare devices sectors (10%). Social Sciences and Arts and Humanities spinouts tend to be more concentrated in Business, Consumer & Professional Services, and Information Technology (particularly Software and Communications/Network Services).

The table also emphasises the unevenness in the coverage of sector data. We do not have sectoral information for large numbers of social sciences, arts & humanities spinouts: around 60% of spinouts in these disciplines are not covered by PitchBook, therefore we report in the table as 'Not Known'.

Coverage for STEM disciplines is higher (around 75% have some sector information), but, given the dominance of STEM spinouts in the dataset (89%), in absolute terms, this equates to a considerable number of spinouts in the data that have unknown sectors.

A key next step is to develop a better classification system that provides greater coverage across, and detail concerning, the diverse spinout population to advance our understanding about the underpinning ideas and technologies, and the sectors UK university spinouts seeking to contribute to.

3.4 Social enterprise spinouts

The Spinout Register also identifies whether the venture operates as a social enterprise (which includes those operating as charities, community interest companies, or with other business structures). These ventures prioritise their objectives towards maximising societal and environmental benefits, as opposed to commercially-driven strategies. As a result, how they operate and deliver impact will differ from the typical for-profit business enterprise, and metrics to determine success should take this into account.

For the first time, the data collection process has allowed HEPs to simultaneously identify a company as both a spinout *and* a social enterprise. Prior to now, the sector-wide HEBCI data has required that HEPs report social enterprises distinctly to university spinouts, meaning we were unable to identify the extent to which there was overlap between these two types of venture.

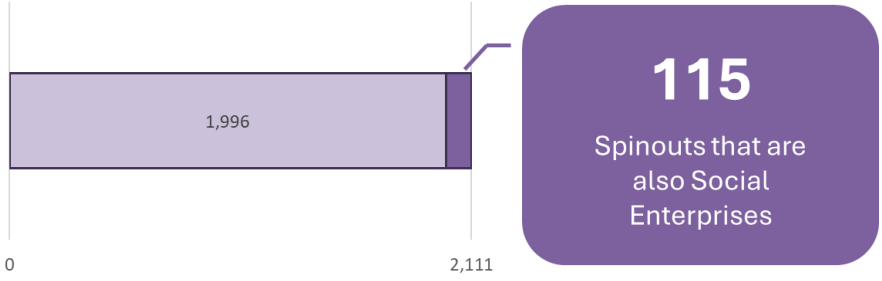
Alongside spinouts that were flagged as social enterprises by HEPs in the Spinout Register, we *additionally* augmented the field to include any company registered as a Community Interest Company (CICs) – which we identified through its legally incorporated name. CICs are a type of limited company where activity benefits the community rather than private shareholders. They are a common legal structure for social enterprises.[17]

What are Social Enterprises?

Referring to HESA's definitions, social enterprises are registered companies which are established to deliver products or services which bring about positive social change i.e. organisations that rate their success on their social outcomes equally or more than their commercial outcomes. They can include, albeit not exclusively, charities.

In total, we identified 115 social enterprise spinouts in our dataset (5% of total spinouts).

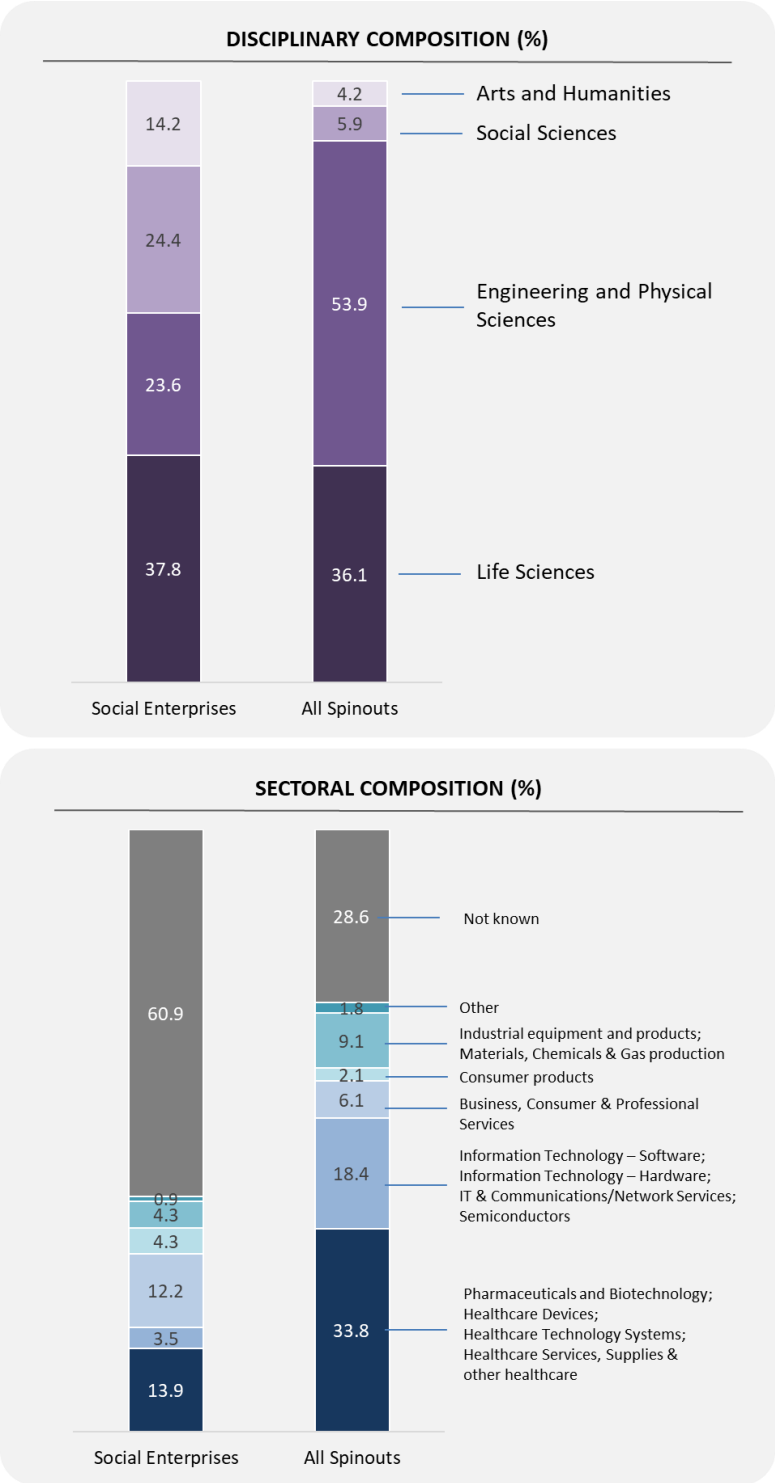
Figure 6 Scale of social enterprise activity amongst university spinouts



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

[17] See National Council for Voluntary Organisations (2021) and UK Government (2025)

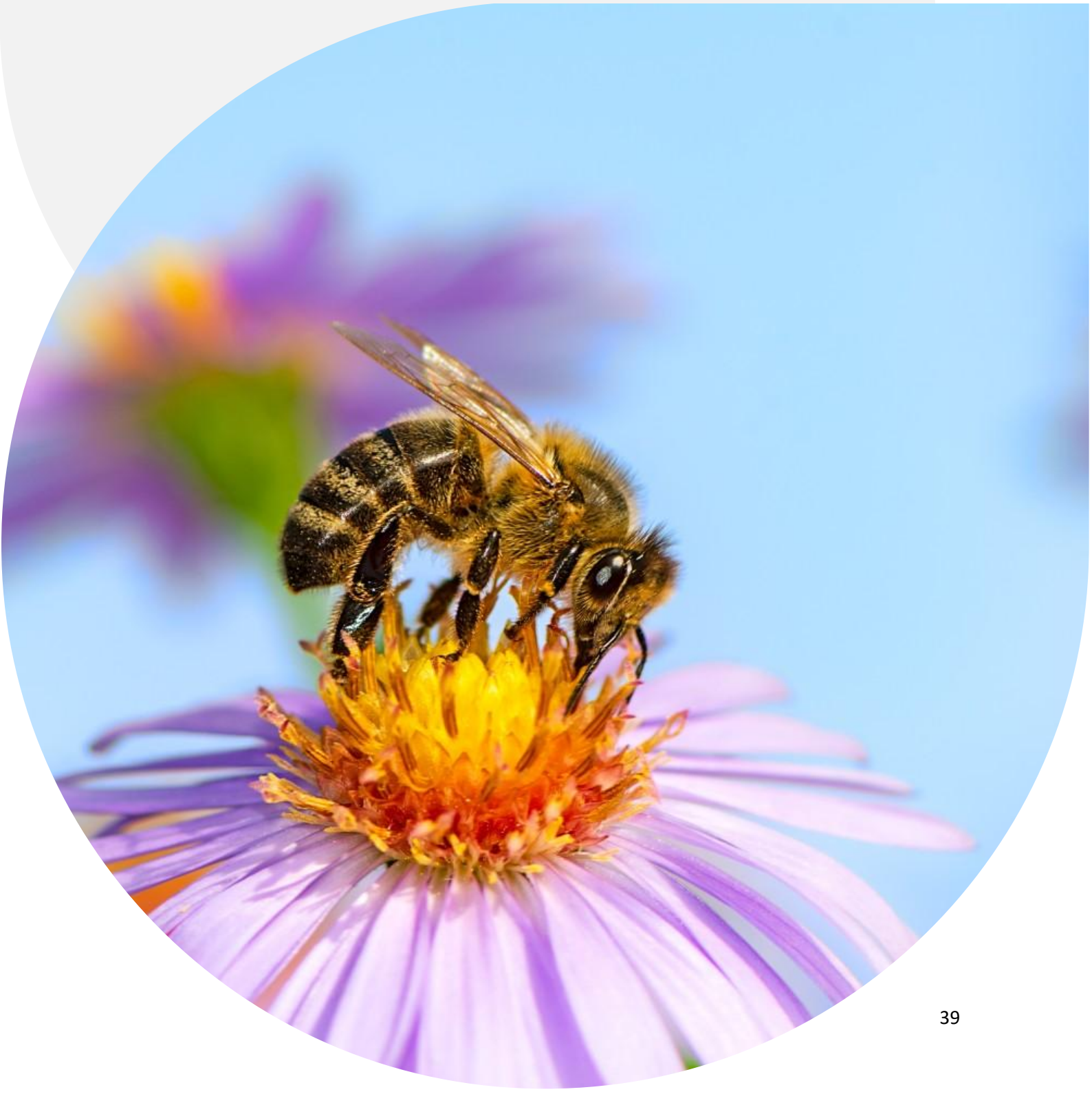
Figure 7 Disciplinary and sectoral composition of social enterprise spinouts, compared to wider spinout population



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

As a segment of the total spinout population, initial evidence suggests that social enterprises may have different compositional make-up to other university spinouts (Figure 7). Social enterprises show a more balanced disciplinary distribution, with notable representation from Arts and Humanities (14.2%) and Social Sciences (24.4%), in contrast to the wider population, which are heavily concentrated in Life Sciences (36.1%) and Engineering and Physical Sciences (53.9%). Considering sectoral composition, similar to the wider population, social enterprise spinouts are also not concentrated in particular sectors. However, the figure highlights that a substantial proportion (60.9%) of social enterprise spinouts are classified as "Not known", due to a lack of coverage of these companies in PitchBook data. This likely reflects that these social enterprises are not typically tracked by these types of investment-driven data platforms, and reemphasises the need for a spinout classification system – work of which is underway – that better reflects the breadth and diversity of the type of spinouts coming out of UK HEPs.

4



4 The universities producing spinouts

Universities play a central role in the creation of spinouts, offering a broad system of support that help transform early-stage ideas into viable commercial opportunities. This includes both direct financial support to increase the technological and commercial readiness of the venture and in-kind support such as connections into investor and alumni networks; training; and access to facilities, equipment, and lab/office space.[18] Moreover, this does not necessarily end at the point of foundation, with universities increasingly playing a role post-foundation in supporting the scaling of spinouts.

The UK's spinout ecosystem sees ventures emerging from HEPs that reflect the breadth and diversity of the UK higher education sector—ranging from globally renowned research-intensive institutions to smaller HEPs with deep ties to local innovation ecosystems. This diversity contributes to a rich and varied pipeline of spinouts across disciplines, sectors, and geographies.

We must also recognise that spinouts are just one route to commercialising the ideas and IP emerging from HEPs. Not all HEPs that engage with spinning out ventures do so as their primary route for commercialising IP. For some institutions, alternative commercialisation pathways may be more relevant and accessible (e.g. consultancy, licensing to existing companies, exchanging and transferring ideas and know-how through research and innovation-focused partnerships), dependent on their position within the innovation ecosystem they operate, their knowledge base, and portfolio of opportunities with commercial potential. These alternative routes are not captured within the scope of the Spinout Register's data and as such the absence of spinout activity should not be interpreted as a lack of commercial or societal contribution.

This section explores the UK HEPs producing the spinouts reported to the Spinout Register in more depth. We investigate their contributions to annual spinout production levels, segmenting our analysis by HEPs with different scales of research base, UK nation and region, and for English HEPs only, KE clusters. We also explore the diverse types of relationships and ownership structures HEPs have with their spinout companies, which go beyond just equity relationships that have been the focus of much discussion and debate in recent years, and reflect the broad types of support that HEPs offer spinouts.

At the outset of this section, to examine the contributions of HEPs to spinout activity, we must also acknowledge the presence of the 77 'collaborative spinouts' we have identified in our spinout dataset. These collaborative spinouts occur where the IP originates from multiple 'parent' HEPs and as such, are reported multiple times in the Register - once by each 'parent' HEP.[19] As a result, while we identified 2,111 unique university spinouts from the data behind the Spinout Register (the sample underlying analysis in the previous section), there are 2,196 recorded instances of HEPs contributing to spinouts (entries in our university *x* company level dataset). In this section, we utilise these 2,196 spinout instances to reflect the distinct contributions made by each HEP. However, this approach naturally involves double counting some spinout companies.

[18] Ulrichsen Roupakia and Kelleher (2022).
[19] Further analysis on the composition of collaborative spinouts is presented in section 4.3.

Figure 8 Scale of HEP contributions to spinout activity in the UK

Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

4.1 About the UK university base producing spinouts

Spinouts emerge from a rich and diverse UK higher education ecosystem, employing over 195,000 academics (full time equivalent, FTE) across 173 HEPs and securing over £10.1 billion in research income in 2024 (Table 6). By devolved nation, English HEPs secured 82% of the total research income. Scottish HEPs secured 13% of the UK's research income, with Welsh HEPs securing 3% and those in Northern Ireland securing 2%. Over half (56.7%) of UK HEPs reported spinouts to the Spinout Register. These HEPs secured almost all (97.5%) of all research income in the UK and employed 85% of the academics.

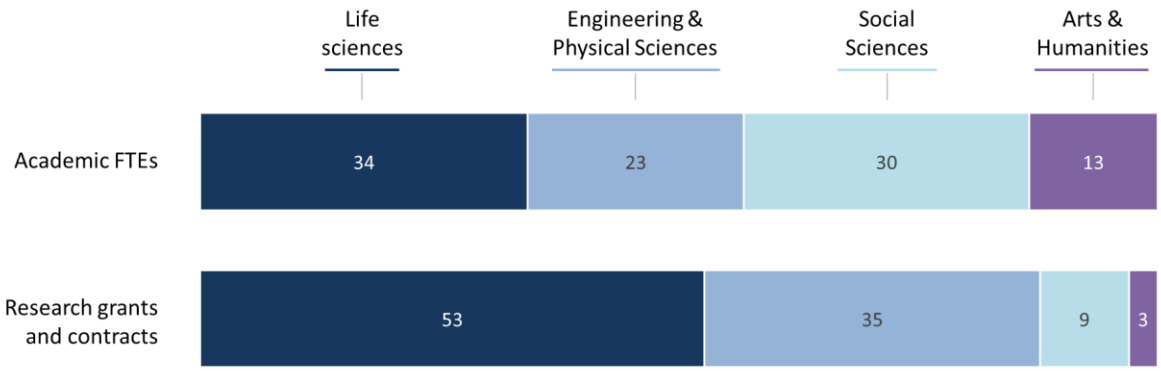
Table 6 Scale of HEP activity across the nations of the UK

Area	All HEPs in UK			HEPs reporting to Spinout Register		
	HEPs (number)	Research income 2024 (£millions)	Academic staff 2024 (FTE)	HEPs (% of group)	Research income 2024 (% of group)	Academic staff 2024 (FTE) (% of group)
UK	**173**	**10,107**	**195,345**	**56.7**	**97.5**	**85.4**
	Of which (% UK total)					
England	83	82	83	51.7	97.2	83.2
Scotland	10	13	11	83.3	98.8	94.8
Wales	5	3	4	87.5	99.5	97.4
Northern Ireland	2	2	2	50.0	99.8	97.3

Note: monetary variables have been adjusted for inflation and are in constant 2024 prices
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and HESA's Finance and Staff Record

The distribution of research income and academic staff is broadly similar to the number of HEPs in each nation. Figure 9 shows that 34% of academics are linked to life sciences disciplines, 23% to engineering and physical sciences, 30% to the social sciences, and 13% to the arts and humanities. Research grants and contracts income is much more skewed towards the scientific and engineering disciplines, reflecting not least the increased costs of delivering research in these areas.

Figure 9 Share (%) of academic staff and research grants and contracts by discipline in 2024



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and HESA's Finance and Staff Record

Table 7 Scale of HEP activity by research scale group

Research scale group*	All HEPs in UK			HEPs reporting to Spinout Register		
	HEPs (number)	Research income 2024 (% UK total)	Academic staff (FTE) 2024 (% UK tot.)	HEPs (% of group)	Research income 2024 (% of group)	Academic staff 2024 (FTE) (% of group)
£300 million and above	6	37	18	100	100	100
£100 million to £300 million	17	36	26	100	100	100
£50 million - £100 million	18	14	13	100	100	100
£20 million - £50 million	15	5	8	87	90	75
£10 million - £20 million	24	5	15	96	97	99
Less than £10 million	93	3	20	23	44	38

* Grouping is based on the average research income of HEPs over the period 2012/13 – 2023/24
Note: monetary variables have been adjusted for inflation and are in constant 2024 prices
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and HESA's Finance and Staff Record

Previous studies have shown that spinout production correlates strongly with the amount of research HEPs undertake (Ulrichsen & Roupakia, 2024). We have therefore grouped HEPs based on their annual research income (average over the period 2012/13 – 2023/24) to identify six 'research scale' groups of HEPs (Table 7). The 41 HEPs with research incomes greater than £50 million secured 87% of research funds in the UK, reinforcing the concentration of research activity within the UK HE system. All HEPs in these three groups reported spinouts in the Spinout Register. A large majority of HEPs with research incomes between £10 million and £50 million also reported spinout activity in the Spinout Register. By contrast, just 23% of 93 HEPs with research incomes of less than £10 million reported any spinouts.

4.1.1 England only

Turning now to England, Table 8 presents information on the structure of the HE sector across its regions. While many HEPs (45) are based in London, the distribution of research income and academic FTEs across the regions is broadly similar to the distribution of HEPs.

Table 8 Scale of HEP activity by English regions

English region	All HEPs in UK				HEPs reporting to Spinout Register		
	HEPs (number)	HEPs (% English total)	Research income 2024 (% English total)	Academic staff (FTE) 2024 (% English total)	HEPs (% of group)	Research income 2024 (% of group)	Academic staff 2024 (FTE) (% of group)
North East	5	3	4	6	100.0	100.0	100.0
North West	15	10	10	12	60.0	98.1	85.2
Yorkshire and The Humber	13	9	9	10	53.8	98.2	86.2
East Midlands	9	6	5	8	66.7	97.8	86.0
West Midlands	12	8	7	9	50.0	92.6	82.2
East of England	10	7	12	8	50.0	98.0	81.5
London	45	31	28	23	44.4	97.0	82.8
South East	19	13	18	16	52.6	97.4	76.1
South West	15	10	8	9	40.0	96.4	80.1

Note: monetary variables have been adjusted for inflation and are in constant 2024 prices
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

We also utilised the KE Clusters that currently underpin the Knowledge Exchange Framework (KEF)[20]. These clusters were developed to identify groups of English HEPs with similar structural characteristics that are believed to shape their KE opportunities. This identified five groups of non-discipline specialist HEPs (Clusters E, J, M, V, and X) and two groups of discipline specialist HEPs (STEM-focused specialists and Arts-focused specialists). The characteristics of each cluster are provided in Annex A. To briefly summarise, Clusters J and M represent small to mid-sized institutions with a more teaching focus (although some research is still in evidence). Clusters V and X represent the large more research-intensive institutions, with Cluster V institutions typically having significant activity in clinical medicine. Cluster E captures broad-discipline HEPs with more applied research and teaching-driven portfolios.

Table 9 shows how many HEPs of different KE Cluster are based in each English region. All English regions have at least one very large research intensive HEP with activity in clinical medicine (i.e. Cluster V). A characteristic of the spatial geography of England is that all regions have a mix of different types of HEPs. This results in the distribution of research income across regions being very similar to the distribution of HEP numbers (see Table 8).

[20] Details about the clusters and the methodology used to derive them can be found in Ulrichsen (2023)

Table 9 Number of HEPs from each KE cluster in each of the English regions

English region	KE cluster (Number of HEPs in English region)						
	Cluster V		X	E	J & M	Specialist STEM	Specialist Arts
	Largest 5 by research	Other					
North East	0	1	1	2	1	0	0
North West	1	1	1	4	5	1	2
Yorkshire and The Humber	0	2	2	4	2	0	3
East Midlands	0	1	2	3	3	0	0
West Midlands	0	2	1	4	4	1	0
East of England	1	0	2	2	2	2	1
London	2	3	3	7	6	5	17
South East	1	1	5	4	5	0	2
South West	0	2	1	3	4	3	2
Number of HEPs	5	13	18	33	32	12	27
% research income in England	***39***	***33***	***13***	***7***	***1***	***6***	***0.4***
% HEPs reporting to the Register	***100***	***92***	***94***	***85***	***9***	***58***	***7***

Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

HEPs in Cluster V secured 72% of all research income going to English institutions. For this analysis, with spinout activity strongly correlating with the scale of the research base, to provide more valuable insights into the trends and dynamics of the spinout ecosystem in England, we separated out the largest five HEPs within cluster V (based on the scale of their research income) to form their own sub-cluster – of which the largest 5 received 39% of all research income to English institutions. HEPs in cluster X secured a further 13% of research income, with HEPs in this cluster also evenly distributed across the English regions.

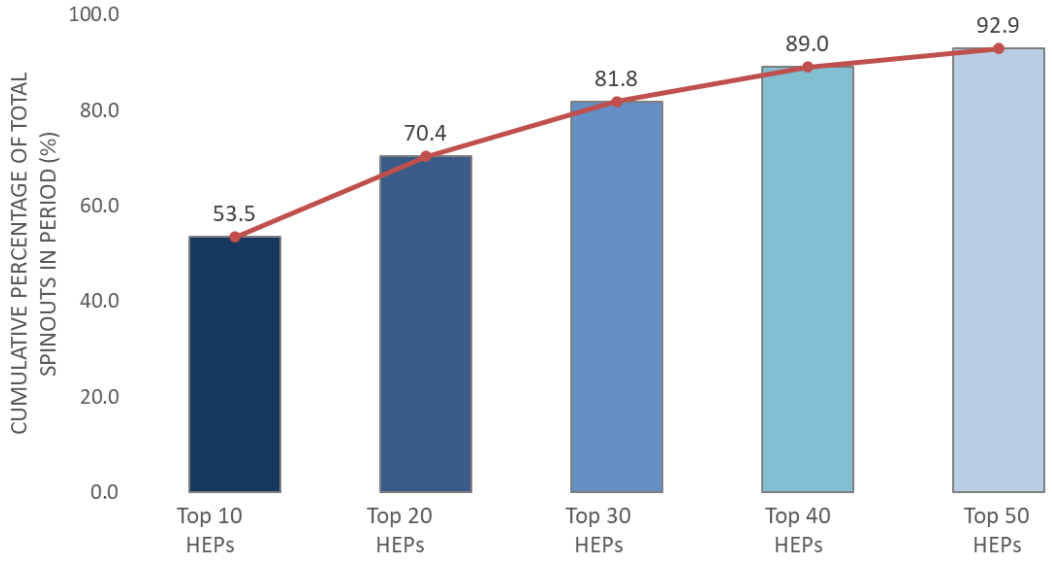
Regarding reporting to the Register, all HEPs within cluster V (largest 5), and the vast majority of HEPs in clusters V (other), X and E, reported spinout activity. Just 9% of HEPs in clusters J & M (more teaching-focused HEPs), and 7% of specialist Arts HEPs reported at least one spinout, while the comparable figure for specialist STEM HEPs was 58%.

4.2 Trends in spinout production across UK universities

In general, spinning out is a highly concentrated activity and production is highly skewed towards a small number of institutions[21]. The largest 10 spinout producers between the period 2013-2024 produced 53.5% of the total spinouts; the largest 20 produced 70.4% and the largest 30 institutions produced 81.8% (Figure 10).

[21] As with the analysis of annual spinout production levels at the sector-level (section 3.2), we limit the sample in this section to spinouts founded between 2013 – 2024.

Figure 10 Proportion of spinout production by the top HEP spinout producers



Note: HEPs ranked by total numbers of spinouts founded 2013-2024

Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

To further investigate the types of HEPs that make up the largest spinout producers and identify areas of growth in spinout production over the last decade, the following subsections segment the analysis by research scale group, region of HEP and (for England only) KE Cluster.

4.2.1 University spinout production by research scale group

Our analysis of the data behind the Spinout Register confirms that there is a strong correlation between the size of the research base and spinout production. Table 10 shows that 82% of spinouts founded since 2013 were from the 41 largest research universities (receiving £50 million in research income or more). The largest 6 research institutions (with research income greater than £300 million) especially dominate spinout production, accounting for 39% of all spinouts.

Table 10 Number and share (%) of spinouts produced by HEPs in each research scale group

Research scale group*	Number of spinouts produced			
	All in the Spinout Register		Since 2013 *(for production trends)*	
	#	%	#	%
£300 million and above	861	39	727	39
£100 million to £300 million	559	25	504	27
£50 million - £100 million	353	16	290	16
£20 million - £50 million	147	7	102	5
£10 million - £20 million	101	5	86	5
Less than £10 million	175	8	154	8
Total	2,196	100	1,863	100

* Based on the average research income of HEPs over the period 2012/13 – 2023/24

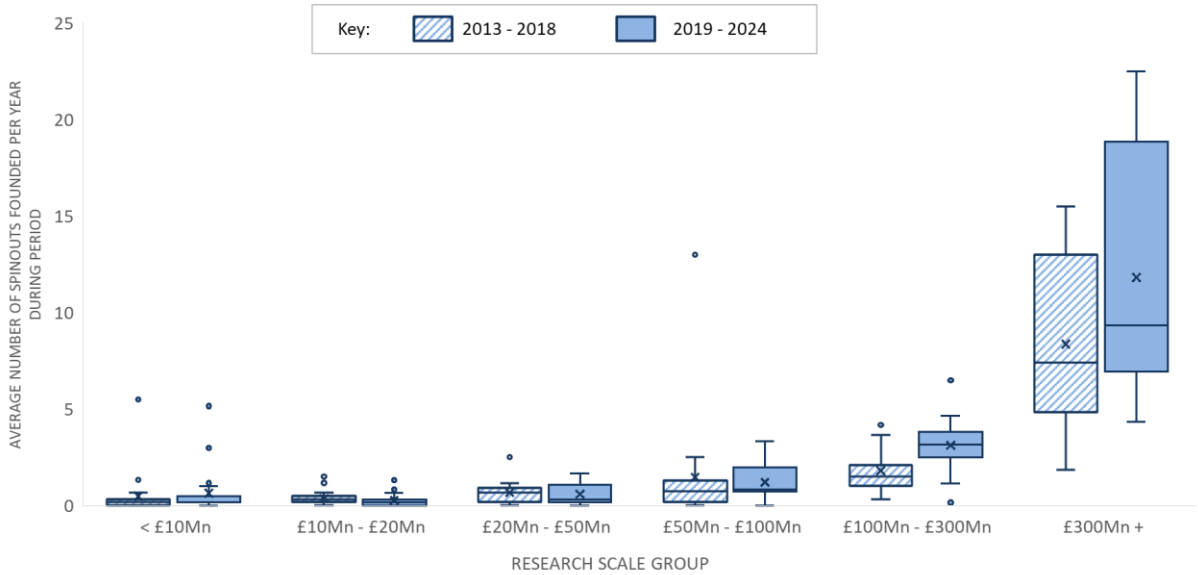
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from HESA's Finance Record

HEPs with more research funding tend to produce more spinouts (Figure 11). Universities with research bases of over £300 million show both higher median spinout production than other HEPs, indicating greater spinout activity on average, and wider distributions, indicating more variation among institutions in this category.

Earlier analysis at the sector-level (Figure 4) showed that 2013 to 2021 was defined by a period of steady growth in annual production levels of spinouts, with a peak reached in 2021. This increase is largely driven by the largest research institutions, where spinout activity is heavily concentrated. Figure 12 shows the very largest research institutions are dominate spinouts production, with their share increasing from 37.2% in 2013-2018 to 40.4% in 2019-2024. The second group of large research institutions (research bases between £100 million and £300 million) also saw a notable rise in spinout share – from 22.7% in 2013-2018 to 30.4% in 2019-2024 (an increase of 7.7 percentage points). This is despite only a modest increase in the share of research income received in that period (increasing only by 0.6 percentage points), suggesting an improvement in the ability and efficiency of these HEPs at producing spinouts.

Smaller research institutions (with research bases of less than £100 million) remain more consistent and limited in their spinout activity, although there are small numbers of outlier institutions, producing more than expected for their category (Figure 11). As a consequence of the increasing dominance of large research intensive HEPs, their spinouts generally constitute a smaller and declining share of the spinout population, whilst their share of research income remained broadly stable.

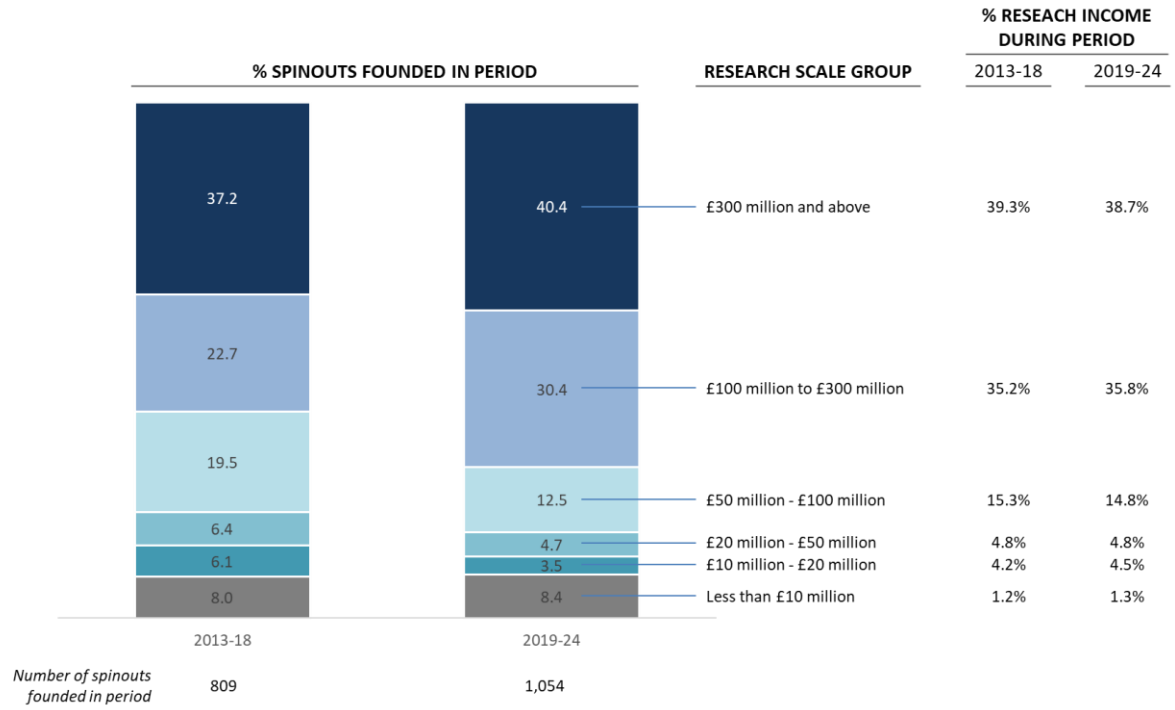
Figure 11 Average annual university spinout production levels for groups of HEPs with different scales of research base during periods 2013-2018 and 2019-2024



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from HESA's Finance Record

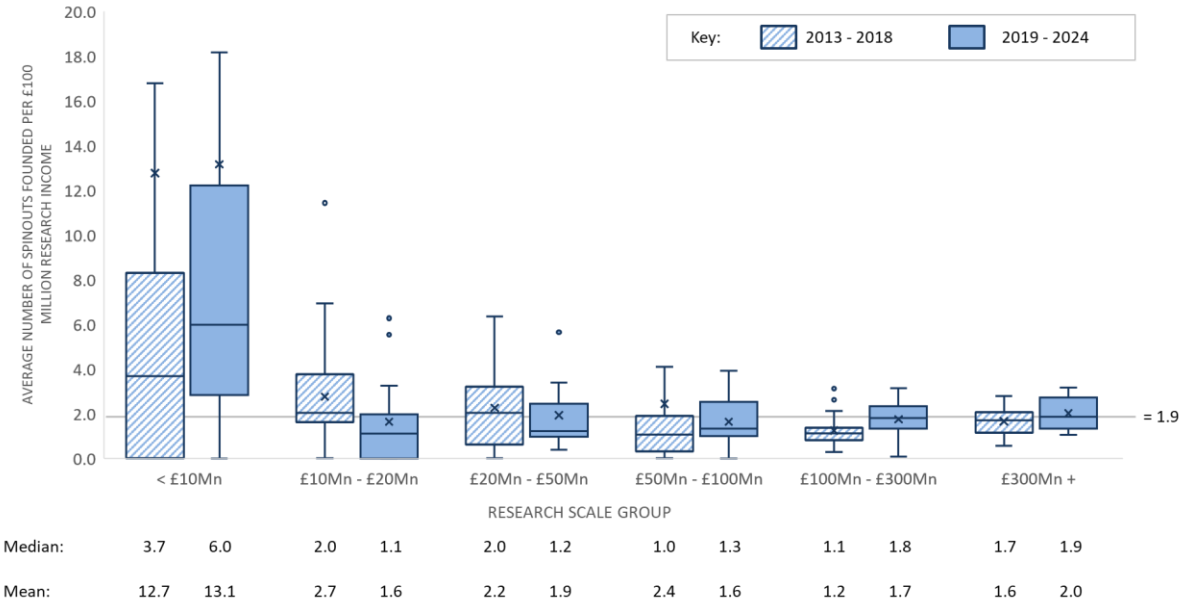
Consistent with evidence presented in Ulrichsen and Roupakia (2024), we also find that spinout production is strongly correlated with the scale of research activity once a certain threshold of research scale has been reached (around £100 million). Figure 13 shows how the numbers of spinouts produced by an institution per £100 million research income (i.e. accounting for the scale of a HEP's research base) varies for HEPs with different scales of research activity.

Figure 12 Distribution of spinouts and research income during periods 2013-2018 and 2019-2024 across groups of HEPs with different scales of research base



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from HESA's Finance Record

Figure 13 Normalised university spinout production rates for groups of HEPs with different scales of research base during periods 2013-2018 and 2019-2024 (spinouts per £100 million research income)



Note: Monetary variables have been adjusted for inflation and are in constant 2024 prices
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from HESA's Finance Record

For the period 2019-2024, we find that for HEPs with a research base above £100 million per annum, the median spinout production rate accounting for the scale of research activity is broadly similar at almost 2 spinouts per £100 million of research income (Figure 13). This rate is comparable to the experiences of leading US universities[22].

By contrast, the median spinout production rate for smaller research HEPs (with research bases between £10 million to £100 million) is between 1.1-1.3 spinouts per £100 million. There are inevitably HEPs within each of these groups that produce relatively more than the median, while others produce fewer. Indeed, some smaller research HEPs produce more spinouts per £100 million of research income than the average for their larger counterparts. This raises an important question of whether there are critical mass thresholds for spinout production, above which it becomes relatively easier to produce, support and nurture additional spinouts.

The group of HEPs with less than £10 million of research income per annum exhibits a very wide distribution. On inspection this is predominantly driven by the combination of some outlier institutions in this category and generally small numbers of spinouts produced alongside small research bases.

Comparing the two time periods, there is very little difference in the performance of the group with research bases greater than £300 million. Yet, other larger research institutions appear to be catching up. HEPs with research bases of £100 million - £300 million experience a significant increase between the two periods (median increases from 1.1 to 1.8 spinouts per £100 million of research income), which now puts them in line with production rates of the £300 million+ group. Furthermore, HEPs with a research base of £50 million – £100 million also saw their median spinout production rate grow from 1.0 to 1.3, a level slightly higher than where the group of HEPs with research bases of £100 million-£300 million were in 2013 – 2018.

In contrast, HEPs in the £10 million to £20 million and £20 million to £50 million categories experienced a decline in both the median and mean average number of spinouts per £100 million of research income between periods. Note, however, that production rates for these institutions, given their much smaller research bases, are more volatile for even with small changes in the number of spinouts produced compared with larger research institutions.

4.2.2 University spinout production by UK nations and English regions

Looking at the distribution of spinout production by UK nation and English region shows little regional effect on the numbers of spinouts produced beyond what we would expect to see given the distribution of research income.

Of the devolved UK nations, since 2013 English HEPs have produced 78% of spinouts, Scottish HEPs have produced 11%; Wales, 8% and Northern Ireland 3% (Table 11). This is very close to the distribution of HEPs and research income across the nations (Figure 14).

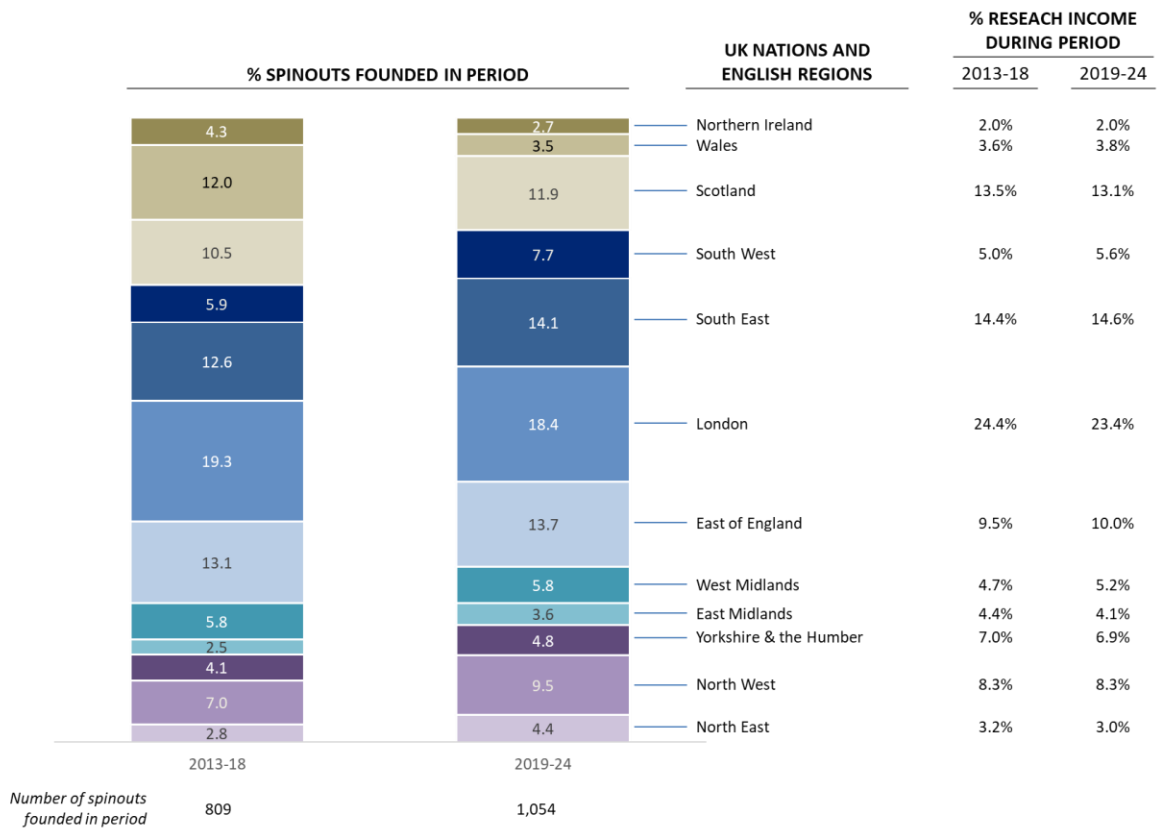
[22] See section 3.3 in Ulrichsen and Roupakia (2024) for a comparison of US and UK spinout production rates.

Table 11 Number and share (%) of spinouts produced by HEPs in each UK nation/region

UK Nation/Region	Number of spinouts produced			
	All in the Spinout Register		Since 2013 *(for production trends)*	
	#	%	#	%
North East	83	4	69	4
North West	190	9	157	8
Yorkshire and The Humber	88	4	84	5
East Midlands	80	4	58	3
West Midlands	132	6	108	6
East of England	321	15	250	13
London	423	19	350	19
South East	265	12	251	13
South West	129	6	129	7
England (total of regions above)	1,711	78	1,456	78
Scotland	237	11	210	11
Wales	165	8	134	7
Northern Ireland	83	4	63	3
Total	2,196	100	1,863	100

Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

Figure 14 Distribution of spinouts and research income during periods 2013-2018 and 2019-2024 across the UK nation and regions



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

Amongst English regions, the Greater South East (comprised of the East of England, London and South East) makes up a substantial share of spinout production since 2013, accounting for 45% of spinouts. This is a product of 4 of the 6 very largest research intensive HEPs and over half of all English HEPs being located in these regions.

Figure 14 directly compares the regional distribution of spinouts and research income between the periods 2013-2018 and 2019-2024. It shows that spinout production has become more strongly correlated with a region's research income over time. Arguably, northern regions of England (Yorkshire & the Humber, North West and North East) have improved performance the most in the period, increasing their share of spinouts by 4.7 percentage points in spite of a small decrease in the share of research income (decreasing by 0.2 percentage points). We see the same trend for the East Midlands (share of spinouts increased by 1.1 percentage points; but the share of research income down 0.3 percentage points.) and Scotland (share of spinouts increased by 1.4 percentage points.; 0.4percentage point fall in the share of research incomes). Wales has seen quite a stark fall in the share of spinouts (from 12% to 3.5%), which can be attributed to a large decline in spinouts produced by a single Welsh institution across the two periods.

4.2.3 University spinout production by KE Cluster (England only)

We finally segment spinout production by the KE Clusters for English institutions only. The analysis (and findings) mirrors that of the research scale groupings, covering the whole of the UK. However, with the KE Clusters developed to group institutions on the basis of differentiating characteristics likely to shape their opportunities for knowledge exchange activity[23], it is not surprising that looking across the KE Clusters provides the starkest set of trends, with respect to the concentration of spinout activity.

Table 12 Number and share (%) of spinouts produced by HEPs in different KE clusters (English HEPs only)

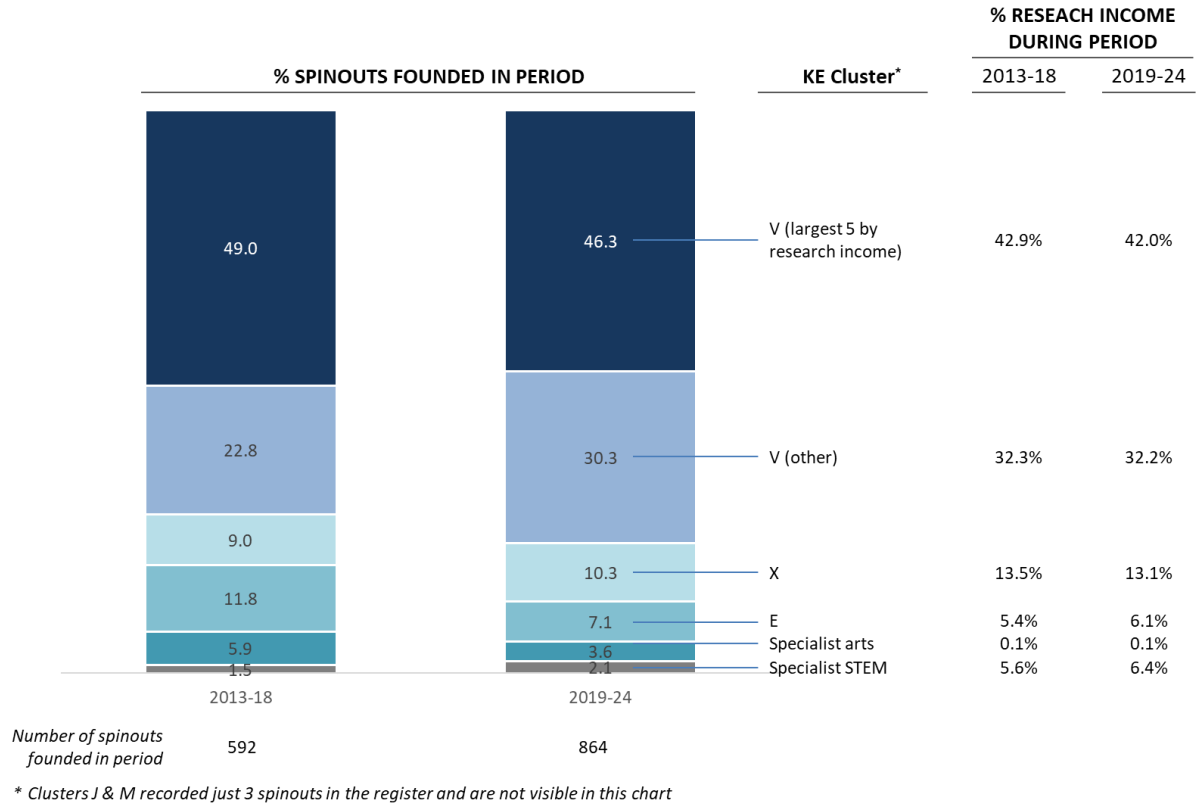
KE Cluster (English HEPs only)		Number of spinouts produced			
		All in the Spinout Register		Since 2013 *(for production trends)*	
		#	%	#	%
Cluster V	Largest 5 by research income	824	48	690	47
	Other	430	25	397	27
Cluster X		186	11	142	10
Cluster E		160	9	131	9
Cluster J & M		3	0	3	0
Specialist STEM		34	2	27	2
Specialist Arts		74	4	66	5
Total		1,711	100	1,456	100

Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

[23] Refer to Annex A for further detail on the KE Clusters

Table 12 shows the total numbers of spinouts produced by HEPs from each KE Cluster and clearly demonstrates the concentrated nature of spinout production. Cluster V makes up 74% of spinouts produced since 2013. The five largest research institutions in Cluster V make up almost half of the English total and the remaining HEPs in Cluster V make up a further 27%. Cluster X contributes 10%, Cluster E contributes 9%, and Specialist STEM and Arts HEPs make up 2% and 5% respectively. Clusters J and M reported only 3 spinouts between them and are largely untraceable in the remaining visualisations in this subsection; we have chosen not to report findings on these two groups of HEPs due to the very small numbers of spinouts produced.

Figure 15 Share of spinouts and research income during periods 2013-2018 and 2019-2024, by KE Cluster (English HEPs only)



** Clusters J & M recorded just 3 spinouts in the register and are not visible in this chart*

Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

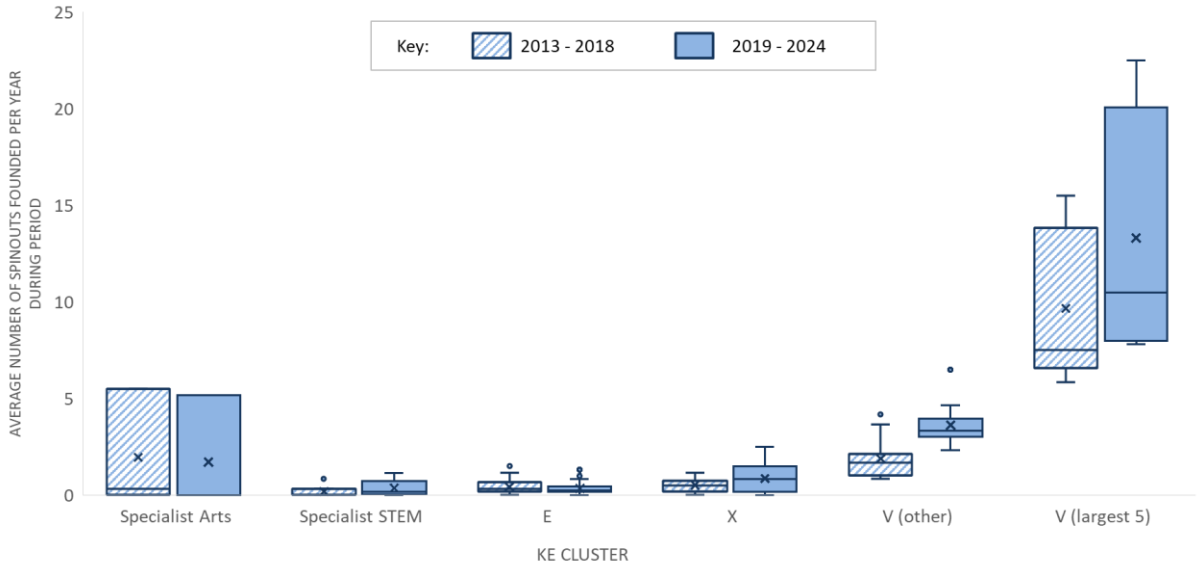
The dominance of Cluster V has grown in the last decade, increasing from 71.8% to 76.6% of total spinouts produced (Figure 15). This is driven by growth in the Cluster V institutions outside of the top 5, who increased their share of spinouts by 7.5 percentage points, whereas the top 5 cluster V institutions reduced their share by 2.7 percentage points. We note that this surge in share from other Cluster V institutions takes them to be in-line with where we would expect given the size of their research base. The distribution of spinouts produced by KE Cluster, generally mirrors that of research income, again suggesting that spinout production is highly correlated to the scale of the research base.

It is important to note the large growth in the number spinouts founded in England in 2019-2024, compared to 2013-18 (from 592 to 864). Therefore, the fall observed in the *share* of the top 5 cluster V universities does not represent a fall in the absolute numbers produced. Indeed, at the institution-level (Figure 16), we see large increases in the average number spinouts produced by Cluster V

universities – both amongst top 5 and the remaining HEPs in this cluster. Furthermore, cluster V HEPs produce more spinouts in absolute terms than other clusters, enabling them to potentially realise benefits from any critical mass effects in spinout production.

There is also small growth in spinout production for Cluster X HEPs, with their share of the total number of spinouts in England increasing from 9.0% to 10.3%. Cluster E, STEM and Arts Specialists experience little change in the average number of spinout produced per institution across the two time periods.

Figure 16 Average annual university spinout production levels for HEPs in different KE clusters during periods 2013-2018 and 2019-2024 (English HEPs only)

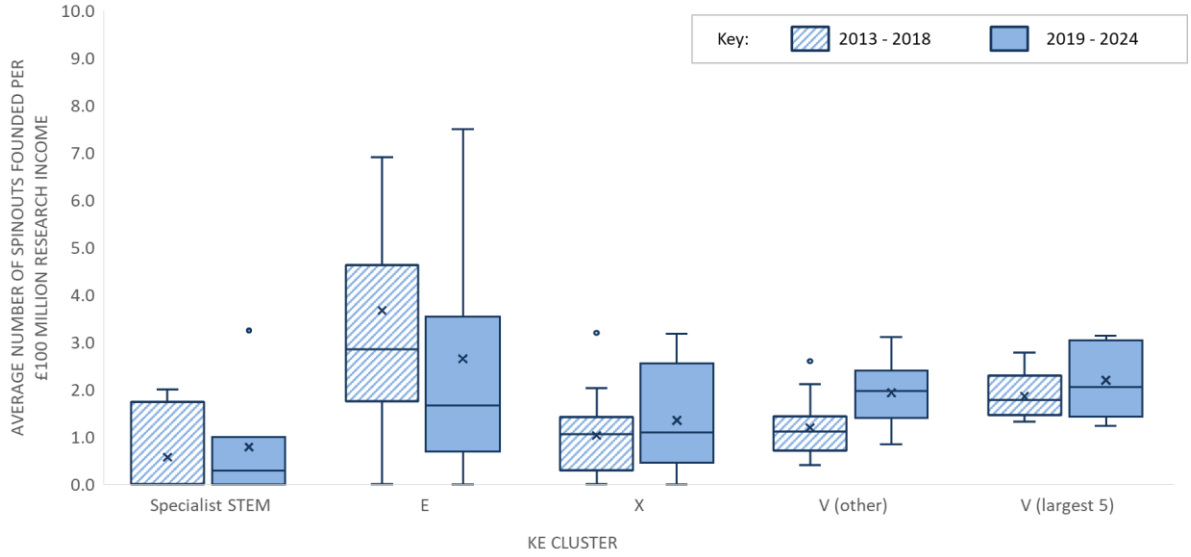


Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

Figure 17 shows how the numbers of spinouts produced by an institution per £100 million research income (i.e. accounting for the scale of a HEP's research base) varies for HEPs in different KE Clusters. Similar to what we observe with our analysis of HEPs with different research scales (section 4.2.1), the spinout production rate at the largest five research universities of Cluster V stayed broadly similar over the two time periods, with only a slight increase in median spinout production per £100 million (from 1.8 to 2.1). The other institutions within Cluster V, however, seem to have significantly increased their spinout production per £100 million of research income over time. While they were previously more like the average for Cluster X (around 1.1 spinouts per £100 million), they are now more similar to the five largest research universities of Cluster V at around 2 spinouts per £100 million.

Cluster X has generally not changed across the periods, although in 2019 to 2024 they show a wider distribution and uplift in the mean average, suggesting that some institutions within this cluster are performing increasingly better than the median Cluster X institution. For Cluster E institutions, on the other hand, there is a decline in spinout production rates, from a median average of 2.7 spinouts per £100m to 1.7.

Figure 17 Normalised university spinout production rates for groups of HEPs in different KE clusters during periods 2013-2018 and 2019-2024 (spinouts per £100 million research income)



Median:	0.0	0.3	2.8	1.7	1.1	1.1	1.1	2.0	1.8	2.1
Mean:	0.6	0.8	3.7	2.7	1.0	1.4	1.2	1.9	1.9	2.2

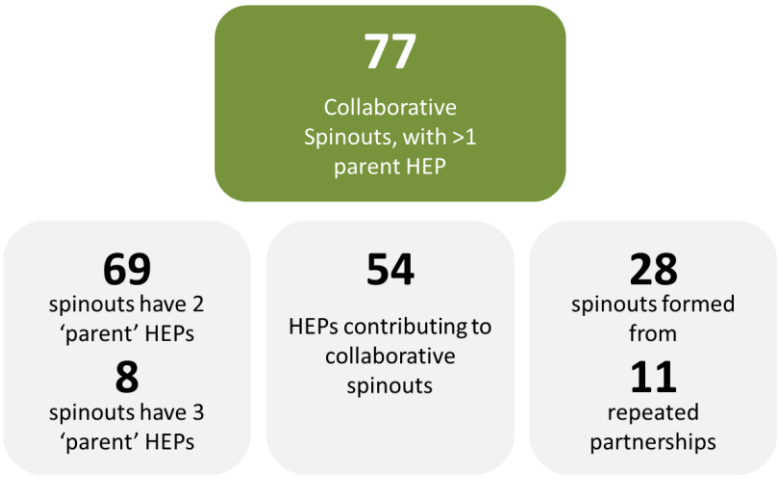
Note: Cluster J and M HEPs were excluded due to very small numbers of spinouts. Specialist Arts HEPs are also excluded due to the very small research bases of these institutions resulting in huge variations that distort the scaling of the chart.
Note: Monetary variables have been adjusted for inflation and are in constant 2024 prices
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

4.3 Collaborative spinouts

An important benefit of the Spinout Register is our ability to identify what we have termed *collaborative spinouts* (see section 2.3.3); an important group of ventures where the IP originates from multiple 'parent' HEPs. This can be the case where, for instance, academics across multiple institutions have collaborated jointly on the underpinning research and seek to commercialise it in partnership, or where the technological solution sees different packages of IP to be brought together from different HEPs. Recent funding programmes, for example the Connecting Capability Fund from Research England, have sought to promote these types of collaborations in commercialisation between HEPs and wider partners to achieve more effective commercialisation outcomes. Combining strengths across different institutions through partnerships has the potential to provide a more complete and integrated set of support.

An advantage of collecting company-level spinout data from HEPs is that we can now identify unique companies and account for any multiple entries where these collaborative spinouts are returned more than once to the HEBCI survey. These were previously masked in collecting HEP-level aggregates only. As a result of the Spinout Register, we can thus develop more robust data and metrics, avoid double counting of these companies and their effects when summing up to HEP and sector levels aggregates. The potential impact of the double count is not immaterial. Using the Spinout Register, we identified 77 collaborative spinouts, reflecting approximately 4% of the total number of spinouts. The majority (69; 90%) having two 'parent' HEPs, and the remaining 10% (8 spinouts) with three (Figure 18).

Figure 18 Scale of collaborative spinout activity



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

Developing spinouts collaboratively with other institutions is not an activity saved for the top HEP spinout producers. Over half of HEPs that have produced spinouts were involved in creating collaborative spinouts. This included all of the top 6 research universities (by research income), 82% of the £100m to £300 million group and 78% of £50 million to £100 million (Table 13).

Table 13 HEPs reporting contributions to collaborative spinouts by research scale group

Research scale group*	HEPs reporting contributions collaborative spinouts	
	#	% (of HEPs in group reporting to the Spinout Register)
£300 million and above	6	100
£100 million to £300 million	14	82
£50 million - £100 million	14	78
£20 million - £50 million	6	46
£10 million - £20 million	8	35
Less than £10 million	6	28
All	54	55

* Based on the average research income of HEPs over the period 2012/13 – 2023/24
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from HESA's Finance Record

Moreover, 28 *collaborative* spinout companies were formed from repeated partnerships between the same institutions, possibly indicating that institutions are establishing deeper collaborations with partners and/or are building on past successes. The network map in Figure 19 depicts the collaboration links between HEPs captured by the Spinout Register that we could identify. The thickness of the grey connecting lines represent the number of spinouts produced collaboratively. The size and colour of the node represents the size of the research base and region for each HEP, respectively.

Partnerships often occur between HEPs of similar sized research bases. There are 4 central institutions (which are the very large research institutions based in Greater South East) that are highly networked and have multiple repeated partnerships between them. As well as lots of examples of inter-regional collaboration, there are key examples of strong intra-regional ties, represented by several

collaborations, for example within the Greater South East, across the North of England, Scotland and South West.

Figure 19 Network of HEPs informed by numbers of collaborative spinouts developed in partnership

Note: Size of the bubble represents the scale of the research income received by HEP

Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from HESA's Finance Record. Created using flourish.studio

Of course, collaborative spinouts are also not necessarily limited to UK institutions only, with research and commercialisation partnerships also reaching overseas. The additional notes provided by HEPs in the data behind the Register suggest that a number have emerged from links with HEPs based overseas, notably with US institutions.

4.4 Nature of relationships between universities and their spinouts

Over recent years, much of the policy debate and discussion around how to strengthen the UK's spinout ecosystems has been focused on the amount of equity taken by HEPs in their spinout companies at the point of foundation. As Ulrichsen and Roupakia (2024) showed, the levels of equity taken by HEPs in their spinouts has been falling significantly over the past decade, with many spinout producing HEPs undertaking major reviews of their approaches in policies in recent years[24]. Previous UCI studies have also shown the importance of considering a broader range of deal terms beyond the equity arrangement, not least the terms associated with the licence (for example, whether it incurs fees, royalties and other milestone-related payments; how these fees might be deferred etc.). These studies showed that the approaches used – and particularly the use of fee-bearing licences – varied for HEPs with different scales of research base, with smaller research institutions typically less likely to see fee-bearing licences, or limit their use to cases where no / limited equity was taken[25].

[24] Ulrichsen, Roupakia and Kelleher (2022)
[25] See Ulrichsen and Roupakia (2024), and Ulrichsen, Roupakia and Kelleher (2022)

Recent developments in response to the Tracey-Williamson Review of Spinouts include the adoption of USIT guidelines on deal terms[26], in an attempt to drive standardisation and template approaches for spinout deals for life sciences and software spinouts. The spinout review also provided recommendations in other areas, not least around increasing the availability of proof-of-concept funding.

At a system level, there is limited data on the types of relationships and ownership arrangements that HEPs have with their spinouts. Within the HEBCI survey, a categorisation of 'HEP-owned' and 'Formal' (the latter renamed from 2024 to 'Other') spinouts has been used to distinguish spinouts which continue to have HEP ownership (of any form) and those where there was never ownership or where ownership has been released. However, anecdotally, we know that ownership was interpreted by some in the sector to be limited to equity, while others interpreted it to include spinouts where there is no equity but a license to the IP. From UCI's 2022 'Busting Myths' study[27] we know that HEPs form different types of ownership and contractual relationships with their spinouts reflecting the diversity of cases being commercialised.

For the university Spinout Register, data was collected to identify the relationship between the parent HEP and the spinout. Binary variables were used to indicate if there was any equity ownership, a licence, or 'other' type of contractual arrangement at specific points in the spinout journey: (i) at the spinout's foundation, (ii) in the current reporting year (2024), and (iii) for inactive spinouts only, the year in which any relationship ceased. Collecting this information marks a key step forward in being able to account for broader types of ownership and relationship structures beyond just equity across the population of UK spinouts. However, we note that the richness of the information is not complete yet. The data collected is only binary so can only tell us if a particular type of relationship is present, or not, and no further information is collected on the terms of such agreements. There is also still a lot of work to do in cleaning this information, and externally verify it through linking.

For this study, we focus on the relationship at the point of foundation; a point in every spinout's journey that is broadly comparable.

Overall, many spinouts have equity and licence arrangements with their HEPs. Figure 20 shows that amongst the 2,196 HEP-spinout entries in the UCI spinout dataset developed from the data behind the Spinout Register, 76% of deals at foundation involved the HEP receiving some level of equity, and 58% involved a licence agreement.

More precisely:

- 50% of had an arrangement with their HEP involving *both* equity and a licence
- 26% of spinouts had an arrangement with their HEP involving equity but no licence
- 8% of had an arrangement with their HEP involving a licence but no equity

[26] Developed by the TenU through intensive dialogue between the six largest research universities in the UK, leading venture capital firms, and legal firms, the University Spin-out Investment Terms (USIT) guides attempt to identify an acceptable landing zone for spinout deals based on current market trends and preferences that are acceptable to all parties

[27] Ulrichsen, Roupakia and Kelleher (2022)

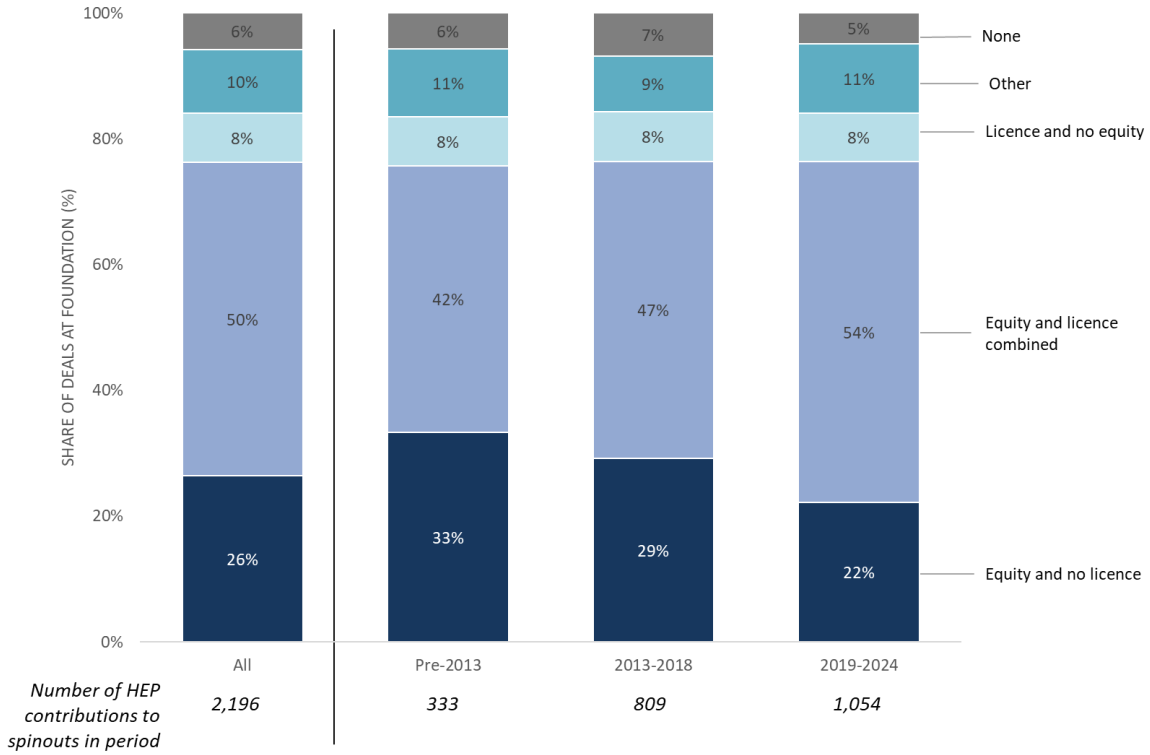
Interestingly, 10% had neither equity nor a licence, but another type of contractual arrangement. Examples of these other types of arrangements include:

- Convertible loans or commercial loan agreements
- Ongoing access to academic founder who remain employed in the HEP through e.g. consultancy, fractional buyout of time or secondment
- Access to ongoing facilities, resources and business development support.

The remaining 6% of spinouts had no formal contractual relationship with the HEP at the point of foundation. Note that the definition of a spinout deliberately did not focus on the presence of some form of ownership links between the HEP and the venture as some analysts have previously imposed; rather it focused on the efforts to commercialise ideas, knowledge and IP emerging from HEPs through establishing a new venture and allowing any form of contractual arrangement to be put in place to govern the process.

Over time, we also see that equity-only deals appear to be falling: their share of total deals has fallen from 33% for spinouts founded pre-2013 to 22% for spinouts founded from 2019 to 2024 (Figure 20). This shift away from equity-only deals, however, seems to be substituted like-for-like with an increase in combined equity and licence deals (increase in share from 42% to 54%). Meanwhile, licence-only deals remained static at 8% of deals at foundation. With considerable focus on equity in recent years, we have perhaps lost sight of these other types of arrangement, licensing being just one, where deeper knowledge and understanding fostered by new data can help us to better articulate the types of relationships and contributions that HEPs make to their spinouts.

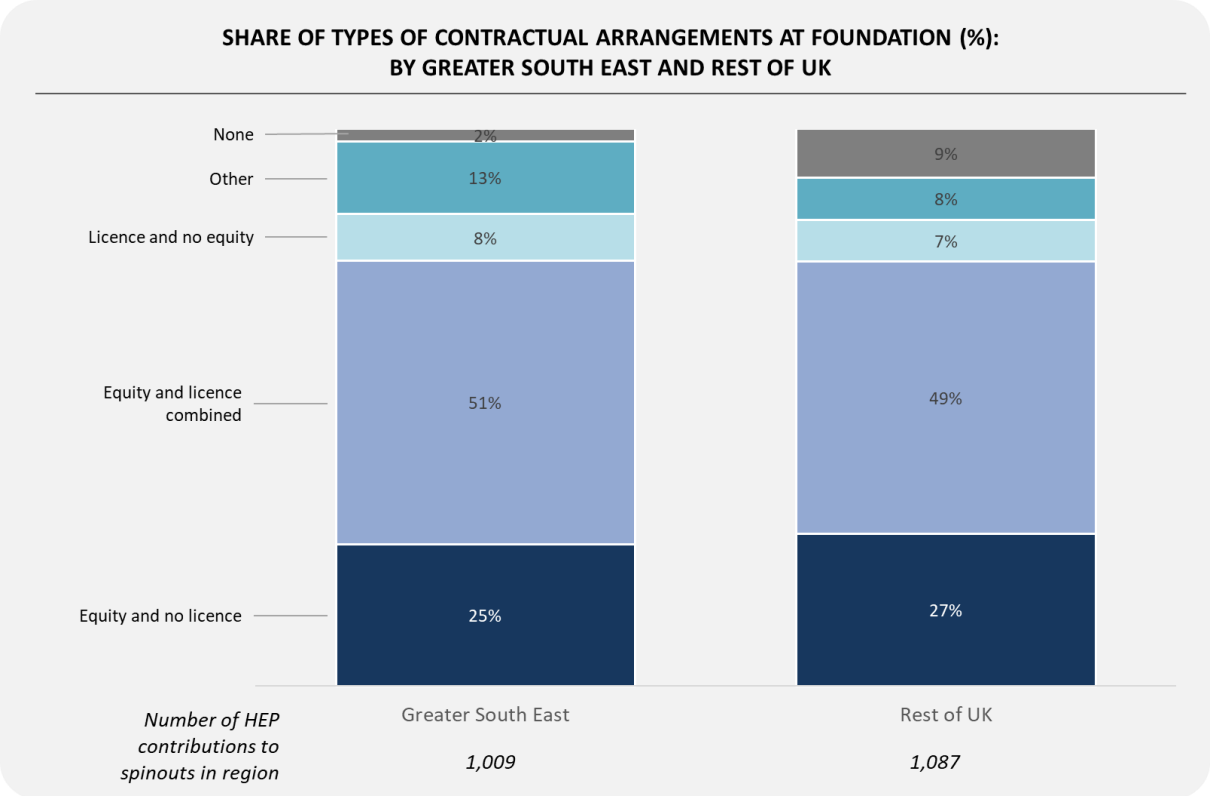
Figure 20 Distribution of types of contractual arrangements between HEPs and their spinouts at foundation in different time periods



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

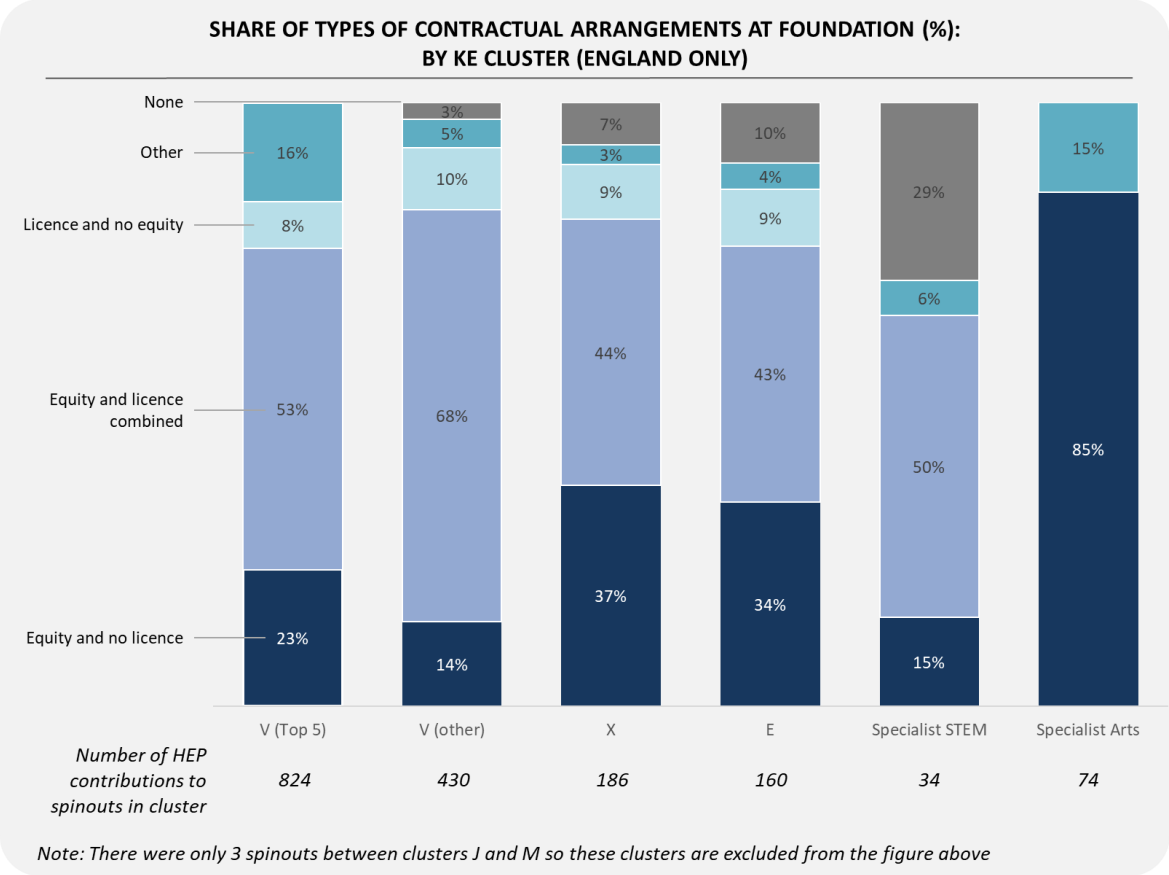
We also investigate whether there is any variation in the types of contractual arrangements used between different regions of the UK and types of HEP (Figure 21 and Figure 22). There is very little difference in the composition of deal types between HEPs within the Greater South East (comprising London, East of England and South East) and the rest of the UK (Figure 21). However, across the English KE clusters we see some obvious differences in the compositions of types of deals (Figure 22). The largest 5 research universities of cluster V had some form of contractual relationship with all of their spinouts at foundation. This is not the case for all Clusters, with the greatest share of no arrangements (29%) amongst specialist STEM institutions. Specialist Arts institutions tend to only use equity only approaches (85% of their deals) or other types of arrangement. This may suggest some key differences in the nature of knowledge and IP being commercialised and how this can be packaged up to drive commercial opportunities. Furthermore, what is also striking from the comparison of KE clusters is that Cluster V institutions have high propensity to use both equity and licencing deals, compared to Clusters E and X.

Figure 21 Distribution of types of contractual arrangements between HEPs and their spinouts at foundation, by location



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

Figure 22 Distribution of types of contractual arrangements between HEPs and their spinouts at foundation, by type of HEP



Note: There were only 3 spinouts between clusters J and M so these clusters are excluded from the figure above

Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register

5

5 The significance of university spinouts for the UK

Only a small proportion of HEP staff will typically seek to set up a spinout company to commercialise intellectual property emerging from their work within the institution[28]. By contrast, many academics will engage with external partners to exchange knowledge and apply their expertise to deliver impacts on the economy and society through many other formal and informal routes, for example through collaborative research and innovation partnerships, sponsored research, consultancy, provision of training to companies, leveraging of HEP facilities and equipment to provide testing services, and providing advice and expertise to help shape the strategic directions of organisations, technologies, sectors and local and national policies.

From the perspective of the UK economy, a 2024 study by UCI[29] showed that UK university spinouts, while a minority activity for academics, play an important and significant role in driving innovative, entrepreneurial activities in strategically important sectors of the nation's economy. Their significance for the UK in enabling science and innovation-led economic growth has seen them take an increasingly pivotal role in UK government approaches and policies to driving innovation-led growth.

In this section, we update the analysis by Ulrichsen and Roupakia (2024) utilising information on the population of spinouts from UK HEPs to examine their significance for the nation's innovation agenda.

5.1 Identifying an appropriate counterfactual

In investigating the significance of university spinouts for the UK's innovation agenda, we must first recognise that these companies are very different from the average new business set up to sell goods and services into the economy. University spinouts are typically set up to commercialise novel ideas and technologies emerging at the frontiers of knowledge. Many are focused on commercialising what has been referred to as 'tough tech' or 'deep tech'. The term 'tough tech' is used by the MIT Engine to refer to transformational technology that solves the world's most important challenges through the convergence of breakthrough science, engineering science, engineering and entrepreneurship[30]. The commercialisation journey for tough tech / deep tech is one that is characterised by significant uncertainties and risks in many areas, notably in markets and the technology itself and its ability to develop into viable applications, as well as in areas such as regulation and in scaling (including in production). It is also a journey that is typically much more capital intensive than for other start-ups[31]. Spinouts commercialising tough tech / deep tech typically require significant and sustained investment over a number of years, and may require different business models and access to enabling support and infrastructure for progress to be made.

[28] Hughes, Lawson, Kitson and Salter (2016)
[29] Ulrichsen and Roupakia (2024)
[30] The Engine Ventures (2021)
[31] Ruiz de Apodaca, Murray and Frølund (2023)

Given that university spinouts are not the typical business start-up, it does not make sense to compare them against the general company population (as is sometimes done), where the majority of companies that start-up are in wholesale and retail, construction, hospitality, accommodation services, arts and entertainment, professional services etc.[32] A more relevant comparator would be a population of knowledge-intensive start-up companies that typically require external investment to develop and grow. While identifying such a population is very difficult, we leverage the fact that commercial investment databases such as PitchBook typically track companies that are likely to raise venture capital, private equity and other private investment to drive their growth. In doing so, they focus on a population of companies that is more comparable to university spinouts.

We therefore focus on the population of UK start-ups identified in the investment datasets of PitchBook that have raised some form of venture capital-related funding (including at pre-seed/seed, early and later VC stages). For comparability, we also limit our UK spinout population to those companies that have also raised similar forms of investment.

5.2 The prevalence of university spinouts in the UK start-up population

The following charts explore the prevalence of this sample of UK university spinouts in the similar population of UK start-ups founded in the UK during the period 2013-2024 in key sectors of the economy. We also explore how this prevalence has changed between the earlier period of 2013-2018 and the more recent period 2019-2024.

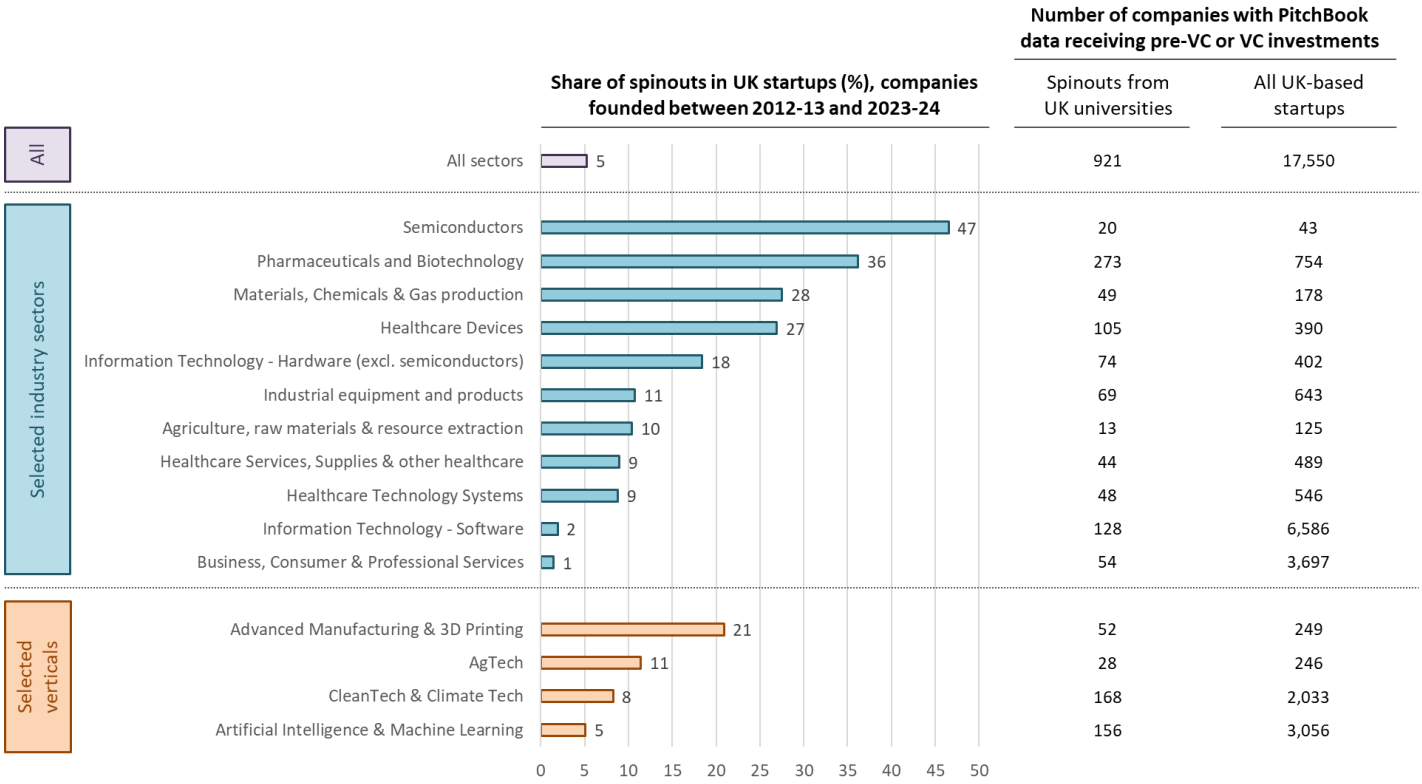
Across all sectors of the economy, UK university spinouts founded during the period 2013-24 and raising VC investments (as captured by PitchBook) formed 5% of the population of UK start-ups founded during same period 2013-24 and raising this type of investment (Figure 23). However, this masks significant variation in the prevalence of university spinouts across different industrial sectors. Using PitchBook's industrial classifications, Figure 23 shows that university spinouts play a much greater role in driving entrepreneurial activity in strategically important sectors for the UK including in pharmaceuticals and biotechnology, where 36% of start-ups founded during 2013-24 were university spinouts; healthcare devices (27% were spinouts); materials, chemical and gases (28% were spinouts); and information technology hardware (excluding semiconductors) where 18% of UK start-ups raising VC investments were spinouts. Important to note that, given the strategic importance of semiconductors, despite 47% of UK start-ups founded in this sector during 2013-24 being university spinouts, the UK produces relatively few companies in this space.

Notably, however, university spinouts were just 2% of UK software start-ups. As Ulrichsen and Roupakia (2024)[33] discuss, this is likely due to the very large number of software companies started in the UK, coupled with the breadth of types of software being created and commercialised through these companies. Included within this category will be everything from digital tools, games, and apps, through to advanced artificial intelligence and machine learning algorithms requiring significant continued investment in the technology development, as well as in the application and market penetration stages.

[32] Office for National Statistics (2023)
[33] Ulrichsen and Roupakia (2024)

PitchBook also identifies market verticals – groups of companies that may cut across multiple industries that serve the same market. These help to further identify strategically important areas for the UK that are hard to capture through an industry sector specific analysis, including advanced manufacturing and 3D-printing; agricultural technologies (AgTech), climate tech and clean tech; and the development of artificial intelligence and machine learning (as opposed to the use of more general software products and services). The prevalence of university spinouts in the UK start-up population for these selected verticals is also shown in Figure 23. In the advanced manufacturing vertical 21% of UK start-ups during 2013-24 were university spinouts; while for AgTech they formed 11% of start-ups founded, 8% in CleanTech and ClimateTech, and 5% in AI/ML.

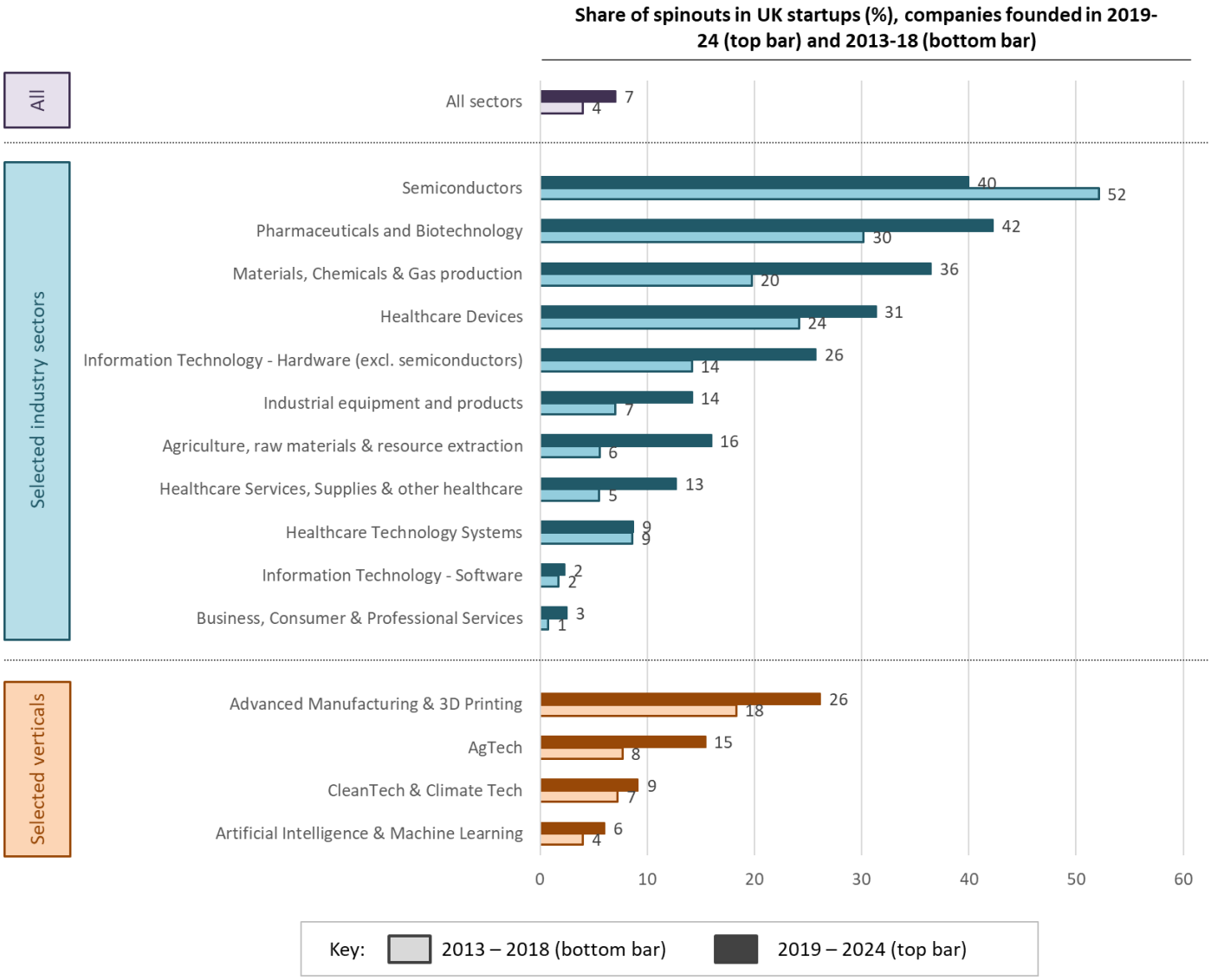
Figure 23 Share of UK university spinouts in the UK start-up population, companies founded between 2013-2024 raising pre-VC/VC funding



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

In many of these sectors, the prevalence of university spinouts in the population of UK start-ups raising VC investments has increased over time, suggesting a growing importance of spinouts in driving entrepreneurial activity in the UK (Figure 24). For example, during the period 2019-2024, university spinouts accounted for 42% of pharmaceutical and biotechnology start-ups founded during this period in the UK. This compares with 30% during the previous period 2013-2018. This pattern is repeated in other sectors and market verticals including healthcare devices, materials and chemicals, IT hardware (excluding semiconductors), advanced manufacturing, and AgTech. For the AI/ML market vertical, the proportion of UK start-ups that are university spinouts increased from 4% in 2013-2018 to 6% in 2019-2024.

Figure 24 Share of UK university spinouts in the UK start-up population, comparing companies founded during 2019-2024 (top bar) and 2013-2018 (bottom bar)



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

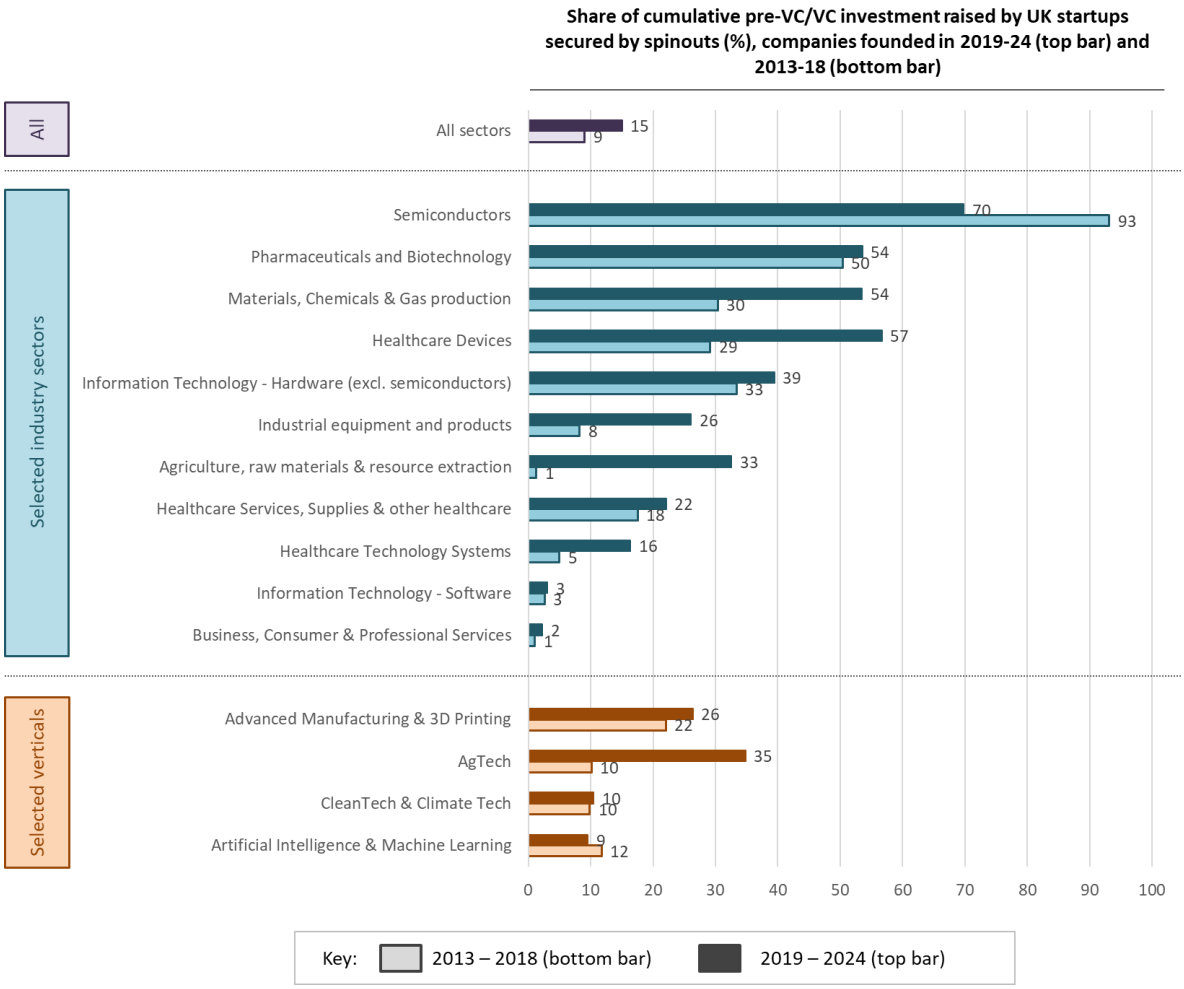
5.3 The importance of spinouts in driving UK entrepreneurial success

With our evidence suggesting that university spinouts are an important driver of entrepreneurial *activity* in key sectors and markets of the UK economy. To what extent are these university spinouts important for driving not just entrepreneurial *activity* but also entrepreneurial *success* and attract VC investments to drive their development and growth in these sectors compared with non-university start-ups?

Figure 25 shows that the significance of university spinouts in developing valuable, investable technologies, products and services is understated if we just look at their prevalence in the start-up population. The figure presents the proportion of venture capital funding (including pre-seed / seed stage, early and later stage investments) secured by university spinouts compared with the

comparable UK start-up population across all sectors, as well as for specific selected sectors and market verticals. Across all sectors, while 7% of UK start-ups founded during 2019-2024 were university spinouts, the latter secured 15% of venture capital investments during this period. This compares with 9% of investments during the previous period 2013-2018.

Figure 25 Share of cumulative pre-VC / VC investment raised by UK start-ups secured by spinouts (%), comparing companies founded in the periods 2019-2024 and 2013-2018

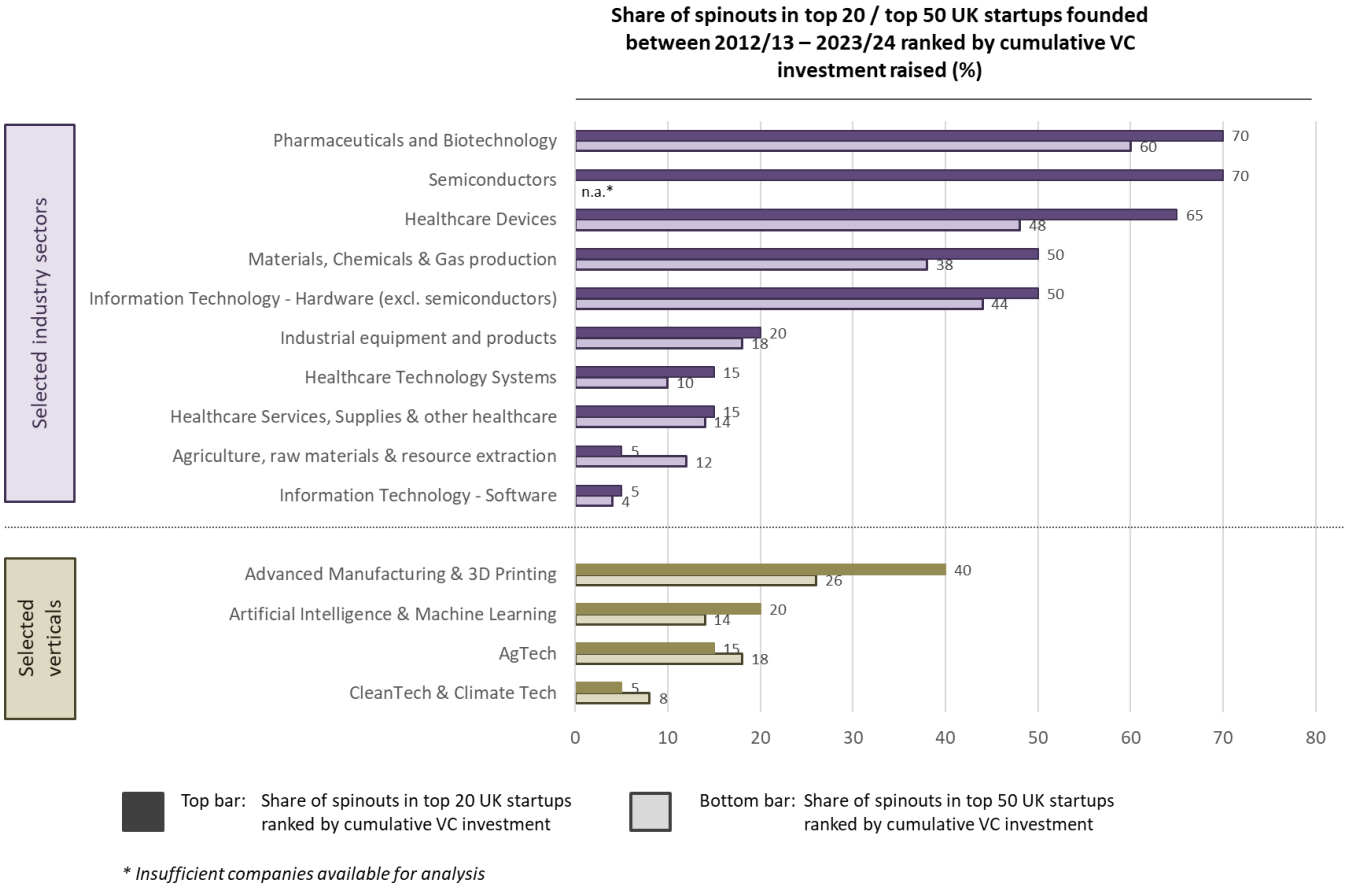


Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

Once again, we see very different levels of importance in the dominance of spinouts in raising VC investments at the sector and market vertical level. For pharmaceuticals and biotechnology sector, the 42% of UK companies in the pharmaceuticals and biotechnology sector during 2019-2024 that were university spinouts, secured 54% of VC investment raised by these companies during this period. Similarly, university spinouts in the healthcare device sector secured 57% of the VC investment during this period, up from 29% in the 2013-2018; spinouts in materials, chemicals and gases sectors attracted 54% of VC investment in the recent period compared with 30% in the previous period; and spinouts operating in AgTech secured 35% of VC investment in 2019 – 2024 compared with just 10% for companies founded during 2013-2018. Semiconductor spinouts also secured a majority of VC investment in during 2019-2024 (noting the relatively small number of start-ups and spinouts founded in this sector which makes the data quite volatile).

AI/ML spinouts secured 9% of VC investment during 2019-2024, down from 12% during 2013-2018, despite seeing an increase in their prevalence in the start-up population.

Figure 26 Share (%) of UK university spinouts in the top 20 (top bar) and top 50 (bottom bar) of UK start-ups founded between 2013-2024 ranked by the cumulative VC investment raised during this period



Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

Turning now to the subset of best performing companies founded during 2013-2024 in terms of VC investment raised, Figure 26 shows that the top performing start-ups in many key sectors are indeed university spinouts. This includes in pharmaceuticals and biotechnology where university spinouts accounted for 60% of the top 50 start-ups ranked by the amount of VC investment raised and 70% of the top 20. For healthcare devices, 65% of the top 20 start-ups by VC investment raised were spinouts (48% of the top 50). In semiconductors, spinouts accounted for 70% of the top 20 start-ups by VC investment and in IT hardware (excluding semiconductors), 50% of the top 20 start-ups (and 44% of the top 50) were university spinouts. In the key market vertical of advanced manufacturing, spinouts accounted for 4 in 10 of the top 20 start-ups ranked by the cumulative amount of VC investment raised. These data show that university spinouts are among the most successful start-up companies in the UK in terms of raising VC investments to drive their development and growth, underlying their importance in driving entrepreneurial activity that results in valuable and investable technologies and product being developed.

Interestingly, while just 5% of AI/ML start-ups founded during 2013-2024 were university spinouts (Figure 23), 20% of the top 20 start-ups (14% of the top 50) ranked by the cumulative amount of VC investment raised were UK university spinouts. This compares to 5% of the top 20 for software companies, underlining the importance of finding ways to further segment the software sector into appropriate subsegments where we might expect the frontier knowledge being developed by universities to have particular impacts.

The analyses presented in this section compare university spinouts to the UK start-up population and reveal their significance for strategically important sectors for the UK economy in driving entrepreneurial activity that results in technologies, products and services valued by investors. What we have not (yet) done is compare how the UK compares with the experiences in other countries to start and grow IP-rich, technology-intensive companies. This will be the subject of future studies.

6

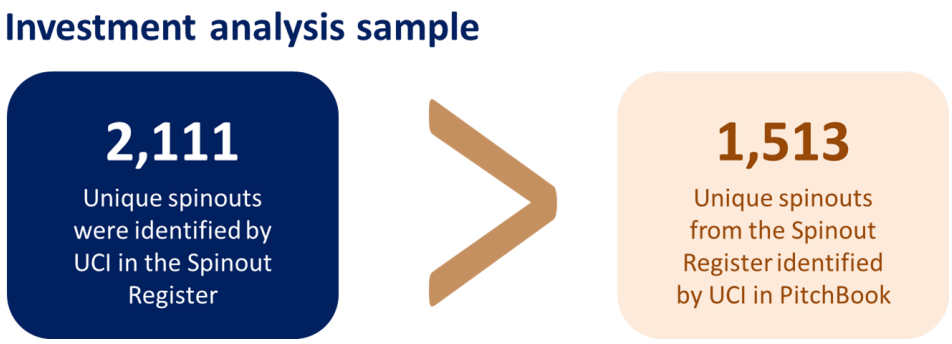
6 Investment trends and spinout outcomes

Having explored key trends and patterns in spinout production and their importance for delivering an entrepreneurially dynamic and innovation-driven economy in the UK, we now turn to examining what happens to university spinouts once they enter the commercial sphere. In this section we focus on two key areas: investment patterns and trends, and spinout survival.

6.1 Investment trends

At the outset of this section, it is important to recognise that not all companies – even IP-rich, technology-driven companies – will develop and grow through equity-backed, VC investments. Indeed, studies of the development of the Cambridge cluster have shown how many important technology-driven companies of the cluster began their lives pursuing a 'soft-start' business model providing R&D / problem-solving contracts and services for customers rather than focusing from the outset on raising capital to develop standard products[34]. Some of these companies were able to leverage the funds raised through these contracts to fund the exploratory phase of their core technology product ambitions, which resulted in them transitioning to become scalable, product-driven businesses that then exploited venture capital investments, later on in their development, to turbocharge their growth.

Nevertheless, the ability of university spinouts to secure equity-backed investments are important for the development of many companies, particularly for those commercialising deep-tech. In this section, we examine the patterns and trends in different types of investment secured by university spinouts to support their emergence and growth. The data for this analysis draws from PitchBook. Our sample that underpins the analyses that follow is therefore limited to the 1,513 university spinouts from the Spinout Register that we were able to identify in PitchBook.



[34] Connell, D., & Probert, J. (2010). Exploding the Myths of UK Innovation Policy. *Centre for Business Research, University of Cambridge*.

To explore different types of investment, we leverage PitchBook's assignment of deals to specific deal types. In particular, we focus on their 'venture capital universe' of deals, which distinguishes:

- Pre-seed (including accelerator, crowdfunding and angel investments)
- Seed stage investments aimed at providing initial financing for a company in the earliest stages of its investment
- Early stage venture capital, defined by PitchBook as series A to series B round deals occurring within 5 years of the company's foundation date
- Later stage venture capital, including series C to series D rounds, rounds that occur more than 5 years after the company's foundation date, as well as 'venture growth' deals (series E+ rounds or rounds funded more than seven years post-foundation with at least six or more VC deals).

PitchBook also provides information on other types of deals, including, not least, grants, IPOs, mergers and acquisitions (M&A), private equity, and corporate investments.

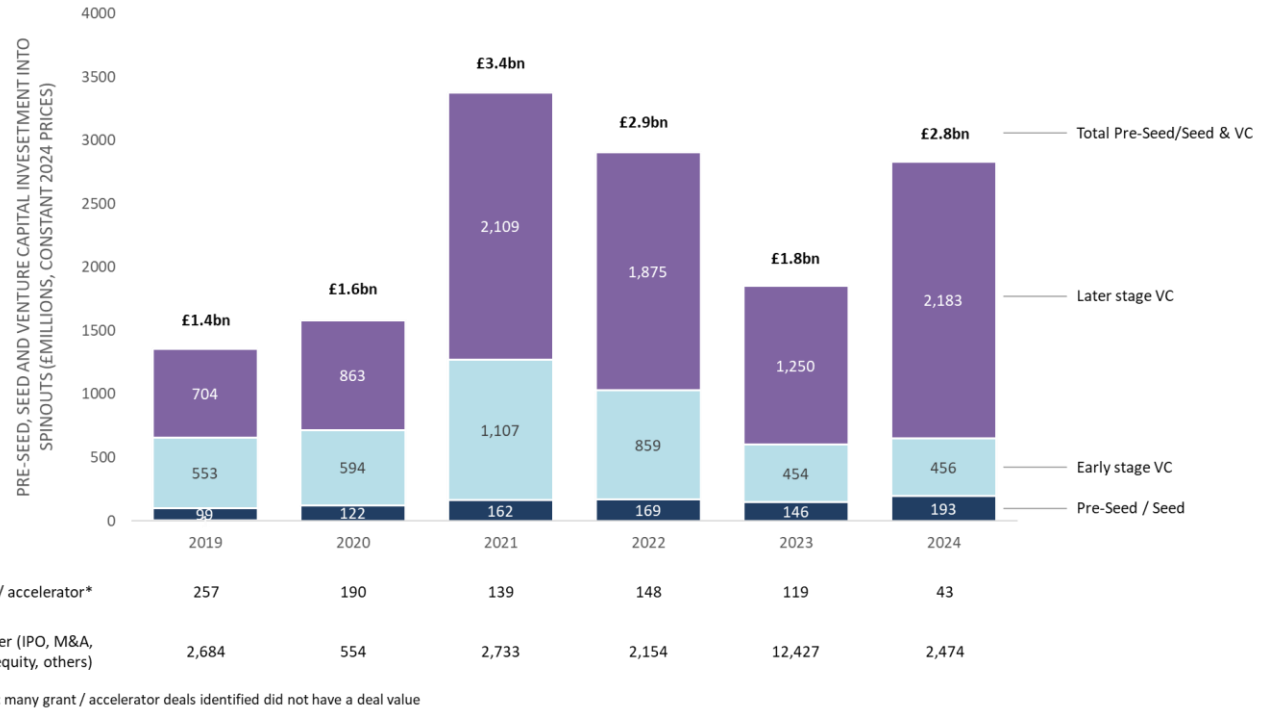
6.1.1 System-wide investment trends

Venture capital investments (including pre-seed stage investments) into UK university spinouts reached £2.8 billion in 2024. Of this, £193 million was secured by spinouts at the pre-seed (including angel investments) and seed stages; £456 million at the early VC investment stages; and £2.2 billion at the later VC stages (Figure 27). In addition, £2.5 billion of investment was secured through exits (IPOs, merges and acquisitions, and other types of transactions).

Looking at trends in the value of investments (in constant 2024 prices) into UK university spinouts over the past six years we find that VC investments have doubled from £1.4 billion in 2019. It increased significantly during the Covid-19 pandemic years of 2021 and 2022, peaking at £3.4 billion in 2021 before falling to back to £1.8 billion in 2023, in what appeared at the time to be a linear increase compared with pre-pandemic years once the 'Covid bounce' was excluded. The significant increase in 2024 to levels similar to the pandemic-era *peak* raises the important question of whether we have moved to a new 'normal' level of sustained VC investment into university spinouts at around £2.8 billion, or whether 2024 is an outlier and investments fall back to those expected if a steady, linear increase were to continue.

Looking more deeply at the different investment at different VC stages reveals a more nuanced picture (Figure 27). Investment growth in the early years of the pandemic was driven by large increases at all stages (pre-seed/seed, early stage VC and later stage VC). However, while both pre-seed/seed and later stage VC investments continue to be significantly higher than pre-pandemic levels (pre-seed/seed investments growing from around £100 million in 2019 to £193 million in 2024, and later stage VC investments increasing from around £700 million in 2019 to £2.2 billion in 2024), the amount of early stage VC investments, following the pandemic-era jump in 2021 has now fallen below the levels seen in 2019 and 2020, and has remained flat during 2023 and 2024 at just over £450 million. This decline in early stage VC investment is seen not just in the total quantum of investment, but also in the average deal sizes, including for those raising the most investment (Figure 32).

Figure 27 Investment into university spinouts, 2019-2024 (constant 2024 prices)

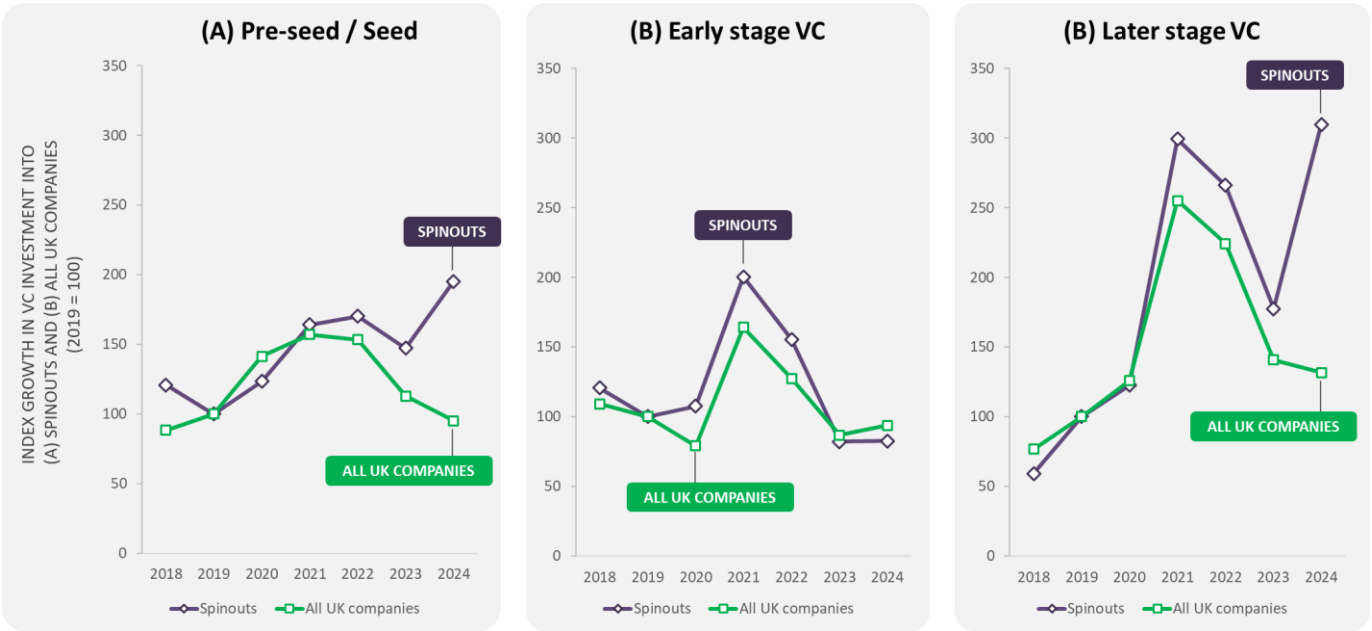


	2019	2020	2021	2022	2023	2024
Grants / accelerator*	257	190	139	148	119	43
Other (IPO, M&A, private equity, others)	2,684	554	2,733	2,154	12,427	2,474

* Note: many grant / accelerator deals identified did not have a deal value

Sample: all spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

Figure 28 Index growth (2019 = 100) of venture capital investment into UK spinouts (purple line) and any UK headquartered company (green line) over the period 2018-2024



Investment was converted to constant 2024 prices using the GDP deflator to adjust for inflation, before calculating the index growth
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

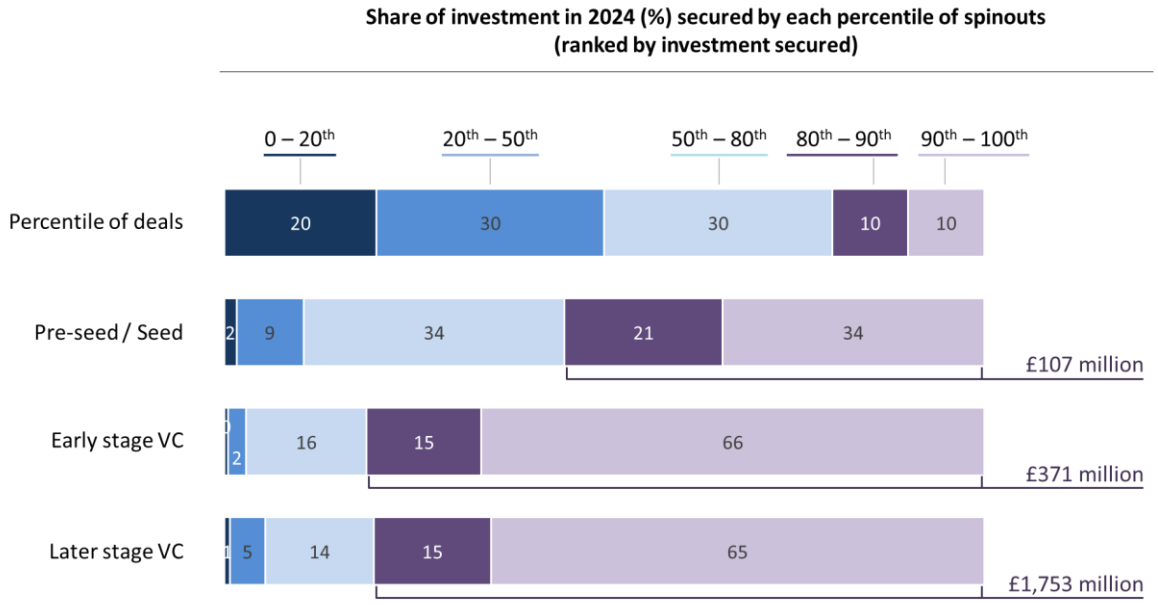
How do these trends in investment into UK university spinout companies compare with wider trends in the VC investment landscape nationally? Data obtained from the investment data platform PitchBook suggests that UK headquartered companies raised approximately £17 billion in pre-seed/seed, early and later stage VC investments in 2024. Comparing the amount of investment raised by spinouts in these investment categories for the same year suggests that UK university spinouts accounted for 17% of all VC investment raised in 2024. Across the whole period 2019 – 2024 UK headquartered companies raised £125 billion in VC investment, with the £13.9 billion raised by UK spinouts accounting for 11% of this total.

Comparing the trends in pre-seed/seed, early and later stage VC investments into the spinout population with trends in these investment categories into any UK headquartered company (Figure 28, based on index growth with 2019 = 100) shows that the worrying trend in early stage VC investments for university spinouts mirrors very closely the wider national picture. More positively, UK university spinouts appear to be performing relatively better than the wider UK headquartered companies in securing investment at both the pre-seed / seed stage and later VC stage, particularly in 2024, with investment into UK spinouts increasing significantly at both of these investment stages, while VC investments into UK companies more widely continued to fall.

6.1.2 Exploring the concentrated nature of spinout investments

Another distinguishing feature of university spinout portfolios is the highly skewed nature of investments, with much of the investment secured by a relatively small number of companies. Figure 29 presents the share of total VC investment in 2024 at pre-seed/seed stage, early stage VC and later stage VC secured by different percentiles of spinouts (ranked by the amount of each stage investment they secure).

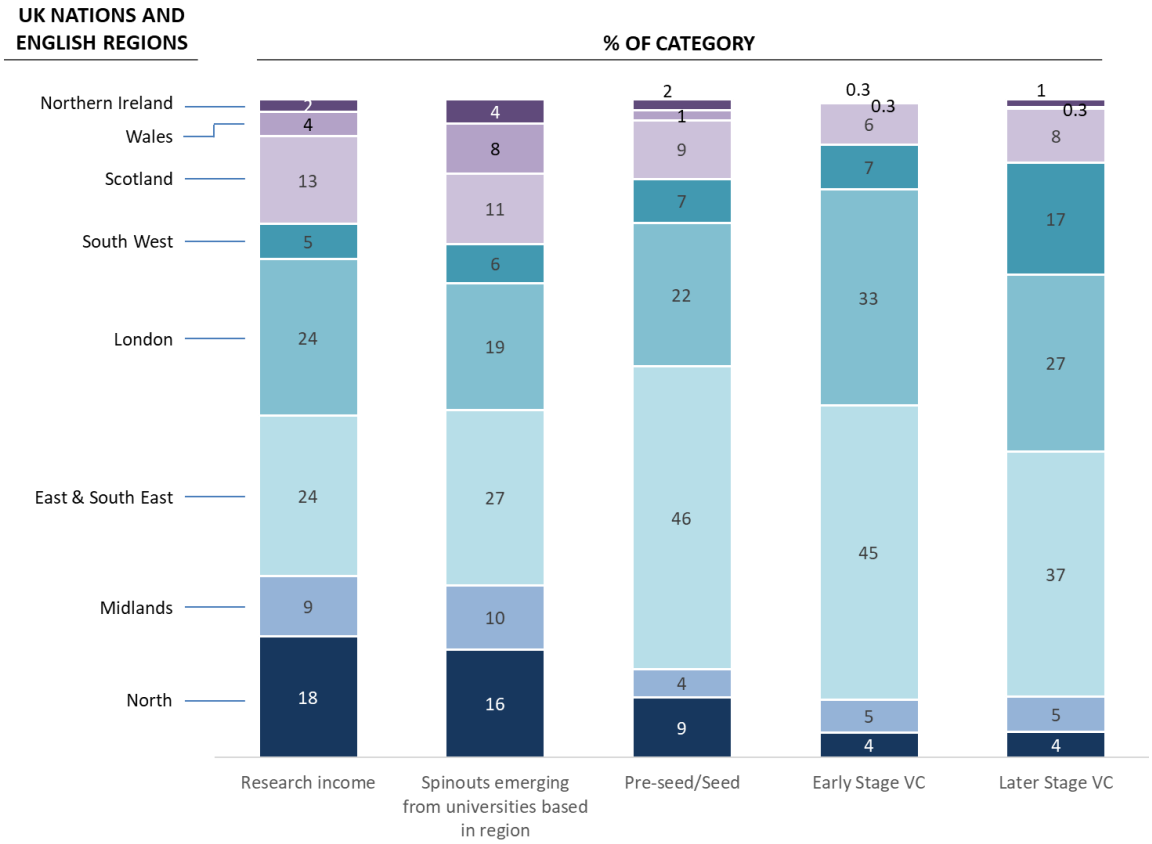
Figure 29 Share of investment at each stage secured by spinouts in different parts of the distribution when ranked by their total VC investment raised at each stage



Sample: all spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

Our analysis shows that the 10% of spinouts in the top decile of investments attracted 34% of pre-seed/seed stage investment, with the next 10% of spinouts (in the 80th-90th percentile) attracting 21%. Together, this top 20% of spinouts captured £107 million of the total £193 million invested in the UK spinout ecosystem at this stage in 2024. By comparison, the 50% of spinouts below the median (i.e. attracting less than the median company) captured just 11% of all pre-seed/seed investments (£20 million). At subsequent investment stages (early/later stage VC), the distributions become even more skewed, with the top decile of companies attracting 66% of early stage VC, and 65% of later stage VC investments. This skewed nature of investment appears to hold true for spinouts in different sectors.

Figure 30 Comparison of the distributions of research income, spinouts, and different stages of investment across the nations and regions of the UK

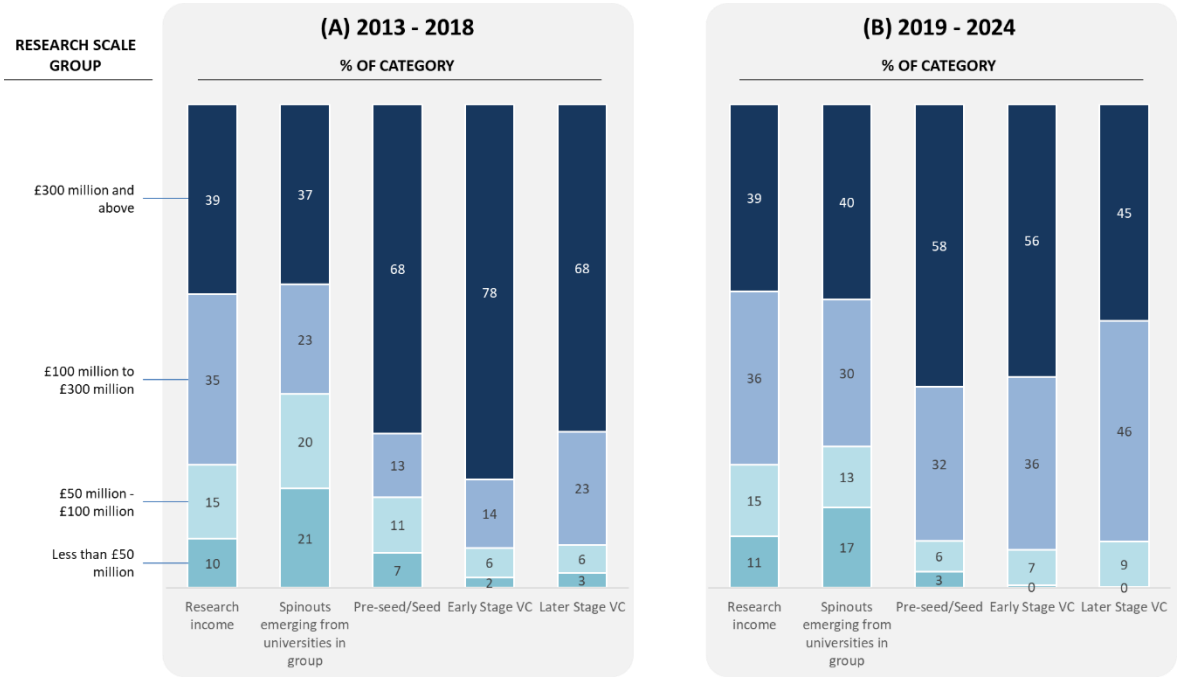


Sample: all spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register, data from HESA's Finance Record, and data from PitchBook Data, Inc.

In section 4.2.2, we showed that the production of spinouts across the nations and regions of the UK were broadly aligned with the distribution of research income. Figure 30 shows that at the investment level, the distribution becomes more skewed towards HEPs based in London, the East of England and the South East (the 'Greater South East'), particularly at the pre-seed/seed and early VC stages. While 46% of spinouts emerged from HEPs based in the Greater South East, these spinouts attracted 68% of pre-seed/seed stage investments, and 78% of early VC stage investments. Note that the increase in the share of later stage VC investment secured by the South West is due to a small number of very successful companies emerging from one HEP based in this region. The figure also highlights the struggles facing spinouts emerging from Welsh and Northern Irish HEPs in attracting pre-seed/seed, early and later stage VC investments.

Figure 31 looks at how these distributions of research income, spinout production and investment change for HEPs grouped according to their research scale. It also looks at how this has evolved between the earlier period of 2013-2018 and the more recent period 2019-2024. It shows that spinouts from the largest (six) research universities historically captured a large majority of investment at pre-seed/seed, early VC and later VC stages. By contrast, HEPs with research incomes between £100 million - £300 million historically produced relatively fewer spinouts than their research incomes would suggest, but have seen significant growth in spinout production in more recent years to bring in more in-line with expectations. This growth in spinout activity appears to be flowing through into investment success, with spinouts from HEPs in this group now securing 31% of investment at the pre-seed/seed stage investment and 36% at the early VC stage, up from 14% and 16% respectively during 2013-2018.

Figure 31 Comparison of the distributions of research income, spinouts, and different stages of investment across the different types of HEPs based on their research scale group during the periods 2013-2018 and 2019-2024



Sample: all spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register, data from HESA's Finance Record, and data from PitchBook Data, Inc.

6.1.3 Trends in the average size of investment deals secured by UK university spinouts

Over the period 2019-2024, the mean average size of pre-seed/seed deals secured by UK university spinouts was £1.7 million (median of £0.9 million). This rises to £9.7 million (median of £2.1 million) for early stage VC and £15.9 million (median of £4.4 million) for later stage VC (Table 14). The significant difference between the mean average and median (the value of the spinout in the middle of the distribution) highlights the significant variation and skewness in the size of investment deals raised by spinouts, with some spinouts raising significantly more than others pulling the mean away from the median. For example, at the pre-seed/seed stage, the mean average deal size for the 20% of spinouts receiving the least investment was £130,000. By contrast, the mean average deal size for the

top 10% of spinouts receiving the most of this type of investment was £7.0 million, and for spinouts in the 80th-90th percentile it was £3.3 million. At the early VC stage, the deals ranged from a mean average of £240,000 for spinouts securing the lowest 20% of deals by size to £62.4 million for the top 10%, while at the later VC stage it ranged from £580,000 to £98.1 million.

Table 14 Average deal size secured by UK university spinouts for different types of deals over the period 2019-2024 (constant 2024 prices)

Investment stage	Mean	Median	Mean average deal size (£ millions) for each percentile group					Ratio of the average deal size for the top 10% of companies to the median company
			0 - 20th	20th - 50th	50th - 80th	80th-90th	90th - 100th	
Pre-seed/Seed	1.7	0.9	0.13	0.55	1.8	3.3	7.0	8
Early Stage VC	9.7	2.1	0.24	1.1	5.3	18.5	62.4	30
Later Stage VC	15.9	4.4	0.58	2.4	8.4	29.1	98.1	22

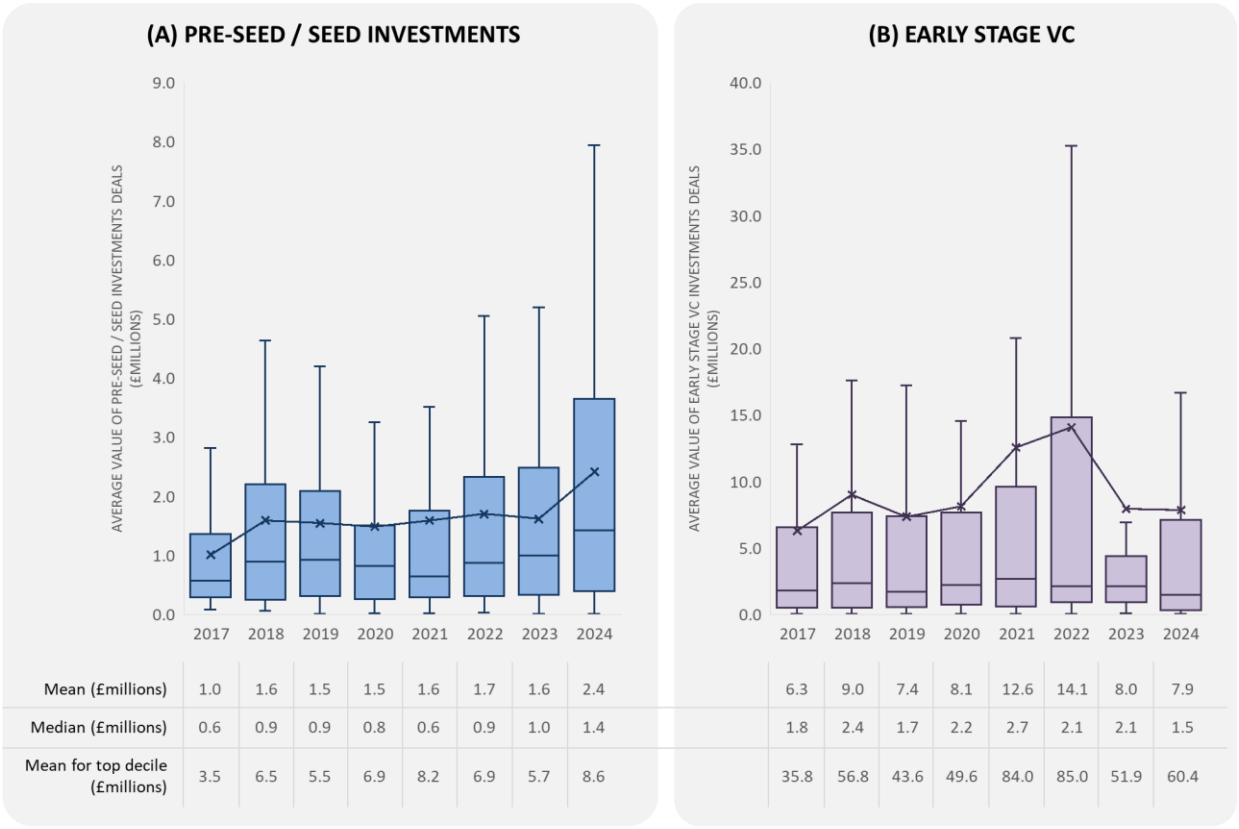
Sample: all spinouts in register with PitchBook data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

Using boxplots to allow visualisations of both the average positions and the distributions around the average, Figure 32 reveals how the size of investment deals secured by UK university spinouts has changed over the period 2017-2024. At the pre-seed/seed stage, the evidence suggests the median average deal size increased in 2024 to £1.4 million from oscillating around the £800,000 - £900,000 mark since 2018. The mean average of the top decile of spinouts by deal size at the pre-seed/seed stage increased significantly over this period, from £6.5 million in 2018 to £8.6 million in 2024.

By contrast, at the early VC stage, following significant increases in the mean average deal size from 2019 to 2022, the most recent two years has seen the mean deal size for spinouts fall from a peak median of £14.1 million in 2022 to a mean of £8 million in 2023 and £7.9 million in 2024, which is at a level similar to pre-pandemic levels (Figure 32). Looking at the boxplots the declines appear to be driven by fewer very large deals in 2023 and 2024.

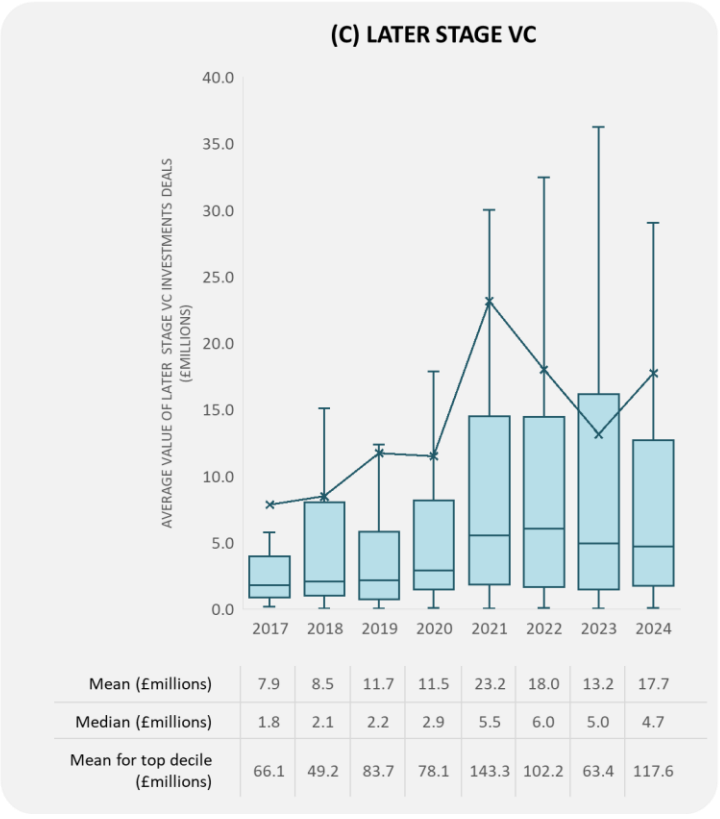
Later stage VC investments appear to be holding up, with the median deal size since 2021 relatively stable at around £5 million - £6 million. This is significantly higher than pre-pandemic, when the median deal size was around £2 million - £3 million. Moving forward, it will be important to further understand the drivers of these investment trends, particularly around early VC investments, and whether the downward pressures on early stage VC are likely to continue, and how this may feed through to future opportunities for later stage investments to drive the scaling of spinouts.

Figure 32 Distribution of the average deal size secured by spinouts at different investment stages over the period 2017-2024 (constant 2024 prices)



	2017	2018	2019	2020	2021	2022	2023	2024
Mean (£millions)	1.0	1.6	1.5	1.5	1.6	1.7	1.6	2.4
Median (£millions)	0.6	0.9	0.9	0.8	0.6	0.9	1.0	1.4
Mean for top decile (£millions)	3.5	6.5	5.5	6.9	8.2	6.9	5.7	8.6

	2017	2018	2019	2020	2021	2022	2023	2024
Mean (£millions)	6.3	9.0	7.4	8.1	12.6	14.1	8.0	7.9
Median (£millions)	1.8	2.4	1.7	2.2	2.7	2.1	2.1	1.5
Mean for top decile (£millions)	35.8	56.8	43.6	49.6	84.0	85.0	51.9	60.4

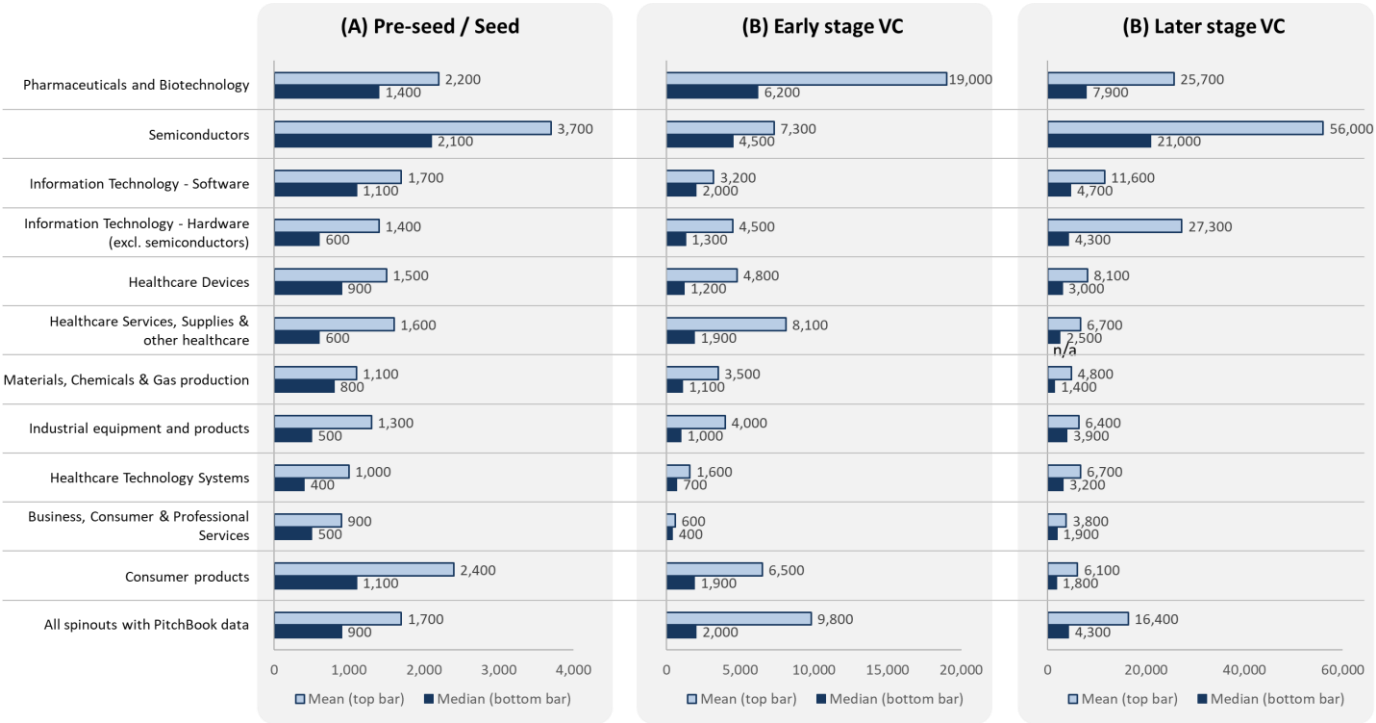


	2017	2018	2019	2020	2021	2022	2023	2024
Mean (£millions)	7.9	8.5	11.7	11.5	23.2	18.0	13.2	17.7
Median (£millions)	1.8	2.1	2.2	2.9	5.5	6.0	5.0	4.7
Mean for top decile (£millions)	66.1	49.2	83.7	78.1	143.3	102.2	63.4	117.6

Sample: All spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

It is also well known that the spinouts in different sectors typically require different levels of investment to develop and grow, reflecting not least differences in the capital requirements to support and enable different technology development and innovation journeys, as well in the scale of the technology and other risks that need to be reduced to gain commercial traction. Figure 33 presents the average size of deals secured by UK university spinouts operating in different industrial sectors, covering deals over the period 2019-2024. It shows that the median deal size for spinouts at the pre-seed/seed stage was higher for spinouts entering the semiconductor sector (£2.1 million) and the pharmaceuticals and biotechnology sector (£1.4 million) compared with ventures entering sectors such as IT software (£1.1 million), healthcare services and supplies (£0.6 million), and business, consumer and professional services (£0.5 million). This investment intensity for both semiconductors and pharmaceuticals and biotechnology is also seen at the early and later stage VC stages, where the median deal size for semiconductor-focused spinouts at the early stage VC investment rises to £4.5 million (mean average of £7.3 million), and for those in pharmaceuticals and biotechnology rises to £6.2 million (mean average of 19 million).

Figure 33 Average deal size (£000s) for spinouts operating in different industrial sectors, for deals covering the period 2019-2024 (constant 2024 prices)



Sample: All spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

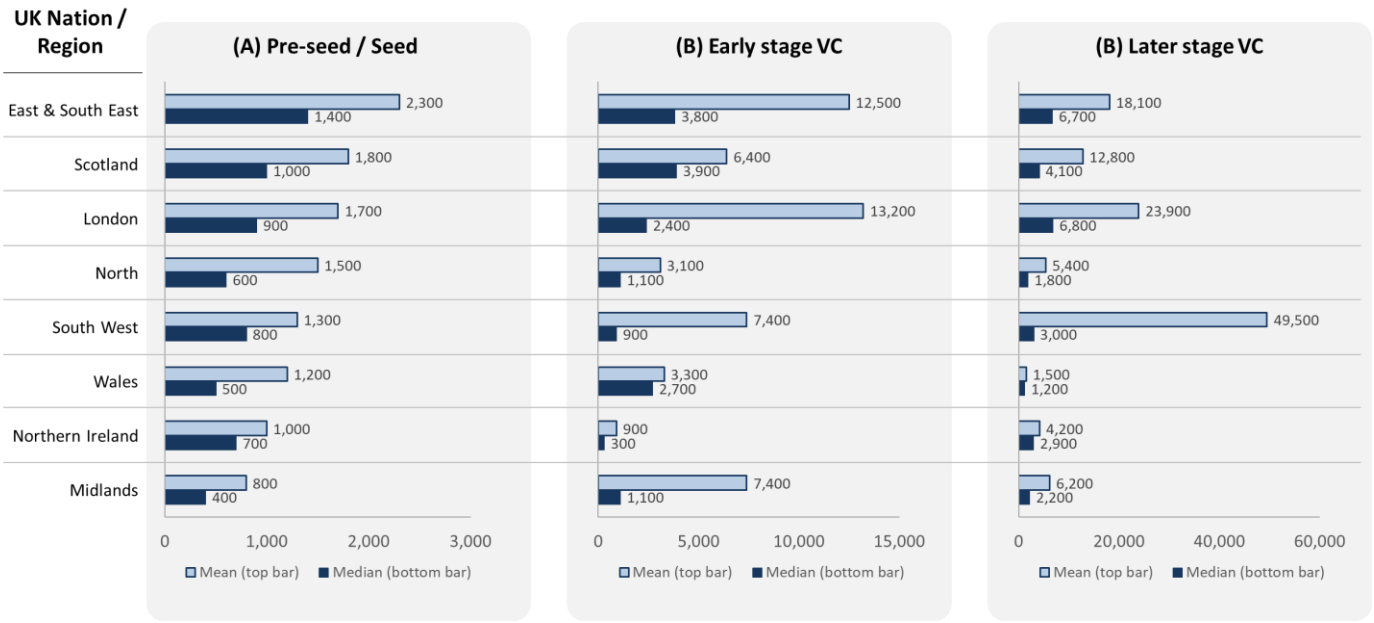
6.1.4 Average size of investment deals secured by spinouts across UK nations and regions

Figure 34 explores differences in the amount of investment raised annually by spinouts emerging from HEPs based in the different nations and regions of the UK. It shows that, at the pre-seed/seed stage, spinouts emerging from HEPs based in the East and South East of the UK raised considerably more on average than those based elsewhere in the UK (mean pre-seed / seed investment of £2.3 million, median of £1.4 million). Spinouts emerging from HEPs in London and Scotland also raised on average

more than elsewhere. The average pre-seed/seed investment into spinouts emerging from HEPs in the South West and North of England was a bit lower than from those linked to HEPs in London and Scotland (mean of £1.3 million, median of £0.8 million). Spinouts emerging from HEPs in the Midlands secured, on average, the least investment at the pre-seed/seed stage (mean deal size of £0.8 million, median of £0.4 million).

At the early and later VC stage, the spinouts from HEPs based in the East and South East of England, and those based in London, secured significantly higher levels of investment on average than those based elsewhere (both in terms of the mean investment and median). Interestingly, while the mean average investment at the early VC stage into spinouts linked with HEPs based in the South West and in the Midlands started to bridge the gap with those based in the East, South East and London, the median investment remained much lower. This tentatively suggests that the better performing spinouts emerging from South West and Midlands-based HEPs are able to attract high levels of follow-on investment, although many struggle.

Figure 34 Average size of investment deals (£000s) for spinouts emerging from HEPs based in different UK nations and regions, for deals covering the period 2019-2024 (constant 2024 prices)



Sample: All spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

Table 15 now turns to how the mean average size of investment deals secured by UK university spinouts at each investment stage has changed over time, looking at the two periods 2013-2018 and 2019-2024. Overall, the picture looks positive, with many parts of the UK seeing rising mean average deal sizes into spinouts emerging from HEPs based in their areas.

For HEPs based in East and South East, London and Scotland the mean average size of investment deals into their spinouts has grown significantly at all stages of the investment journey. For those based in the North of England, the mean deal size has grown particularly at the pre-seed/seed and early VC stage. The mean deal size for spinouts emerging from HEPs based in Northern Ireland has

grown at the pre-seed/seed stage over the period, although it remains significantly lower than for HEPs based in the Greater South East and Scotland.

Table 15 Comparing the mean average size of investment deals (£000s) in the periods 2013-2018 and 2019-2024 for spinouts emerging from HEPs in each region (constant 2024 prices)

UK Nations and English Regions	Pre-seed/Seed deals during period:		Early Stage VC deals during period:		Later Stage VC deals during period:	
	2013-18	2019-24	2013-18	2019-24	2013-18	2019-24
North	600	1,500	1,400	3,100	7,700	5,400
Midlands	700	800	2,200	7,400	4,600	6,200
East & South East	1,800	2,300	6,900	12,500	7,800	18,100
London	1,000	1,700	10,200	13,200	16,900	23,900
South West	500	1,300	8,700	7,400	47,800	49,500
Scotland	1,100	1,800	4,300	6,400	1,800	12,800
Wales	1,100	1,200	900	3,300	1,300	1,500
Northern Ireland	500	1,000	900	900	1,900	4,200

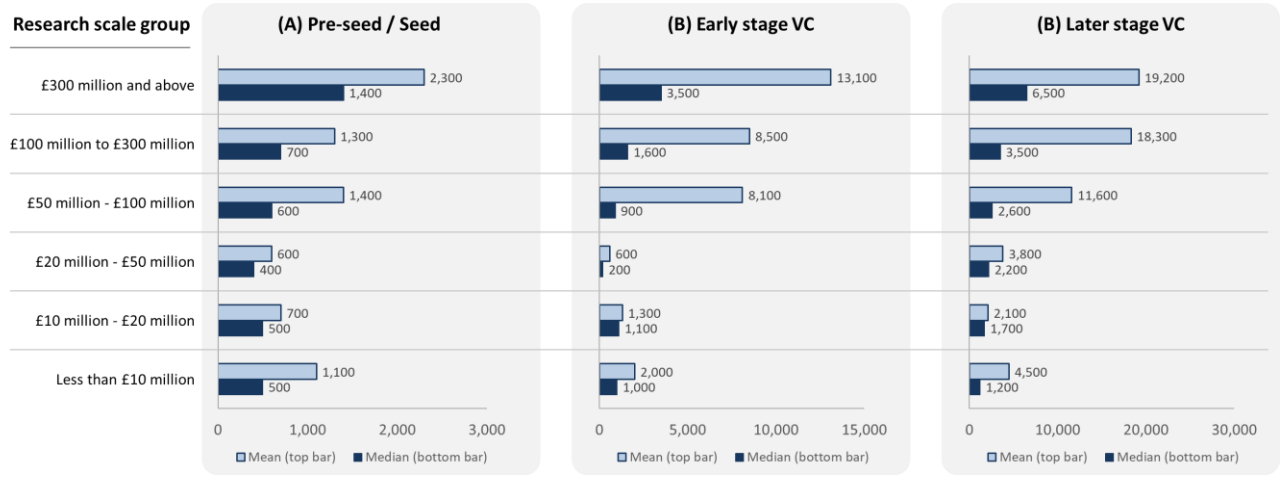
Sample: Spinouts in register founded in each period and with PitchBook investment data
Investment data has been adjusted for inflation using the HM Treasury GDP deflator
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

6.1.5 Average size of investment deals secured by spinouts emerging from different types of HEPs

In this section, we look at how the average size of investment deals varies for spinouts emerging from different types of HEPs. Figure 35 shows that the average deal size for spinouts emerging from the six HEPs with the largest research bases (£300 million and above) was much higher at the pre-seed/seed stage (mean of £2.3 million, median of £1.4 million) than for spinouts emerging from other types of HEP. This pattern continues into the early VC stage. Note, though, that for spinouts reaching the later VC phases of their development, when they are typically seeking to scale, the mean average is very similar for spinouts emerging from six HEPs with the largest research bases and those with research bases between £100 million and £300 million. Note here that, given the skewed nature of investment success for spinouts, the mean will be influenced much more by outliers, i.e. those spinouts very successful in raising investment. By contrast, spinouts emerging from HEPs with research scales of less than £50 million appear to struggle to raise significant amounts of investment at all phases of the investment journey.

Looking at how average deal sizes have changed over time (Table 16), spinouts emerging from HEPs with research bases of more than £50 million have seen significant growth in the average deal size at the pre-seed/seed stage. For the six HEPs with a research base greater than £300 million, the average pre-seed/seed stage deal grew from £1.9 million between 2013-2018 to £2.3 million between 2019-2024. For those HEPs with a research base between £100 million and £300 million, the mean average size of deal secured by their spinouts grew from £0.8 million in the earlier period and £1.3 million in the more recent period, with a similar growth experienced by spinouts linked to HEPs with a research base of between £50 million - £100 million.

Figure 35 Average size of investment deals (£000s) for spinouts emerging from different types of HEPs, for deals covering the period 2019-2024 (constant 2024 prices)



Sample: All spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

Table 16 Comparing the mean average size of investment deals (£000s) in the periods 2013-2018 and 2019-2024 for spinouts emerging from different types of HEPs (constant 2024 prices)

Research scale group	Pre-seed/Seed deals during period:		Early Stage VC deals during period:		Later Stage VC deals during period:	
	2013-18	2019-24	2013-18	2019-24	2013-18	2019-24
£300 million and above	1,900	2,300	7,500	13,100	12,100	19,200
£100 million to £300 million	800	1,300	4,000	8,500	4,600	18,300
£50 million - £100 million	500	1,400	7,200	8,100	2,000	11,600
£20 million - £50 million	600	600	2,400	600	2,000	3,800
£10 million - £20 million	400	700	800	1,300	2,300	2,100
Less than £10 million	400	1,100	400	2,000	1,000	4,500

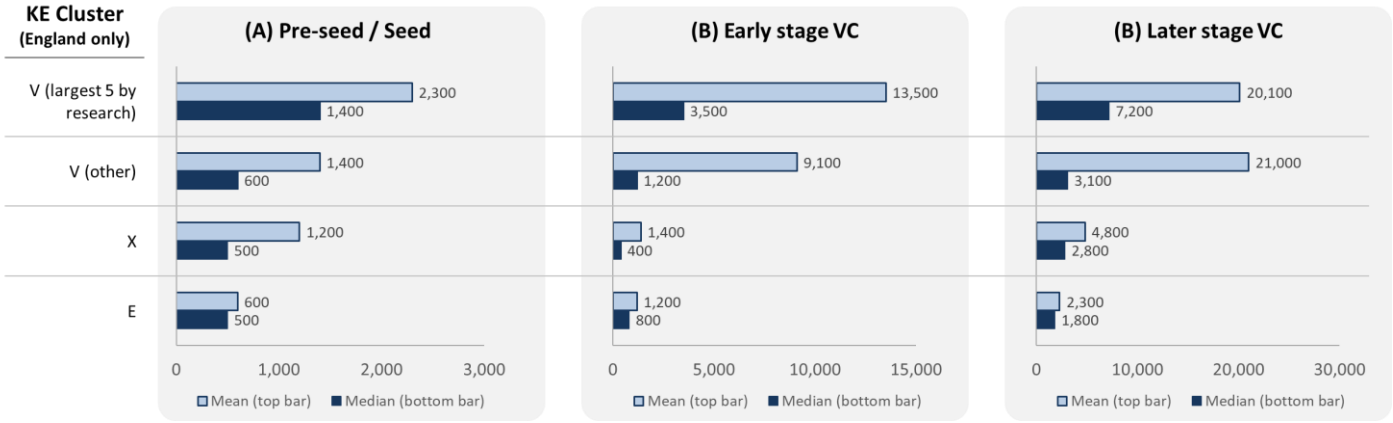
Sample: Spinouts in register founded in each period and with PitchBook investment data
Investment data has been adjusted for inflation using the HM Treasury GDP deflator
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

For English HEPs only, section 4.1.1 introduced a grouping of institutions based on similarities in a broad range of underlying characteristics, well beyond the scale of research activity, that were believed to shape their opportunities for knowledge exchange (including spinning out companies to commercialise ideas and technologies). Figure 36 and Table 17 explore how the average deal size secured by spinouts at different investment stages varies by HEPs based in these different KE clusters. As outlined in section 4.2.3 (Table 12), spinout production is heavily concentrated within cluster V, with the largest five HEPs of cluster V based on research scale producing almost half of all spinouts reported to the Spinout Register, and the remaining HEPs in the cluster producing a further 25%. To increase the relevance of our findings, we therefore separate out the largest five cluster V HEPs from the rest of this group.

Figure 36 shows that spinouts linked to the largest five HEPs of cluster V were, on average, able to secure deals much larger than from HEPs at each stage of the investment journey. The median deal size at pre-seed/seed stage was £1.4 million (mean of £2.3 million), compared with £0.6 million for the other HEPs in cluster V and £0.5 million for spinouts linked to HEPs in cluster X.

At the early VC stage, the median was £3.5 million (mean of £13.5 million, highlighting the power of a number of very successful spinouts in lifting the mean significantly above the experience for the spinout in the middle (50th percentile) of the distribution, well above £1.2 million for spinouts emerging from the other HEPs of cluster V (mean of £9.1 million), and just £400,000 for those linked to HEPs in cluster X. At the later VC stage, the median deal size for spinouts linked to the largest five HEPs of cluster V remained considerably higher than the experiences of spinouts linked to other HEPs at £7.2 million (mean average of £20.1 million). However, the mean average deal size for spinouts linked to the other HEPs of cluster V was at a similar level. This suggests that this group of other HEPs from across cluster V are producing spinouts that, while securing less investment at the early phases of development, once through this early part of their journey are able to attract significant growth-stage VC investments, similar to those from the largest HEPs with significant experience in producing spinouts.

Figure 36 Average size of investment deals (£000s) for spinouts emerging from HEPs in selected KE clusters, for deals covering the period 2019-2024 (England only analysis, constant 2024 prices)



Sample: All spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

Table 17 explores how the average deal size at different phases of the investment journey has changed over time for English HEPs based in different KE clusters. Perhaps more strikingly than the analysis of HEPs grouped by research scale, it shows that the spinouts linked to the largest HEPs of cluster V continue to strengthen their ability to secure larger deals over time (noting that our analysis adjusts for the effects of inflation), with the mean average pre-seed / seed stage deal rising from £1.9 million between 2013 – 2018 to £2.3 million in 2019 – 2024; the mean deal size at the early VC stage rising from £7.9 million in the earlier period to £13.5 million in the more recent period; and the mean deal size at the later VC stage rising from £12.5 million to £20.1 million.

Perhaps more importantly are the developments in the wider group of HEPs in cluster V. This group has also seen a significant strengthening of their spinout ecosystems over the 12 year period studied. They have seen a doubling of the mean average deal size at the pre-seed/seed stage from £700,000 to £1.4 million; and an almost doubling of the size of deals at the early VC stage from £4.8 million to £9.1 million. At the later stage, the average deal size of their spinouts during 2013-2018 was £5.6 million compared with £12.5 million for spinouts linked to the largest HEPs of cluster V, but in the more recent period, the mean average deal sizes were similar for the two groups. A number of factors could be driving these changes, not least the maturing of university ecosystems to support spinouts in these HEPs compared with the more mature ecosystems in place for the largest cluster V HEPs; a strengthening of the spinout value propositions emerging from these HEPs; and a growing availability of investment looking for opportunities beyond the biggest HEPs based in Golden Triangle of Oxford, Cambridge and London.

Table 17 Comparing the mean average size of investment deals (£000s) in the periods 2013-2018 and 2019-2024 for spinouts emerging from HEPs in selected KE clusters (England only analysis, constant 2024 prices)

KE clusters (England only)	Pre-seed/Seed deals during period:		Early Stage VC deals during period:		Later Stage VC deals during period:	
	2013-18	2019-24	2013-18	2019-24	2013-18	2019-24
V (largest 5 by research)	1,900	2,300	7,900	13,500	12,500	20,100
V (other)	700	1,400	4,800	9,100	5,600	21,000
X	300	1,200	6,100	1,400	2,200	4,800
E	400	600	1,500	1,200	4,100	2,300

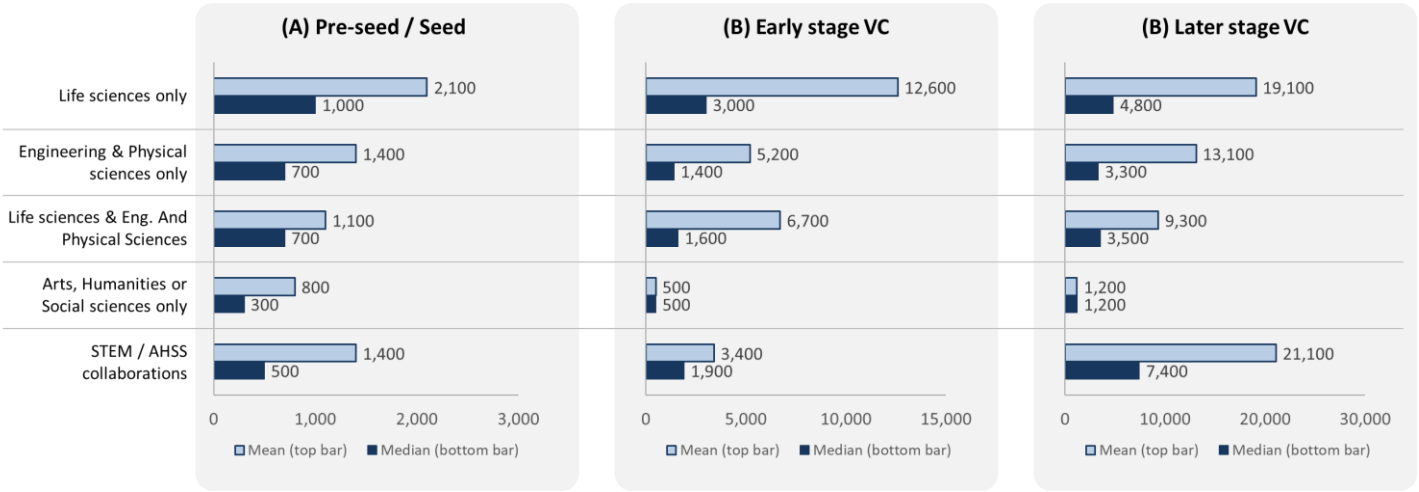
Sample: Spinouts in register founded in each period and with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

6.1.6 Average deal size for spinouts emerging from different disciplines

The final set of analyses focus on the experiences of spinouts emerging from different disciplines. Figure 37 shows that spinouts emerging from the life science disciplines raised considerably more investment at the pre-seed/seed stage compared with those from other disciplines, with a median average deal size of £1 million (mean average of £2.1 million), compared with £0.7 million for spinouts from engineering and physical sciences (mean of £1.4 million), and just £300,000 for those emerging from AHSS disciplines (mean of £800,000). This pattern continues at the early VC and later VC stages of the investment journey. The low levels of investment into AHSS spinouts may reflect the less capital intensive nature of many of these ventures, alternative spinout development and growth paths based on non-VC investments, and the relative immaturity of the spinout and investment ecosystems available to support and nurture these ventures[35].

[35] Abdul-Rahman, Ulrichsen and Vorley (2024)

Figure 37 Average size of investment deals for spinouts emerging from different disciplines, for deals covering the period 2019-2024 (constant 2024 prices)



Sample: All spinouts in register with PitchBook investment data
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

6.2 Spinout outcomes and survival

Having looked at the trends and patterns of UK spinouts in attracting investment to drive their early development and growth, this section now turns to looking at what happens to these ventures focusing on different types of exits, cumulative investment success, and survival rates.

At the outset of this section it is important to recognise that spinouts may grow and develop through different pathways – not just through equity-backed VC investment leading to acquisition or public listing. They may realise success and contribute significantly to the economy and society in different ways, not just through scaling to become 'unicorns' and large employers. While the latter are clearly important for driving economic growth and prosperity in the UK – particularly if, as a nation, we can anchor more of the employment domestically – some spinouts may emerge to provide niche, yet critically important, products and services to strategically important industries nationally and regionally (including for national security), or may provide enabling services that, while not employing large numbers of people, may help other companies to become more productive and competitive. The role and importance of these types of spinouts is hard to identify and capture in aggregate analyses of spinout outcomes, and is an area where further work is urgently needed.

Our analysis of spinout outcomes begins with an assessment of the cumulative VC (from pre-seed to later stage) investment raised by the spinout companies in the UCI spinout dataset developed from the data behind the Spinout Register, before looking at the status of spinouts in the reporting year 2024.

Across all spinouts reported to the Spinout Register and in our dataset, 53 have raised more than £100 million, 45 have been listed on a stock exchange, 170 have been acquired (including 13 that first went to IPO before being acquired), 1,560 were still active, and 342 had dissolved or were in the process of being liquidated (Figure 38).

Figure 38 Status of UK university spinouts in the reporting year 2024

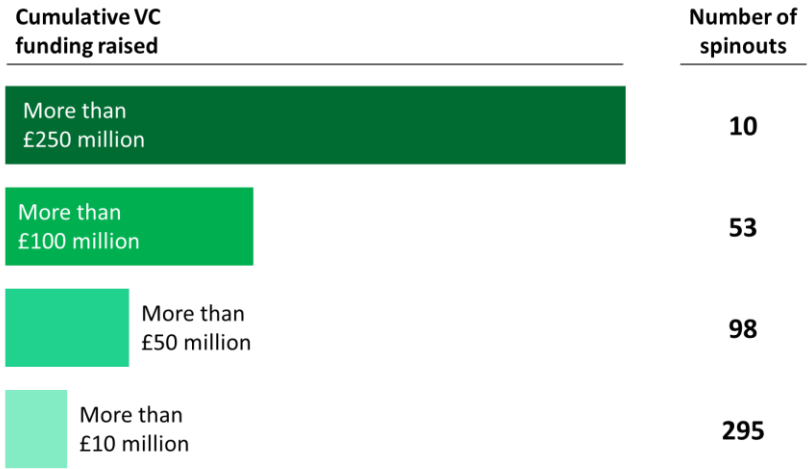
** Some spinouts were acquired following their public listing on a stock exchange*

Note: Investment data has been adjusted for inflation and are in constant 2024 prices
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register, Moody's FAME and ORBIS databases, and data from PitchBook Data, Inc.

6.2.1 Cumulative venture capital investment raised

While not appropriate for all spinouts, the cumulative amount of VC investment raised from foundation to-date can highlight companies that have raised significant equity capital to drive their growth and investors see significant value. Drawing on the population in our Spinout Register-powered dataset, over the years we find that 53 of the 1,513 spinouts identified in the PitchBook investment data platform have raised more than £100 million (10 have raised more than £250 million), and 295 have raised more than £10 million[36]. Note that this includes spinouts that have been acquired, listed on a stock exchange, or are no longer active.

Figure 39 Number of spinouts raising different levels of cumulative investment over their lifetimes to-date



Note: Investment data has been adjusted for inflation and are in constant 2024 prices
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from PitchBook Data, Inc.

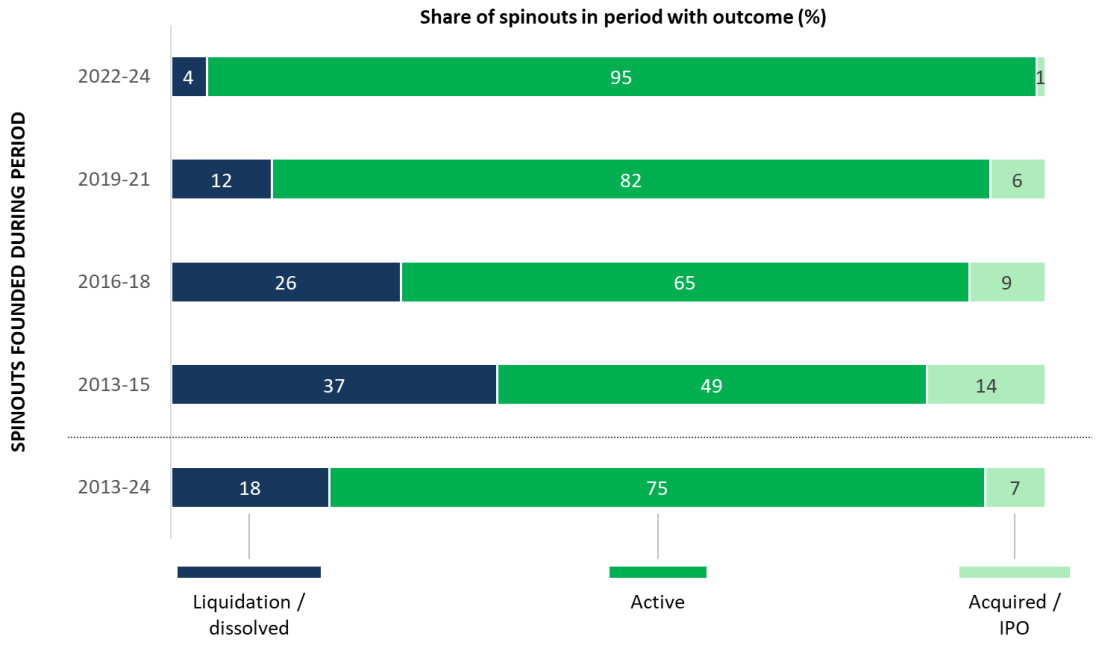
[36] Note that investment data has been adjusted for inflation and is reported in constant 2024 prices.

6.2.2 Spinout outcomes

The numbers highlighted in Figure 38 include all spinouts in our Spinout Register-powered dataset, including those founded prior to 1st August 2012. Recall that HEPs only submitted spinouts before this date if they were still active in 2024. Including these in a systematic assessment of spinout survival and outcomes would positively bias the results. To remove this bias, in this section we therefore limit our attention – unless otherwise stated – to spinouts founded during 2013-2024.

For spinouts founded between 2013-2024, we find that 7% have been acquired or went to IPO, 18% had been dissolved or were in the process of being liquidated, and 75% remained active (Figure 40). Unsurprisingly, the share of spinouts with a positive exit (acquisition or IPO) increases for the older spinouts given the time taken to develop to the point where these types of exits become viable. Similarly, the share of spinouts dissolved or in liquidation increases with spinout age. For spinouts founded between 2013-2015, 14% had been acquired or listed on a stock exchange, and 37% were now dissolved or being liquidated. This compared to 6% of the younger cohort of spinouts founded during 2019-21 being acquired or publicly listed and 12% now dissolved or being liquidated.

Figure 40 Share of spinouts (%) founded during each time period with different outcomes in the reporting year 2024



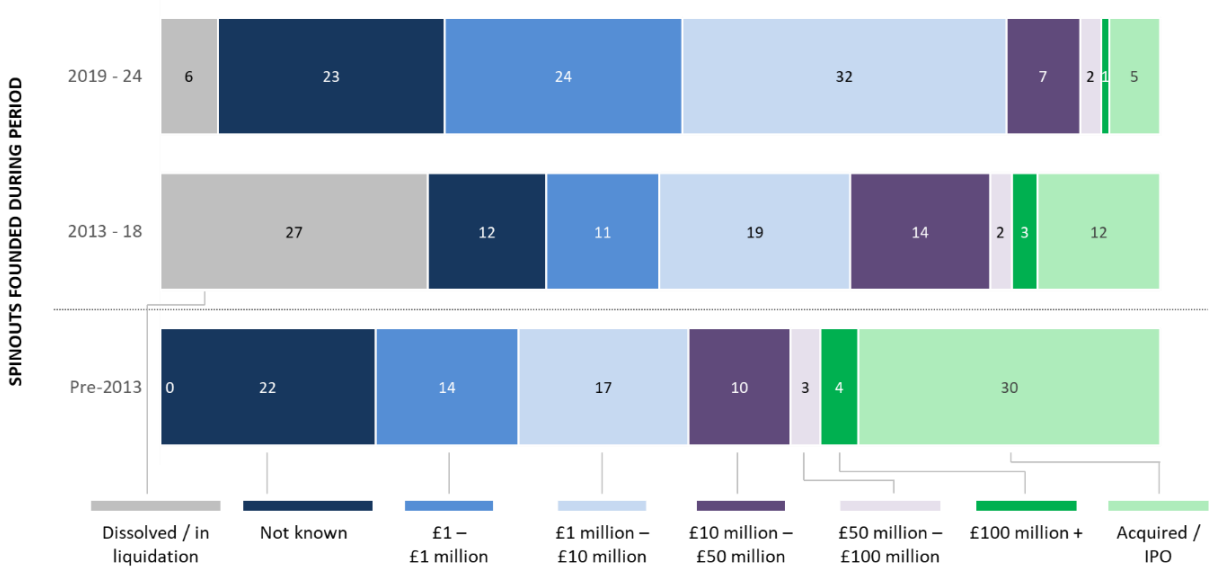
Sample: Spinouts in register founded in each period with data on status outcomes obtained from FAME
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register, and data from Moody's FAME and ORBIS databases

Figure 41 expands out this analysis of spinout outcomes to include the cumulative amount of total investment raised by spinouts (of any form, venture capital or otherwise). Note that this analysis relies of information available through PitchBook, with some spinouts not identified in the dataset. *Although broadly consistent, the distributions presented in this figure are therefore slightly different to those in Figure 40*. In the analysis presented in Figure 41, we look at spinouts founded during different periods, isolate those that have been acquired or listed publicly, and those that have failed; and for the remaining companies we examine the cumulative amount of investment secured.

The investment outcome analysis shows that for spinouts founded between 2013-2018, 15% have either been acquired or listed publicly (12% - 84 spinouts), or have raised more than £100 million in investment (3% - 18 spinouts). A further 2% of the sample (15 spinouts) raised between £50 million and £100 million, and 14% raised between £10 million and £50 million. Given the length of time it can take deep-tech spinouts to develop, demonstrate and scale their applications, it is unsurprising that the proportion of spinouts raising significant investment or realising a positive exit is lower for companies founded in the more recent period 2019-2024.

Figure 41 also presents the investment outcomes for the older spinouts reported to the Spinout Register, noting that by definition they are still active in the current period. Of these companies, 30% had been acquired or were listed on a stock exchange. A further 4% had raised more than £100 million in investment and 7% had raised more than £50 million.

Figure 41 Share of spinouts (%) founded during each time period with different outcomes in the reporting year 2024



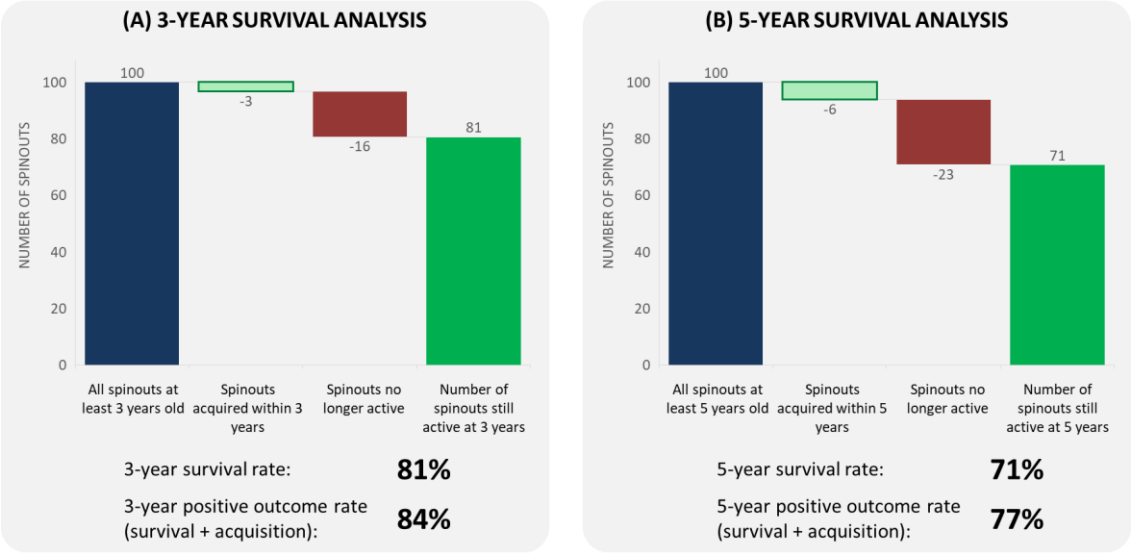
Sample: Spinouts in register founded in each period and has PitchBook investment data, or was dissolved regardless of whether the company has been identified in PitchBook
Note: By design, no spinouts were reported to the Spinout Register during the pre-2013 period that had dissolved or were in liquidation
Note: Investment data has been adjusted for inflation and are in constant 2024 prices
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register, data from Moody's FAME and ORBIS databases, and data from PitchBook Data, Inc.

6.2.3 Survival analysis

Figure 42 presents an initial survival analysis for UK university spinouts. It starts with UK university spinouts founded since 1st August 2012 and looks at the share of spinouts that remain active 3-years and 5-years post foundation, adjusting for those that were acquired during this period. Figure 42 (panel A) shows that of the 100% of spinouts founded during this period, 3% were acquired within 3-years, and a further 16% were no longer active. This results in 81% of ventures remaining active at the 3-year mark (3-year survival rate). Acknowledging that acquisition is typically a positive exit for spinouts, we argue this should be added to the survival rate to produce a *3-year positive outcome rate* of 84%. At the 5-year mark (Figure 42, panel B), 6% of spinouts had been acquired within 5 years, 23%

were no longer active, leading to a 71% survival rate and 77% positive outcome rate. This initial analysis focuses on whether the spinout is reported as active in Companies House. Further analyses will attempt to look at how many spinout companies survive subject to a minimum threshold of activity, as well as comparing this to a wider comparable population of start-up companies.

Figure 42 3-year and 5-year survival rates for UK university spinouts



Sample: Spinouts in register founded in each period with data on status outcomes obtained from FAME
Source: Analysis of the UCI spinout dataset developed from the data behind HESA's Spinout Register and data from Moody's FAME and ORBIS databases

7

7 Concluding remarks and moving forwards

The Spinout Register has transformed our ability to understand the structure and dynamics of UK university spinout ecosystem in more robust and systematic ways. Developed by HESA with expertise from Research England and UCI, the Register makes every effort to capture the population of spinout companies emerging from the population of UK HEPs. Crucially, it provides base information on each spinout collected to standard definitions, including identifiers that allow these companies to be linked into other datasets. In doing so, we believe it creates an invaluable national data asset and a common baseline on the spinout population for groups interested in spinouts to drive their own insights and analyses.

Our report has only begun to scratch the surface of the types of insights and analyses that could be undertaken. Taking the data behind the Spinout Register as our baseline, we further curated and cleaned the data, linked additional information on each company from different sources to create a powerful dataset able to unlock detailed insights on the structure and dynamics of the UK spinout ecosystem and its significance in driving entrepreneurial activity and success in the UK economy.

The scale of value offered by the Spinout Register becomes apparent when we begin to link it to other datasets. For this report, we link to other HESA records capturing key characteristics of HEPs, allowing us to segment and explore trends in spinout production across different parts of the UK and from different types of institutions. We also leverage data from other data providers including Companies House, Moody's FAME and Orbis, and the investment data platform, PitchBook. This has allowed to us to unlock additional insights, moving beyond the origins of spinouts and trends in spinout production to examine the development journeys and outcomes of these companies. Furthermore, by finally having information on the UK population of spinout companies, we can much more robustly assess the importance and performance of these ventures in driving entrepreneurial activity across the UK compared with a comparable population of UK start-ups.

A key benefit of the Spinout Register is that it allows us to move below the aggregate totals for each HEP. Given the portfolio nature of spinout activity, with significant successes driven by a relatively small number of companies, we can now look at how the experiences of different segments of spinout portfolios are changing in different parts of the UK, for different types of HEPs, and for spinouts operating in different sectors of the economy. For example, we shows the significance of the top 10% of spinouts in driving investment success compared with the bottom half of the portfolio based on the amount of investment raised. Company-level information also allows us to explore in much more detail the nature and dynamics of the UK's full portfolio of spinout companies and the value potential they may unlock. Furthermore, by having available company-level data we can, for the first time, surface a group of 'collaborative spinouts' that emerge from multiple HEPs, which need to be carefully accounted for in any analysis of sector trends to avoid duplication and double counting of effects.

While we have made much progress in this report in understanding the significance, structure and dynamics of the UK spinout ecosystem, there is much more that we need to do. The analyses captured in this report were naturally limited by the time available, and could be extended in many directions. For example, even with the databases we have currently linked to the data underlying the Spinout Register, we can further leverage our combined datasets to better understand the employment effects of spinouts at different stages of their development, and how spinouts move across the UK and internationally as they emerge, develop and grow. These are two critically important topics for understanding the extent to which the UK and local economies are benefiting from spinouts. We can also investigate the types of investors investing into university spinouts, how they might vary for spinouts in different parts of the UK and for different types of HEPs, and over time; all with potential consequences for how universities work with the investor community to support these companies.

We can also begin to link other data with our Spinout Register-powered datasets. Obvious candidates include research and innovation funding data to better understand how public sector support may have underpinned spinouts and supported their early development journeys; and patent data to provide additional information on their origins, technological focus, and development journeys. We also need to get much better at classifying the technology and industrial focus of spinouts across the population of spinouts to help us better capture where they seek to make significant contributions to the economy and society. The widely available Standard Industrial Classification (SIC) system is not suitable, and many spinouts are still not captured by data platforms that provide more relevant classifications. At UCI, we are working on making meaningful advances in this area.

Our analyses clearly show the importance of spinouts in driving entrepreneurial activity and success in strategically important sectors of the UK economy. Moving forward, we hope the Spinout Register can help us and many others to leverage the increased information available to find ways of building the ecosystems across the breadth of the UK that are needed to seed, nurture and grow spinouts, and better support these companies to grow, thrive and scale for the benefit of the UK and the world.

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Annex A: KE Clusters

Throughout the report, we group English HEPs by the KE Clusters that currently underpin the Knowledge Exchange Framework (KEF). Table 18 below summarises the specific structural characteristics of each cluster. Details about the clusters and the methodology used to derive them can be found in Ulrichsen (2023).

Table 18 Structural characteristics of KE clusters of English HEPs

Cluster	Characteristics
Cluster E	• Large universities with broad discipline portfolio across both STEM and non-STEM excellent research across all disciplines. • Many academics have both a teaching and research focus or teaching only focus • Significant amount of research funded by government bodies/hospitals (cluster average 45%); 9% from industry and 12% from charities. • Large proportion of part-time undergraduate students. Smaller postgraduate population dominated by taught postgraduates.
Cluster J	• Mid-sized universities with a more teaching focus (although research is still in evidence). • Academic activity across STEM and non-STEM including other health, computer sciences, social sciences and humanities • Research activity funded largely by government bodies/hospitals (41%) and charities (20%); 9% from industry. • Smaller postgraduate population dominated by taught postgraduates.
Cluster M	• Smaller universities, often with a teaching focus. Few research-only academics • Academic activity across disciplines, particularly in other health domains, social sciences and humanities. • Research activity typically funded by non-UKRI sources, covering government bodies/hospitals (38%) and industry (27%); 14% from charities.
Cluster V	• Very large, very high research intensive and broad-discipline universities undertaking significant amounts of excellent research. • High proportion of research-only academic staff • Research funded by range of sources including UKRI (34%), other government bodies (26%), charities (24%) and industry (11%). • Significant activity in clinical medicine and STEM disciplines • Student body includes significant numbers of taught and research postgraduates.
Cluster X	• Large, high research intensive and broad-discipline universities undertaking a significant amount of excellent research. • High proportion of research-only academic staff • High proportion of research funded by UKRI (45%); 29% from other government bodies; 8% from industry and 12% from charities. • Discipline portfolio balanced across STEM and non-STEM although less or no clinical medicine activity. • Large proportion of taught postgraduates in student population

Source: Ulrichsen (2023)

Annex B: Interpreting Boxplots

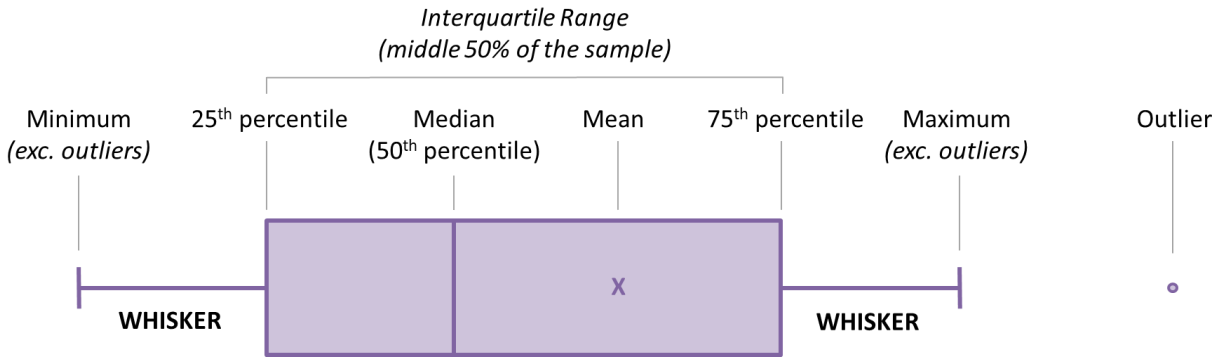
In our analysis, we employ 'box-and-whisker plots' as a powerful tool for data visualisation. These plots serve as a valuable tool to illustrate not just the median average of a variable but also the extent of variability surrounding the median. In this way, it provides a visual summary of the distribution and central tendencies of a dataset while also identifying potential outliers or extreme values. This allows for much more meaningful comparisons between different groups.

How to read a boxplot

Interpreting a box plot involves understanding the key components and features it represents.:

1. **Box:** The box in the plot represents the interquartile range (IQR), which includes the middle 50% of the data**.** The left (or bottom) edge of the box represents the first quartile (Q1) or the 25th percentile, and the right (or top) edge represents the third quartile (Q3) or the 75th percentile. The height of the box, therefore, shows the spread of the middle 50% of the data.
2. **Line inside the box:** This line represents the data's median or the 50th percentile. It shows the midpoint of the dataset.
3. **Cross inside the box:** Where represented, this indicates the mean average of the distribution.
4. **Whiskers:** The whiskers extend from the edges of the box and reach the minimum and maximum data values (excluding any outliers) within a defined range.
5. **Datapoints outside the whiskers:** These represent outliers, defined as values greater than (or less than) 1.5 times the interquartile range above the third quartile or below the first quartile.

Figure 43 Interpreting box plots



Note: not to scale
Source: UCI

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