Turning Durham into the next Silicon Valley

Introduction

County Durham is actively enhancing its innovation landscape, guided by a reinvigorated strategic focus to develop a comprehensive and contemporary framework structured around four fundamental pillars: people, productivity, places, and promotion. Despite the government's historical and continuous efforts to support regional development through initiatives such as Innovate UK and leveling up programs, innovation activity and startup rates are relatively limited within the Northeast. It has consistently exhibited lower performance across various indicators(employment rate, GVA, etc.) when compared to other regions in the UK (Department for Levelling Up, Housing and Communities, 2022). Similarly, in line with the Northeast Strategic Economic Plan, the Northeast region demonstrates lower-than-average rates in employment, economic activity, and Gross Value Added (GVA) compared to the UK's average, excluding London (North East LEP, 2022).

While some sectors reflect vital signs of growing activity, general indicators of innovation outputs lag behind the national averages. It can be inferred that several implicit resource barriers (i.e., access to funding, knowledge gaps, operational/infrastructural issues) have led to an underutilization of regional support thereby exacerbating an unfavorable scenario that has led to the deterioration of both the employment and economic activity rates in the Northeast. Further, the issues surrounding the Northeast region's struggling economic foundation and the inconsistent performance across industrial sectors have contributed to the persistent decline in Gross Value Added figures (North East LEP, 2022).

Anchored in regional trends and growing concerns, a Durham University Business School research team has undertaken a rigorous investigation utilizing a range of authoritative databases, including the Office for National Statistics (ONS), the Department for Business, Energy & Industrial Strategy (BEIS), and localized Northeast sector data. Pertinent policy documents such as the leveling up white paper, chamber of conference reports, and share prosperity fund directives were also used. Throughout our investigation, we have successfully discerned a multitude of pertinent issues and discernible trends within the region. These insights have subsequently been utilized in condensing the current innovation delivery framework, ensuring its alignment with the prevailing circumstances and requirements. The integration of these efforts has culminated in a set of focused findings, meticulously presented alongside pertinent recommendations, encapsulating the proposed path forward for innovation development within the county.

Summary of response

- The current county delivery plan raises concerns about its effectiveness in a changing market.

The county should provide comprehensive and industrially tailored business support to new and emerging ventures to enhance innovation. The structure of these programmes must transcend merely beyond funding efforts, by addressing the need for an enhanced understanding of strategic, technological, and operational hurdles faced by growing firms.

- The Northeast region excels in industries such as automotive, advanced manufacturing, life sciences, universities, and research centres, with emerging sectoral clusters. The UK's commitment to achieving net-zero emissions, requiring substantial annual capital investment, allows the Northeast to leverage its manufacturing and engineering heritage, potentially creating around 27,000 direct job opportunities by 2050, positioning the region for significant employment growth.

- The Northeast region, known for its strong manufacturing base, is facing a technological transformation due to the UK's net-zero goal by 2050, which could lead to job losses through automation. Jobs at higher risk of automation involve low skills and machine interactions, with the Northeast and other regions particularly vulnerable. To ensure long-term sustainability, the region should prioritize skill enhancement and foster development in less vulnerable high-tech sectors.

- Research investment in the UK's Northeast region is low, leading to lower wages in high-tech sectors and a struggle to retain talent despite the presence of universities and research institutions. A shortage of skilled occupations is also evident, with many businesses having limited workforces. To address these issues, the county needs to foster skill-intensive occupations through targeted initiatives, offering incentives and supportive frameworks, increasing research funding, and raising researcher wages. These steps aim to enhance high-tech positions, ultimately improving talent retention and attraction.

- An analysis of the historical Innovate UK data indicates a notable disparity in application counts between the Northeast region and Durham, reflecting uneven resource distribution. Funding applications mainly focus on Manufacturing and Responsive sectors, with limited attention to industries like AI and Data Science, aligning with concerns about potential automation risks. Factors such as low retention rates and complex application processes hinder SME engagement. For effective policy development, the county should prioritize equitable resource distribution within Durham and encourage the growth of technology zones, supported by clear frameworks and digital platforms to enhance SME access to funding opportunities.

- Data highlights a trend of investor-investee pairings primarily within the Northeast region, which could deepen reliance on manufacturing. To counter this, strategic efforts are needed to expand beyond the region, including collaborations with neighbouring areas through support projects, exhibitions, and social events. These initiatives aim to diversify investments and promote innovation-driven progress in the Northeast.

What are we good at and where are the opportunities to grow?

The region is characterised by a strong mix of adjacent industrial sectors and technological expertise. According to both the Department for Levelling Up, Housing and Communities (2022) and the County Durham Inclusive Strategy 2035, the Northeast region excels in areas such as automotive, advanced manufacturing, life sciences, universities, and research centres. Additionally, there are sectoral clusters either under construction or already established. Furthermore, an analysis commissioned by the Department for Business, Energy, and Industrial Strategy (BEIS) underscores the potential benefits for the Northeast region. The Northeast is poised to capitalize on this transformation by leveraging its substantial manufacturing and engineering heritage. Projections indicate the potential for an additional 27,000 direct job opportunities to materialize by 2050, underscoring the region's capacity to become a focal point for employment growth.

High levels of industrial fragmentation and small organizational sizes across the business population dilute the potential to offer targeted innovation support at a macro level, leading to numerous support agencies adopting different approaches to monitor and support business development in disparate ways. This issue is exacerbated further by the significant disparity in the data management and reporting conventions that exist in monitoring key innovation performance metrics across stakeholders, supporting institutions, sectors, regional boundaries, etc. across County Durham and the Northeast.

The region's prosperity is bolstered by a robust employment pipeline, primarily driven by the county's exceptional quality schools. These institutions consistently achieve educational attainment levels above the national average at Key Stage. Notably, the region boasts four prominent further education colleges: Derwentside College, New College Durham, East Durham College, and Bishop Auckland College. Durham Learn, a dedicated adult learning and skills service, complements these. The educational landscape is further enriched by the presence of the Northeast Institute of Technology, specializing in construction, engineering, manufacturing, and digital sectors. This collective educational prowess forms a solid foundation for advancing the county's overall educational standards. (County Durham Economic Partenership, 2022)

Moreover, the county is strategically positioned to harness emerging subsectors and capitalize on new opportunities. Prominent among these are the realms of space and satellites, fintech, and the green economy. These emerging domains are poised to create a fresh wave of employment prospects for local residents. The county distinguishes itself as a significant contributor to renewable energy generation in the Northeast, particularly excelling in geothermal energy and onshore wind capabilities. This leadership extends to pioneering sustainable business practices, further reinforcing its reputation as an innovative hub. (Durham County Council, 2019)

The county's economic landscape benefits immensely from strategically situated major employment sites. Aykley Heads, an appealing city center business hub adjacent to Durham's main train station, is evolving into a vibrant knowledge cluster. Here, forward—thinking enterprises converge to cultivate novel concepts in technology and the service economy. Additionally, the county takes

pride in hosting NETPark, a prestigious science park located in Sedgefield. This is complemented by prestigious innovation institutions like the Centre for Process Innovation (CPI). Clusters in Durham City and Newton Aycliffe further bolster the region's innovation ecosystem. As stated by (Adner, 2006), no groundbreaking innovation achieves success in isolation, underscoring the indispensability of an innovation ecosystem. Building upon these existing institutions and strengths, the county is poised to propel itself into high-tech industries that are anticipated to shape the mainstream future. (County Durham Economic Partnership, 2022) The county is well-positioned for sustained growth and heightened educational attainment by capitalizing on these educational and economic assets. As it embraces emerging opportunities and leverages its existing strengths, the region is destined to play a pivotal role in shaping the trajectory of its local economy and the broader innovation landscape.

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Industrial Sector	Percentage of Business Population	Small	Medium	Large	Turnover (Millions)	Notes:
Financial and Insurance Activities	2%	99.98%	0.10%	0.10%	Unknown	
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	11%	99.75%	0.20%	0.05%	18,840	Large firms acct for 28% of turnover
Manufacturing	4.70%	97.80%	2%	0.20%	16,718	
Construction	17.50%	99.90%	0.10%	0	8,769	
Professional, Scientific and Technical Activities	12.60%	99.78%	0.20%	0.02%	5,300	
Administrative and Support Service Activities	7%	99.20%	0.60%	0.20%	4,635	Medium and Large Firms acct for 41% of Turnover
Transportation and Storage	7.70%	100%	0%	0	4,198	
Mining and Quarrying; Electricity, Gas, Steam and Air Conditioning Supply; Water Supply; Sewerage, Waste Management and Remediation Activities	1%	99%	1%	0%	4,136	
Human Health and Social Work Activities	6%	99.30%	0.50%	0.20%	3,411	Medium and Large Firms acct for 46% of Turnover
Information and Communication	4.70%	99.94%	0.06%	0	2,663	
Accommodation and Food Service Activities	5%	99.44%	0.50%	0.06%	2,153	Large firms acct for 25% of turnover
Real Estate Activities	2.20%	99.98%	0.10%	0.10%	1,908	
Agriculture, Forestry and Fishing	2.60%	100%	0%	0%	984	
Arts, Entertainment and Recreation	4.50%	99.73%	0.20%	0.07%	952	Large firms acct for 41% of turnover
Other Service Activities	7.50%	100%	0.00%	0.00%	678	
Education	4.30%	100%	0.00%	0.00%	484	

*Adapted from BEIS Data, 2023

While numerous economic monitors collectively demonstrate the key indicators of innovation performance across the broad region, there remains significant disparities between institutional conventions, audiences, and methodologies. This makes analysis and assessment of interventions problematic, as the lack of reporting makes assessing performance indicators across sectors and counties difficult to assess. Further to this issue is the high volume of sector intersections and adjacencies required to foster high-tech innovation and diversification options for firms.

The United Kingdom formally introduced its commitment to achieving net-zero emissions by 2021. This ambitious endeavour is projected to necessitate an annual capital investment ranging from

£50 billion to £60 billion, particularly as we progress through the late 2020s and into the 2030s. (HM Government, 2021). This financial commitment is part of a broader initiative to transition towards a carbon-neutral economy.

What the region may face with the trend of automatization?

The northeast is famous for its strong manufacturing base, however, Following the UK's goal of transitioning to net zero by 2050, there has been a technological transformation that encompasses both labour augmentation and labour replacement. Estimates regarding the proportion of UK jobs at risk of automation range from 7.4% to 35% (Department for Levelling Up, Housing and Communities, 2022).

Jobs most susceptible to automation are those characterized by low skill requirements, predictable work patterns, and predominantly involve interactions with machines rather than human beings. The Office for National Statistics (ONS) reveals that, upon scrutinizing these vulnerabilities across various regions in England, namely the Northeast, East, Southwest, and coastal areas, the potential for job losses stemming from automation is particularly pronounced.

This phenomenon underscores the need for a revaluation of regional development priorities moving forward. Specifically, there should be a concerted effort to enhance the skill levels within the Northeast region. Furthermore, the focus of development endeavours should be strategically redirected towards high-tech sectors that are less susceptible to displacement. Examples of such sectors include automotive vehicles and digital science. This strategic shift is imperative to ensure the region's long-term sustainability and resilience in the face of evolving technological advancements.

What is the current situation regarding research and development as well as high-tech business activities within the region? How can it be improved?

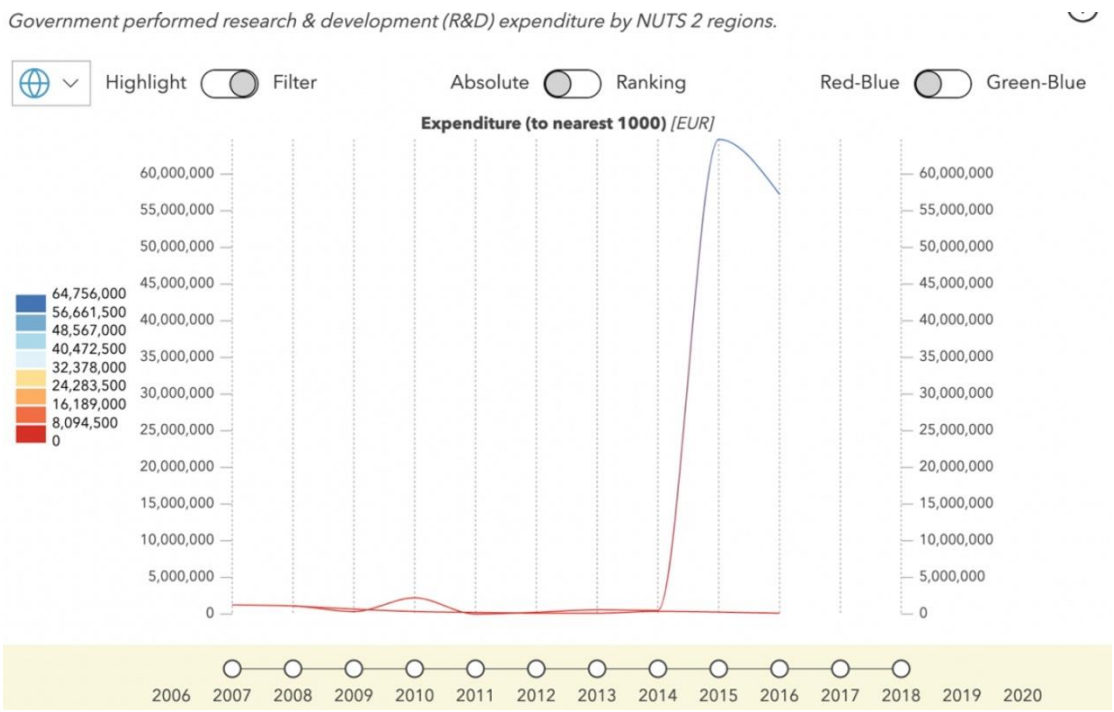
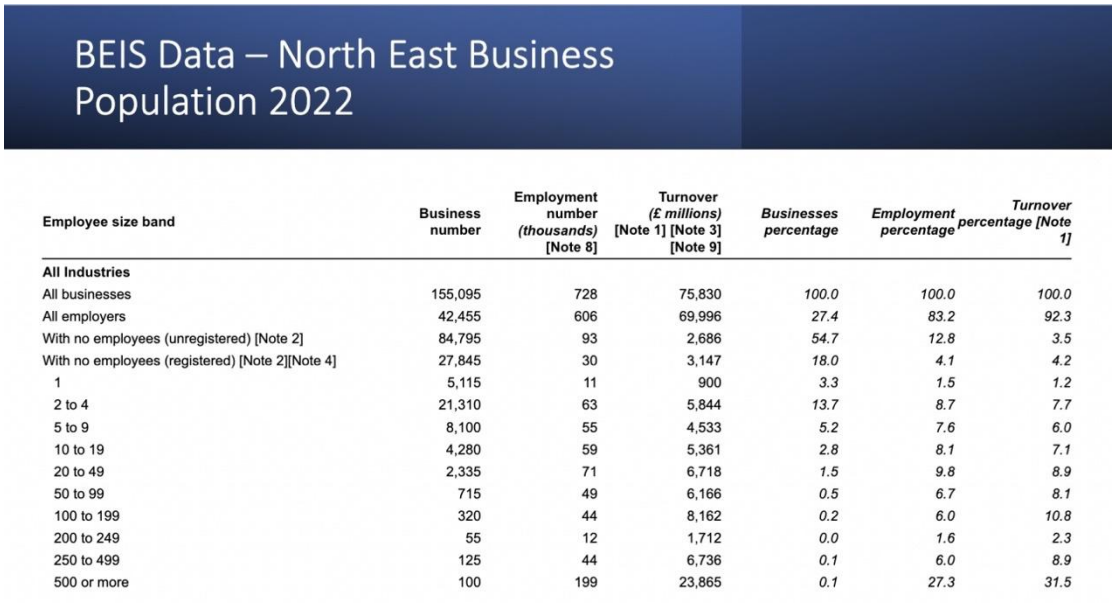


Fig 2.1. Government performed research & development (R&D) expenditure by NUTS 2 regions. (BEIS & Nesta, 2016)

- In Fig 2.1 The upper line represents Northumberland and Tyne and Wear (UKC2), while the lower line corresponds to the Tees Valley and Durham (UKC1). It is evident that despite a substantial increase in government expenditure on research and development (R&D), the status of the Durham region has shown relatively modest improvement.
- The professional employment rate within UKC2 and UKC1 regions stands at 21.4% and 16.9% respectively in 2020.
- The HE intellectual property income within UKC2 and UKC1 regions stands at £ 26,237,000 and £ 51,000 in 2018. (BEIS & Nesta, 2016).

The above data reveals that R&D investment in the Northeast region of the UK remains relatively low. This, in turn, has contributed to lower average wages in high-tech sectors across the entire country. This is also why, despite the presence of numerous universities and research institutions in the Northeast, the region has consistently experienced a lower talent retention rate.



Employee size band	Business number	Employment number (thousands) [Note 8]	Turnover (£ millions) [Note 1] [Note 3] [Note 9]	Businesses percentage	Employment percentage	Turnover percentage [Note 1]
All Industries						
All businesses	155,095	728	75,830	*100.0*	*100.0*	*100.0*
All employers	42,455	606	69,996	*27.4*	*83.2*	*92.3*
With no employees (unregistered) [Note 2]	84,795	93	2,686	*54.7*	*12.8*	*3.5*
With no employees (registered) [Note 2][Note 4]	27,845	30	3,147	*18.0*	*4.1*	*4.2*
1	5,115	11	900	*3.3*	*1.5*	*1.2*
2 to 4	21,310	63	5,844	*13.7*	*8.7*	*7.7*
5 to 9	8,100	55	4,533	*5.2*	*7.6*	*6.0*
10 to 19	4,280	59	5,361	*2.8*	*8.1*	*7.1*
20 to 49	2,335	71	6,718	*1.5*	*9.8*	*8.9*
50 to 99	715	49	6,166	*0.5*	*6.7*	*8.1*
100 to 199	320	44	8,162	*0.2*	*6.0*	*10.8*
200 to 249	55	12	1,712	*0.0*	*1.6*	*2.3*
250 to 499	125	44	6,736	*0.1*	*6.0*	*8.9*
500 or more	100	199	23,865	*0.1*	*27.3*	*31.5*

Fig2.2 Northeast Business Population (BEIS, 2022)

Another contributing factor to the low retention rate pertains to the scarcity of skilled occupations, as demonstrated in Figure 2.2. It is evident that a significant portion of businesses within the Northeast region either operates without any employees or maintains a limited workforce (consisting of fewer than 10 employees), underscoring a deficiency in available occupations.

Given the above circumstances, it becomes imperative for the county to proactively nurture the establishment and advancement of skill—intensive occupations through well—targeted initiatives. This entails the creation of conducive incentives and supportive frameworks that facilitate the growth of such occupations. Additionally, the county should prioritize the augmentation of research funding and the elevation of average wages for researchers situated within the Northeast region. Collectively, these measures aim to augment the overall prevalence of high—tech technical positions within the region.

By orchestrating a coherent and collaborative implementation of these strategies, the region can lay the groundwork for a more favourable retention rate, consequently bolstering the capacity to attract and retain top—tier talents.

Another project under the innovate UK, the Northern Accelerator is boosting the North East's economy, creating real—world impact from worldleading research and commercialising innovation.It has been a game changer for commercialization inthe region, developing a thriving innovation ecosystemand significantly increasing the number of spin—outsto 38 in the last five years. The new funding routesand support networks created have led to spin—out business raising over £100 million in this period. Northern Accelerator is a collaboration between Durham, Newcastle, Northumbria, Sunderland and Teesside Universities, supported through Research England's Connecting Capability Fund.

Apart from the above information, given the case study information from Northern accelerator (2020), most of such UKRI funds are centered and successful in the health and life science sectors . for

example, the “Atelerix” from Newcastle university that encapsulated human cells in an alginate gel made from seaweed making them practical, adaptable and easy to store and transport, even at room temperature. And the “Giff ai” using Artificial Intelligence to transform detection of disesases

What can be concluded from innovate UK and UKRI data?

One of the initiatives operating under UK Research and Innovation(UKRI) is the Northern Accelerator, which is making a substantial contribution to the North East's economy by translating world—class research into tangible outcomes and commercializing innovative ideas. This initiative has had a transformative impact on the region's capacity for commercialization, fostering a vibrant innovation ecosystem and significantly amplifying the creation of spin—out ventures – reaching a count of 38 over the past five years. The infusion of new funding channels and the establishment of robust support networks have facilitated these spin—out endeavors, resulting in an aggregate funding of over £100 million during this period. The Northern Accelerator stands as a collaborative endeavor involving Durham, Newcastle, Northumbria, Sunderland, and Teesside Universities, with the backing of Research England's Connecting Capability Fund. (UKRI, 2023)

In addition to the aforementioned details, drawing insights from the case study provided by Northern Accelerator (2020), it becomes evident that a substantial proportion of UKRI funds are concentrated within the health and life science sectors inside the northeast region. For instance, consider "Atelerix" from Newcastle University, a remarkable innovation that encases human cells within an alginate gel derived from seaweed, rendering them practical, adaptable, and viable for storage and transportation, even under ambient conditions. Additionally, there is "Giff AI," which harnesses Artificial Intelligence to revolutionize disease detection processes.

Innovate UK NE/CD Analysis

Row Labels	# of NE applications	Perecentage of all NE	County Durham Applications	CD % of NE applications	CD Sum of actual spend	NE Sum of Actual Spend	CD %
Ageing Society, Health & Nutrition	233	11%	29	12%	£2,710,600	£123,329,000	2%
AI & Data Economy	64	3%	9	14%	£681,676	£4,106,975	17%
Clean Growth & Infrastructure	309	14%	35	11%	£105,900	£207,441,449	0%
Connect	27	1%	1	4%	£28,000	£11,823,468	0%
Global	77	4%	9	12%	£1,018,000	£5,360,072	19%
Innovation Lending	4	0%	1	25%	£272,373	£3,065,303	9%
Investor Portfolio Lending Investment	18	1%	4	22%	£472,651	£2,088,859	23%
Manufacturing, Materials & Mobility	581	26%	103	18%	£13,713,711	£392,579,790	3%
Responsive	862	39%	199	23%	£14,743,645	£50,860,144	29%
Strategy	18	1%	2	11%	£100,000	£401,705	25%
Grand Total	2193	100%	392	18%	£33,846,556	£801,056,765	4%

Fig 3 .1Innovate UK NE/CD Analysis(NE Stands for northeast, CD stands for county Durham)

Key observations were drawn from Figure 3.1 Firstly, it is evident that despite the Northeast region registering a total of 2193 applications, the Durham area's application count remains notably low, comprising only 392 (18%). This discrepancy predominantly reflects an uneven distribution of resources and corresponding regional facilities. Secondly, an analysis reveals that in Durham and the broader Northeast region, most funding applications continue to be concentrated in industries such as Manufacturing and Responsive sectors. Conversely, applications in industries with promising growth prospects, like AI and Data Science, amount to a mere 3%. This aligns with the prior discussion, emphasizing the potential constraints of overreliance on such industries in light of the risk of automation-driven displacement.

These patterns may stem from various factors, including the aforementioned low retention rate and lack of research funding, which consequently hinder the initiation of new ventures in relevant sectors. However, our group's investigation highlighted the scattered and distinct application processes associated with Innovate UK and other funding programs. Consequently, numerous small and medium enterprises struggle to access the requisite application information swiftly.

Table 8: County Durham and North East comparison against overall grants awarded and total value of grants awarded, based on Innovate UK data (2004-September 2018) [10].

Region	Awards	(%) of Total	Total Awarded (£)	(%) of Total
UK	32808	100.00%	£7,327,401,501.00	100.00%
North East	1253	3.82%	£577,125,613.00	7.88%
County Durham	**227**	**0.69%**	**£21,812,077.00**	**0.30%**

Fig 3.2 innovate UK data comparison

As evident from the data illustrated in figure 3.2, Table 8 underscores a startling reality: County Durham's allocation of total grants stands at a mere 0.69%, accompanied by a meager 0.30% share of total funding, amounting to only £21,812,077 over a span of fourteen years. This figure is shockingly low. One possible interpretation for this phenomenon could be linked to the concept of the "headquarter effect." This effect tends to concentrate funding resources within regions hosting corporate head offices and research and development hubs, which are frequently situated in the London and South East England area (Greg , 2019)

In the trajectory of subsequent policy development, the county should prioritize two fundamental strategies. Primarily, a critical imperative exists to fortify the equitable distribution of resources within the geographical confines of the Durham area. After this, a concerted effort should be made to stimulate the emergence and growth of avant-garde technology zones akin to those fostering the advancements in artificial intelligence (AI) and related domains. This endeavor should encompass multifaceted provisions encompassing financial incentives, the establishment of dedicated research institutions, and the essential augmentation of infrastructural requisites. Concurrently, meticulous attention should be devoted to providing more precise frameworks and digital platforms underpinning the gamut of support programs. This strategic overhaul is poised to deliver accessible and comprehensive information conduits, thereby furnishing Small and Medium Enterprises (SMEs) with an amplified prospect of engaging with funding opportunities.

How can the county encourage investment in the region?

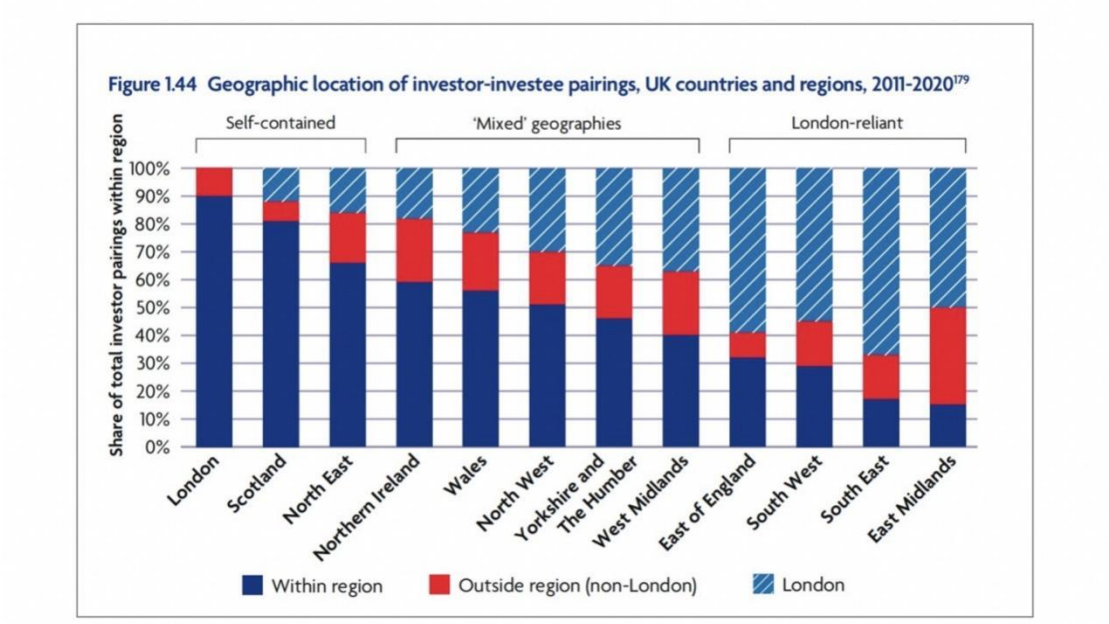


Fig 4. Investor—Investee pairings UK countries and region (Department for Levelling Up, Housing and Communities, 2022)

The analysis depicted in Figure 4 underscores a prevailing trend of investor—investee pairings predominantly occurring within the geographical boundaries of the Northeast region. However, an in—depth examination of prior analyses reveals a less sanguine economic landscape in the Northeast, characterized by a notable reliance on the manufacturing sector. This ongoing emphasis on internal investments bears the potential to further entrench this dependency, consequently exerting constraints on the infusion of financial resources.

As such, a strategic reorientation in future developmental pursuits becomes not only prudent but imperative. This recalibration necessitates a deliberate and expansive outreach beyond established confines. One prospective avenue of pursuit involves the cultivation of collaborative frameworks with neighbouring regions. Through judicious collaborative efforts, the Northeast can proactively extend a welcoming gesture to a diverse cohort of potential investors.

This collaborative paradigm materializes through multifaceted channels, encompassing the provision of instrumental support projects, the orchestration of dynamic exhibitions, and the curation of engaging social events. These strategic endeavours collectively serve as a compelling magnet, drawing investors spanning a spectrum of industries. The ultimate goal is to invigorate and diversify the investment landscape, thereby catalysing a more robust and propitious trajectory for innovation—driven progress within the Northeast region.

How to improve the innovation delivery model

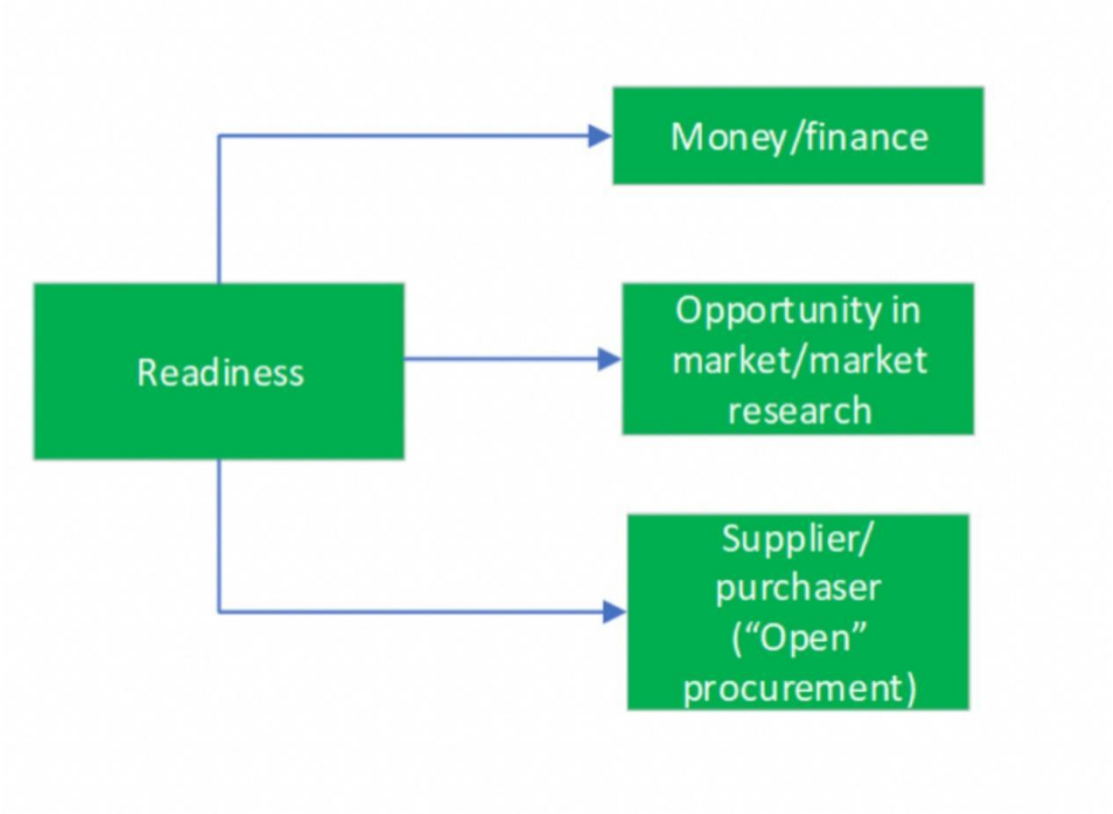


Fig 1.1 Innovation delivery structure from the county

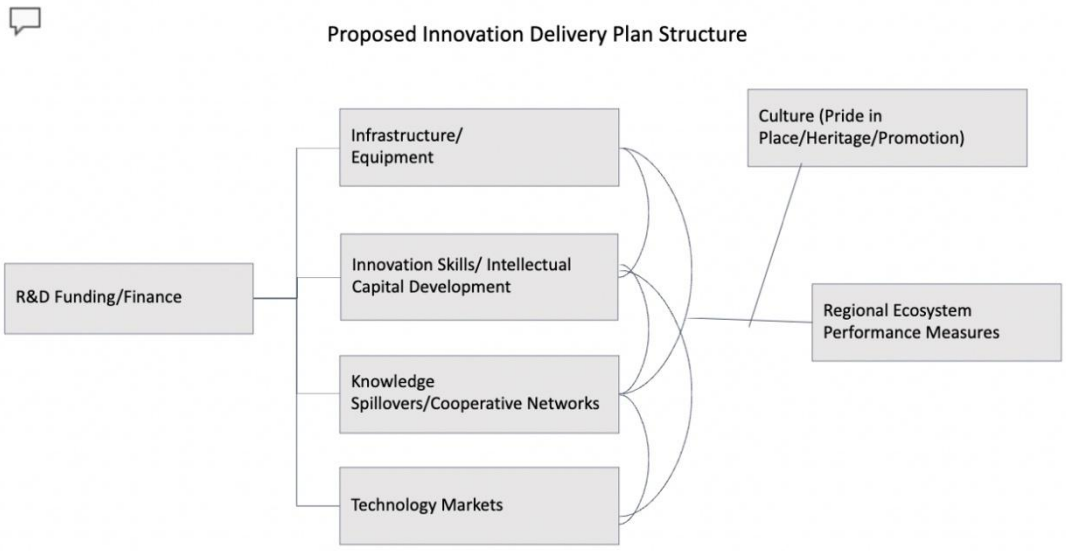


Fig 1.2 Condensed innovation delivery plan

Intellectual Capital Development/Innovation Skills

HUMAN CAPITAL	ORGANIZATIONAL CAPITAL (Firm-Level)	SOCIAL CAPITAL
Educational Attainment Levels	Accumulated Technological Know-How	Inter-organizational networks
Entrepreneurial Mindset	Strategy and Competitive Design	Culture of collaboration
Prior Experience	Manufacturing Processes	Broad networks
Mentorship and Training Access	Information/Data Intelligence	Knowledge Brokers and Connectivity
Creativity, motivation	Value Chain/Configurations	
Net Migration		

Fig1.3 Intellectual capital development/innovation skills

Following an in—depth discussion with team members, it is evident that the current county delivery plan is characterized by a relative degree of simplification. This simplicity raises concerns about potential compromises in its efficacy when confronted with the dynamic and ever—evolving market conditions. To attain a higher degree of success in innovation delivery, it is imperative for the county to provide both internal and external support to small and medium—sized enterprises (SMEs). For instance, elements portrayed in Figure 1.1, such as "money" and "finance," warrant distinct segmentation. Drawing inspiration from Figure 1.2, the county could establish a more comprehensive and mutually reinforcing structure, thereby cultivating a resilient regional ecosystem. This streamlined approach is grounded in the understanding that, despite the favourable impact of financial backing on firms' innovation endeavours, non—monetary support appears to exert a more potent influence on innovation openness than its monetary counterpart (Cano—Kollmann et al., 2016). Furthermore, disentangling these two forms of support mechanisms is often challenging, as they tend to coexist.

As depicted in Figure 1.3, a comprehensive compilation of essential considerations extends from individual and organizational spheres to the broader societal context. To elaborate, recent data from the County Durham Economic Partnership (2022) shows that Durham currently exhibits a 32% attainment rate for individuals possessing NVQ level 4 and above, in contrast to the national average of 42%. This underscores the imperative to enhance educational attainment and cultivate a qualified workforce for pivotal high—tech and research roles that drive innovation.

The amalgamation of these strategic interventions can yield substantial benefits for the trajectory of future innovation. The overarching objective remains resolute in catalyzing sustainable and

progressive innovation within the Northeast region, even after disassociating from the county's initial sponsorship.

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