THE PRODUCTIVITY INSTITUTE

UKRI Economic and Social Research Council

Knowledge Diffusion and Regional Productivity Growth:

Summary of TPI Research Programme 2023-2026

Authors:

Raquel Ortega-Argilés

The University of Manchester

Philip McCann

The University of Manchester

Date:

April 2026

RESEARCH PROGRAMME REPORT

The Productivity Institute

Productivity Insights Paper No. 087

Key words
Knowledge diffusion, R&D, institutional centralisation, innovation, collaboration networks, skills dynamics, value chains, regional policy.

Authors' contacts
raquel.ortega-argiles@manchester.ac.uk
philip.mccann@manchester.ac.uk

Copyright
© R. Ortega-Argilés, P. McCann (2026)

Suggested citation

R. Ortega-Argilés, P. McCann (2026) *Knowledge Diffusion and Regional Productivity Growth: Summary of TPI Research Programme 2023-2026*. Productivity Insights Paper No. 087, The Productivity Institute.

The Productivity Institute is an organisation that works across academia, business and policy to better understand, measure and enable productivity across the UK. It is funded by the Economic and Social Research Council (grant number ES/V002740/1).

The Productivity Institute is headquartered at Alliance Manchester Business School, The University of Manchester, Booth Street West, Manchester, M15 6PB. More information can be found on The Productivity Institute's website. Contact us at theproductivityinstitute@manchester.ac.uk

Abstract

This paper synthesizes findings from the TPI Knowledge Diffusion Research Programme (2023–2026), examining why the UK struggles to translate world leading research strengths into broad-based productivity growth. Despite strong knowledge-generation capabilities and well-constructed competition and regulatory systems, the UK exhibits weak diffusion of knowledge from its most prosperous regions and firms to the rest of the economy. The research highlights structural features, including high regional concentration of R&D, institutional centralisation, and uneven absorptive capacity, that limit the spread of innovation and reinforce interregional disparities. Using novel empirical approaches across multiple studies, the programme demonstrates how relatedness, collaboration networks, skills dynamics, global value-chain shocks, and spatial patterns of public and private R&D investment shape regional innovation outcomes. The findings reaffirm the view that the UK functions as a "hub with no spokes," where knowledge spillovers insufficiently support lagging regions. The programme underscores the need for reoriented industrial and regional policies focused on enhancing diffusion mechanisms, strengthening regional capabilities, and improving the spatial balance of R&D investment.

Contents

1. Knowledge-Diffusion and Productivity Growth

Since the 1980s, the advent of modern knowledge, information and communication technologies (ICT) has transformed all of our lives and our economies, in terms of new ways of working, new forms of business development, new approaches by firms regarding investments in knowledge-related activities, new forms of subcontracting, and new relationships between firms and other knowledge-related institutions such as universities. However, there is still something of a paradox in that it is still often difficult to find evidence of these profound transformations in official productivity data. In 1987, Nobel Laureate Robert Solow (1987) said, "*You can see the computer age everywhere but in the productivity statistics*". Productivity impacts of ICT eventually emerged, especially in service sectors of the economy. However, after more than thirty years, Solow's point still holds when extended to new digital technologies, including artificial intelligence, where we see still little or no obvious increases in productivity growth rates (van Ark, 2016; Wolf 2018; Bloom et al. 2020, Fillipucci et al. 2024; Goldin et al. 2024).

We know that knowledge-generation activities such as R&D foster innovation, and we also know that innovation is central to productivity growth, but the relationships between knowledge-generation, innovation, and productivity growth are nowadays understood as not being linear and instead may exhibit complex interrelationships. During the middle decades of the twentieth century, the dominant assumption was that the links between these features of the economy were indeed largely linear. Moreover, it was also assumed that well-regulated competitive markets of themselves would maximise not only knowledge-generation, but also the ensuing innovation and productivity-generating processes. As such, little explicit thought was given to the nature of the mechanisms driving the links between knowledge, innovation and productivity growth.

In contrast, today we understand that these relationships are indeed complex, and that intervening and mediating influences such as institutions, culture, the structure of the banking system, labour relations, share ownership systems and other influences, all play a role in driving these links, and increasingly research is focusing on the impacts of these types of issues (Lewis, 2020).

These complex relationships give rise to several key features of the modern links between knowledge-generation, innovation, and productivity, which at times appear to be somewhat paradoxical and shape the spatial diffusion patterns of knowledge-related activities.

First, the productivity growth impacts of innovations are often observed in locations which are different from the original location of those innovations. Similarly, innovation often takes place in locations which are different to the original knowledge-generation processes. The reasons for these spatial differences arise variously from the market-mediated effects, including knowledge spillovers, knowledge leakages, clustering, and also investment allocation decisions taken by multi-plant, multi-establishment, and multi-national firms as part of their strategic priorities. As such, the geography of knowledge-generation and innovation may not reflect the geography of productivity growth.

Second, the advent of modern knowledge, information and communications technologies appears to favour specific groups in society. As such, one of the issues where the impacts of

knowledge, information and communications technologies are evident is in terms of the increased partitioning of incomes and wealth on the part of different groups in society, and in many countries, this also appears to be the case in terms of geography and regions.

Although the presence of many of these technologies is ubiquitous, the fact that, in economic terms these new technologies appear to favour specific groups or places over others reflects the characteristics of these new knowledge-based technologies being deployed in what is nowadays referred to as the 'knowledge economy'. The knowledge economy is understood as being the parts of the economy which are dominated by the production and trading of intangibles, whether in the form of knowledge assets or flows of information deriving from knowledge assets.

Over time, the role played by intangibles in the economy appears to be increasing and also changing many aspects of how the economy works. The importance of intangibles in the economy may well increase, also in response to the experience of covid-19 lockdown. In response to the lockdowns, the rate of digitalisation which has been taking place during the last couple of years is currently at some 25 times the pre-pandemic rate (*Financial Times* 2020), and in just the first few months of the covid-19 pandemic, the levels of digitalisation were spurred by a matter of 3-4 years (McKinsey Global Institute, 2020). Increased digitalisation is likely to be disruptive of many existing innovation processes (Neirotti and Pesce 2019), potentially spurring new open-innovation systems and further blurring the boundaries between manufacturing and service innovations (OECD 2018a; Gal, Nicoletti, Renault, Sorbe, and Timiliotis, 2019) as the 'knowledge economy' evolves.

The key features of the 'knowledge economy' and its embodied technologies are argued by Haskel and Westlake (2018) to be characterised by 'the four *Ss*': namely that knowledge is *Scalable*, knowledge incurs *Sunk costs*, knowledge displays *Synergies*, and knowledge provides and benefits from *Spillovers*.

In terms of economic geography, the fact that knowledge is both scalable and exhibits sunk costs is likely to lead to pressure towards the spatial concentration of knowledge activities and investments. These features would be expected to reinforce centripetal forces favouring agglomeration effects and the geographical centralisation of many types of knowledge-related activities. On the other hand, the fact that knowledge also displays both synergies and spillovers could lead to the spatial dispersion of knowledge-related activities depending on how these spillovers and synergies play out.

The shift towards a largely 'weightless' economy (Quah 1999; Varian 2001, 2018) would, on face value, suggest that synergies and spillovers can potentially take place easily between intangible investments and activities across locations, thereby spurring centrifugal forces that encourage the geographical diffusion and dispersion of knowledge. On the other hand, the fact that electronic communication is highly correlated with face-to-face communication (Gaspar and Glaeser 1997) suggests that although intangibles can indeed be traded weightlessly, the advantages of proximity still matter for both tangibles as well as intangibles, thereby enhancing centripetal forces.

In other words, it may be that knowledge-related synergies and spillovers may either help to foster centrifugal forces of knowledge diffusion and dispersion, or they may contribute to even further geographical concentration of knowledge-related activities and investments. The actual

spatial configuration of knowledge-related investments and activities across a country will therefore reflect a balance between these opposing centripetal and centrifugal forces.

2. The UK Knowledge-Diffusion Context and Characteristics

In the UK, the centripetal knowledge-concentrating forces appear to dominate any centrifugal forces of knowledge dispersion to an extent which is not at all typical of most other industrialised economies. At the same time, the UK's ability to translate knowledge-related and research-related investments and activities into productivity-enhancing outcomes also appears to be much less than might be expected, especially when comparing the UK with its peer group of OECD countries. These two observations are somewhat intertwined, and the combined result of these two features is that processes of interregional knowledge diffusion in the UK appear and their associated outcomes in terms of regional patterns of innovation appear to be much less than one would expect. At present, the reasons for these observations are unclear, as are the potential remedial actions that can be taken to address this deficit, but some clues can already be gleaned.

The UK suffers from lower levels of research and development (R&D) investment than many other OECD countries, although the reasons for this are unclear. While it is true that service industries account for a markedly larger share of the UK economy than other countries, and service industries tend to undertake less R&D than manufacturing or science-based industries, other countries with similar industrial structures to the UK, such as The Netherlands, for example, undertake more R&D as a share of their national output than the UK.

There are recent arguments (Haskel et al., 2022) based on tax claims which suggest that the UK's R&D effort is somewhat larger than previously supposed, but a full comparison of the implications of this for the UK within the global knowledge and innovation economy would also require a similar exercise to be undertaken across all OECD countries, something which as yet has not been undertaken. In other words, the structural argument for the UK's R&D deficit is still not entirely convincing.

At the same time, the UK is a world leader in fundamental 'blue skies' types of research, with a world-class university system consistently ranking amongst the very best in the world, and as also reflected in the second highest number of Nobel prizes, and the highest per capita of any country. The UK also has well-constructed competition and regulatory systems. As such, the combination of strong knowledge-generation capabilities allied with competitive market structures might be expected to produce strong knowledge-dissemination and innovation-diffusion processes throughout the economy, which in turn will drive widespread productivity enhancements. However, there is little evidence to support this supposition. Indeed, most of the evidence suggests that there is something of a missing link between the UK's fundamental research and its ability to translate this knowledge into commercial outcomes.

A particular key weakness within the UK economy appears to be associated with the dissemination and diffusion of knowledge from more prosperous places and firms to less

prosperous ones, including a weakness in diffusing global knowledge flows to local economies. As a country, our institutional inability to effectively diffuse ideas (Haldane 2018a) means that we appear to be a 'hub with no spokes' (Haldane 2018b) and the evidence suggests that this paucity of diffusion concerns not only technological, but also managerial and organisational ideas (MGI 2018b).

We know that the UK is differently positioned in international trade networks from other non-resource dominated exporters in that the UK is as far upstream in global supply chains as resource-based exporting countries such as Canada and Australia (OECD 2013). It may therefore be the case that knowledge spillovers operate differently in the case of the UK than in many of our competitor countries and that, in some ways, this contributes to the 'hub no spoke' phenomenon. But this still begs the question as to why this is the case.

One possible explanation, which potentially could be consistent with the observed facts, concerns the issue of local capabilities, and in particular interregional differences in the capabilities of firms and localities to absorb, adapt and transfer knowledge and information from external environments throughout their local economic, business and social networks. Differences in either the levels or types of local capabilities available may act either to facilitate or inhibit knowledge flows and spillovers within and between different parts of the UK economy, and we investigate whether such differences do indeed exist, where, when, and why.

To answer these questions in this research programme, we build on both the knowledge and technological-relatedness and growth-complexity literatures now burgeoning in many countries, but about which we know almost nothing in the UK context. These literatures are underpinned by the principle of common capabilities and they have advocated novel new analytical and empirical techniques for understanding both the positioning and evolutionary trajectories of countries and regions in modern global knowledge and trade networks (Cicerone et al. 2020). Wide-ranging evidence from other countries demonstrates that these relatedness and growth-complexity approaches allow us to identify not only how, but also the specific ways in which, the relationships among local skills, local technologies, local tradeables, local goods and local services all influence the productivity growth processes exhibited by different places. If UK regions are indeed very differently positioned in growth-complexity and relatedness terms, then this may well help unlock much of the productivity puzzle relating to the UK's apparently limited internal knowledge diffusion mechanisms. However, as yet, our knowledge of these issues in the UK context is extremely limited, and indeed it is less than for almost any other advanced economy.

At the same time, public policy responses to addressing these issues have largely foundered, except in the 'Golden Triangle' regions of London and its hinterland. Indeed, the geography of public funding allocations appears, if anything, to have bolstered the already highly skewed geography of UK R&D, with some £4bn of investment in the golden Triangle beyond what would be expected on the basis of the experience of other countries. Forth and Jones (2020) argue that, in comparison to other OECD competitor countries, public research-related investments have been so overly concentrated in the same prosperous regions that they have effectively starved many other public and private sector knowledge-related activities in other regions. Their argument is that a new institutional set-up and new ways of determining research-related funding is required in order to begin to rebalance these issues.

As a result of the Levelling Up agenda, there is now a concerted national effort to address these spatial R&D imbalances, but exactly what the outcomes of this effort will be, and how such a spatial R&D rebalancing can enhance both UK regional and national R&D-productivity outcomes, is still unknown.

The research examines the knowledge-related linkages between private sector firms, and also between UK public and private research institutions and research teams and the market environments in which this research could be commercially applied. The research is conducted also in the light of the evidence arising from previous UK initiatives and also from international comparator countries across the OECD.

3. Research Outcomes

It is important to set out the scene in which this research programme is situated, and both the conceptual and policy-related challenges which these discussions in the UK context face. Over the last three decades, much of the UK policy and governance architecture regarding the design and funding of industrial and regional policies aimed at supporting R&D and its translation into realisable commercialisation opportunities has been a result of earlier and somewhat outdated understandings of the links between knowledge spillovers, economic growth and interregional convergence.

These issues are set out in the first two papers emerging from this workstream (McCann and Ortega-Argilés 2022, 2026). The challenging context facing the UK in terms of knowledge diffusion, and how this relates to challenges facing the logic and design of industrial policy and regional policy, are discussed in detail in McCann and Ortega-Argilés (2022), against the backdrop of a worldwide shifts in our understanding of these issues, as examined by (McCann and Ortega-Argilés 2026).

The first published journal paper emerging from this Knowledge Diffusion research programme is:

McCann, P. and Ortega-Argilés, R., 2022, “Regional Innovation, Industrial Policy and UK Interregional Challenges”, Review of Public Economics- Hacienda Pública Española, 243-(4/2022): 83-100

This paper examines the challenges associated with fostering regional innovation via place-based innovation policies in a context where a country previously had little or no real place-based thinking or policy-framing. The UK displays a combination of both high interregional inequalities and a highly centralisation and top-down governance system. For many years, UK national industrial policy was based on the assumption that knowledge spillover effects from the London economy would naturally diffuse throughout the country as long as the economy was competitive and regulatory mechanisms ensured that would continue to be the case and this assumption was so strongly embedded across institutions as to be rather more of an assertion than an underlying assumption. However, the ‘hub, no spokes’ (Haldane 2018) experience of recent years has cast significant doubt on the veracity of these assumptions-assertions. Recently, there has emerged a growing realisation that these interregional

knowledge-diffusion effects have not happened as was previously expected. This observation, in part, motivates the devolution-related governance reforms aimed at fostering regional development. Yet the over-centralisation of the UK governance system itself militates against this. In this paper, we therefore discuss the economic development and governance-reform challenges associated with a shift towards more devolved policy making, in the specific UK setting of good institutions which are ill-designed for the challenge.

The second published journal paper emerging from the Knowledge Diffusion research programme is:

McCann, P. and Ortega-Argilés, R., 2026, "Technological Change, Knowledge Diffusion and the Growth of Cities and Regions: Analytical, Empirical and Policy-Making Challenges", *Spatial Economic Analysis*, DOI: 10.1080/17421772.2026.2619183

This paper examines how spatial economic analysis within the international research arena over recent decades has considered questions of knowledge generation and knowledge diffusion in urban and regional settings. The aim of the paper is to explain how these issues were understood and analysed in different periods, spanning the postwar era, through to the turn of the New Millennium, and then the aftermath of the 2008 Global Financial Crisis. We then examine how these earlier approaches gave rise to our current understandings and research investigations, and the policy framings and assumptions-assertions evident until very recently, as discussed above. More recently, the post-crisis shocks associated with underlying regime shifts across many OECD countries from regional economic convergence to regional economic divergence have ushered in a new generation of empirical approaches which are reshaping our understanding of how knowledge generation and diffusion relate to cities and regions. These new understandings also increasingly influence the framing of regional policy approaches in which knowledge generation and diffusion increasingly play a central role, but in a manner that is more detailed and focused than in previous eras. These new conceptual and empirical approaches are taken up and deployed in detail throughout the Knowledge-Diffusion research programme.

The third published journal paper emerging from the Knowledge Diffusion research programme is:

McCann, P., Ortega-Argilés, R., Thissen, M. and Hsu, M-W., 2026, "Mercantilist and Protectionist Shocks on Innovation, Growth and Economic Policy in European Regions", *Journal of Evolutionary Economics,* 36.3, https://link.springer.com/article/10.1007/s00191-025-00921-w

This paper assesses the potential innovation and growth implications on UK and European regions of the recent rapid global shifts in political economy towards mercantilism, tariffs, and protectionism. The new trade shocks have the potential to reshape the geography of UK and European innovation, and we examine the likely global value-chain implications on regional innovation in both (science-technology-innovation) STI-driven and (doing-using-interacting) DUI-driven regions using a unique EU-wide regional input–output database. The analyses undertaken here using the EU EUREGIO-FIGARO datasets allow us to incorporate not only the direct demand transmission effects of international trade across European regions, but also the full trade-in-value-added logic, which also includes the indirect effects of GVCs spanning EU regions and non-EU countries. By extrapolating the variance decomposition of the different

possible shocks, we are able to examine the additional implications for interregional trade and GVC-transmission processes arising from uncertainty. Uncertainty can undermine knowledge and knowledge-diffusion processes and we analyse these effects on different types of regions. We demonstrate that both STI-driven and non-STI/DUI-driven regions are exposed in different ways to these trade shocks, and that Europe's territorial innovation, growth, and development challenges are likely to become even more complex in today's global political context, depending on where regions are positioned in global value chains.

In the specific UK context of knowledge diffusion challenges, the fourth journal paper emerging from the Knowledge Diffusion research programme is:

Ortega-Argiles, R. and Yuan, P-Y., 2026, "Do Research Collaborations in R&I Promote Economic Prosperity and Levelling-up? An Analysis of UKRI Funding Between 2004-2021", *Industrial and Corporate Change*, https://doi.org/10.1093/icc/dtag007

This is the first paper to econometrically examine the extent to which public funding of research-related investments in the UK contributes to regional development and the fostering of regional convergence processes. This issue arises against the backdrop of the shifting public perceptions following the UK's 'Levelling Up' agenda, in which there was an explicit mission to significantly increase the share of R&D public support in the regions outside of London and the Greater South East. Yet, whether such a policy is a realistic approach for driving regional development was previously unknown, because this itself depends on how the impacts of publicly funded research play out across the economic development landscape.

The aim of this paper was to assess whether the funding logic and architecture over the last two decades has contributed to regional development and convergence or Levelling Up. To achieve this, the analysis develops a novel multilevel structural equation modelling methodology applied to panel data constructed using social network analysis techniques. This novel methodology then enables us to uncover all direct, indirect, and induced development effects operating both within and between regions, arising as a result of public funding. The analysis uses the UK Research and Innovation (UKRI) repository of funded projects between 2004 and May 2021, involving 25,122 projects and 44,406 participant firms and organisations, and accounting for approximately 32% of the total UK government-supported R&D over the period. The results from the analysis provide new evidence and insights into the regional development effects of different types of knowledge collaborations supported by publicly funded sources. In particular, the results show that the effect of publicly funded research on regional economic development is mediated by the effect of regional private R&D. Second, the evidence shows that private R&D can account only for the effect of public R&D and collaboration on economic development, but not on economic convergence or levelling up. Third, the knowledge-investment transmission mechanisms primarily influence regional economic development via between-region collaborations, rather than intraregional collaborations. Fourth, interregional collaborations also foster regional economic convergence, although this is primarily associated with collaborations with London, as well as having diversified project portfolios.

The fifth journal paper emerging from this Knowledge Diffusion research agenda provides a complementary analysis to the above paper on regional R&D linkages by further extending the analysis to the wider economy. This paper is:

Ma, H., Ortega-Argilés, R., Lyons, M., and Kratena, K., 2026, "Regional R&D Spending, Absorptive Capacity and the Regional Innovation Paradox", *Spatial Economic Analysis*, 1–21. https://doi.org/10.1080/17421772.2026.2635379

This paper examines the implications of the fact that, while we know that innovation and research and development (R&D) investments are central to regional economic growth, in the specific case of the UK, these activities are heavily concentrated in the Greater South East, which receives the majority of public and private R&D spending. This imbalance has contributed to the UK's status as one of the most regionally unequal developed economies. Redistribution of public R&D has been proposed as a key solution, but it also raises questions about whether shifting investment can reduce disparities without undermining national performance. Existing empirical studies offer limited insight into how spatial redistribution affects regional inequalities, particularly when accounting for spillovers and absorptive capacity. This paper fills the gap by using the multi-regional input–output (MRIO) model SEIM-UK (socio-economic impact model for the UK).

The findings reveal that the Greater South East (GSE) experiences disproportionately high benefits due to strong demand multipliers and spillover effects, rather than through productivity gains. Furthermore, absorptive capacity plays a significant role in moderating the relationship between R&D spending and regional outcomes, disproportionately limiting growth in lagging regions. The analysis suggests that an equitable redistribution of R&D investments could promote balanced regional growth without hindering the performance of high-achieving areas like London and the South East. Therefore, enhancing regional innovation systems and addressing constraints in absorptive capacity are essential policy measures to achieve this goal.

Further work on these topics is articulated by the working paper by Ma et al. (2024), the full details of which are:

Ma, H., Ortega-Argiles, R., and Lyons, M., 2024, "UK Levelling Up R&D Mission Effects: A Multi-Region Input Output Approach. (pp. 3-51). Manchester Institute of Innovation Research. mioir.wp.2024-03.pdf

In this paper, the UK implications for regional and national growth associated with different geographical investment patterns of publicly-funded R&D are examined in the light of the recommendations of the 2022 Levelling Up White Paper, aimed at balancing the national economy. The White Paper outlines twelve main "missions" focused on science, technology, and education to achieve this goal. One of these missions aims to increase domestic public Research and Development (R&D) by at least 40% outside the Greater South East (GSE) by 2030. The paper develops three scenarios based on different assumptions about extra R&D allocation.

The analysis considers three alternative ways to implement the UK's R&D levelling-up mission. The first is an equal uplift scenario that raises R&D spending outside the Greater South East by 40%. This preserves existing regional shares in GDP. This scenario expands overall activity but largely maintains current spatial inequalities. The second is a redistributive scenario that channels proportionally more funding to regions with historically low public R&D support. This yields the strongest regional convergence and the most effective levelling-up outcomes. Finally, a third, market-driven scenario allocates new public R&D in line with the geography of

private R&D investment. This maximises efficiency and short-term returns but tends to reinforce pre-existing regional disparities. Using data from UKRI and ONS to determine the current distribution of R&D investment in the UK and then using the multi-regional Socio-Economic Impact Model for the UK, we evaluate our three proposed R&D spending scenarios. Our findings suggest that the regional impact varies significantly across the different proposed scenarios. The scenario that allocates more GERD to areas with previously low funding levels yields the largest effect. On average, output, employment and GVA in regions outside GSE increase by 0.33%, 0.37% and 0.34%, respectively, showing a potentially positive effect on the levelling up of R&D in the country. Our analysis of both internal and external multipliers highlights the importance of investing in regional redistribution. We demonstrate that the GSE is more self-sufficient as it has much higher internal multipliers than the rest of the UK. However, we identified a potential obstacle: the capacity to absorb human capital, which could reduce the expected positive results of a more spatially balanced R&D expenditure across the UK.

Delving even more deeply into specific types of UK knowledge-diffusion processes, the sixth journal paper emerging from this Knowledge Diffusion research agenda is:

Cicerone, G., Losacker, S., and Ortega-Argilés, R., 2026, "Relatedness and Regional Specialization in Green, Digital and Twin Economic Activities: Evidence from the UK", *The Annals of Regional Science,* https://doi.org/10.1007/s00168-025-01445-8

This paper examines the geography and relatedness properties of green, digital, and twin (both green and digital) economic activities across UK local authorities, thereby contributing to debates on whether the two domains are truly synergistic. Using an innovative web based real-time industry classification dataset covering about 200,000 firms, we identify regional specialisations and compute industry-relatedness from firm-level co-occurrence patterns. Spatial mapping and urban scaling analyses reveal interesting patterns. In particular, digital industries tend to concentrate in large urban centres, while green and twin industries are rather more dispersed. Furthermore, regression models show that relatedness in one domain (e.g. green) is positively associated with specialisation in the other (e.g. digital), with twin industries (both green and digital) exerting the strongest mutual influence on both green and digital domains.

These results provide empirical support the notion that capabilities in one domain can facilitate diversification into the other, and that twin activities can act as a bridge linking them. By explicitly identifying activities that are simultaneously green and digital, and by quantifying their relatedness to other industries, this paper offers new insights into the structural interdependencies underpinning the twin transition and its geography in the UK context.

Cicerone, G., P. McCann, and V. Venhorst, 2026, "Disentangling Relatedness: The Complementary Impact of Non-Specialized Related Technologies", *Spatial Economic Analysis* (forthcoming).

This analysis builds on the logic of earlier work (Cicerone et al. 2020). The paper proposes a fundamental and new modification to the Relatedness Index which is so widely used in relatedness research. This new relatedness modification considers the region's whole technological structure, including linkages between technologies in which the region is specialised, along with linkages to technologies in which the region is not specialised. When carefully disentangled, relatedness to technologies in which the region is not ostensibly

specialised are shown to boost diversification into new, or not yet developed, technologies, over and above the positive role of relatedness to technologies where a local specialisation does exist. This phenomenon is more pronounced in high-income regions, and provides the crucial insight that these more varied and complex local linkages help high-productivity regions be so productive.

Further work from the Knowledge Diffusion research programme on the shifting knowledge-diffusion arenas in the European and UK contexts will be published soon.

In the wider European context, the 2026 draft paper by Silvia Rocchetta and Martin Iori entitled "Jumping the Ladder: The Role of Technological Unconventionality and Green Innovation in Shaping Regional Productivity" builds on earlier work (Rocchetta et al., 2026), and explores the productivity growth role played by unconventionality and green innovation across European regions. The regional panel analysis spanning some four decades finds strong evidence that technological unconventionality helps regions to 'jump' up the technological and productivity ladder. While green innovations are also seen to enhance productivity, green investments and technological unconventionality do not reinforce each other.

The 2026 draft paper entitled "Skills Demand and Regional Productivity" by Alexandra Badort, Bernardo Caldarola, Tommaso Ciarli and Sidharth Rony, analyses rapid advancements in technologies, including GPTs, which change the way in which products and services are produced and traded, demanding new skills and tasks. Firms adapt their skill requirements to integrate these technologies and increase productivity in the context of a yet-unexplained productivity slowdown, and the twin-transition. The availability and diversity of skills within firms significantly impact productivity and this suggests that regions that update their skills are more productive, providing a higher number of possible skills-technology-matching combinations, although as yet it is not clear precisely which types of combinations matter the most for productivity. Applying panel data techniques to Lightcast data on 103 million online job advertisements covering EU regions in 10 countries across the period 2014-2020, the analysis finds that skills coherence is negatively associated to changes in labour productivity in the short run, while new, unrelated skills pay off.

In the long run, however, productivity growth is higher for regions with stronger initial knowledge coherence. Regarding digital and green skills, the analysis finds that more digital skills demand is associated to modest short run productivity increases, while regions with higher demand for green skills show lower productivity growth, due to adjustment costs within existing industries. This adverse effect comes particularly from greening industries rather than initially green ones.

Again, in the specific UK context, the ongoing work by Carolin Ioramashvili and Maria Savona, M., 2026, "Labour Market Dynamics, Knowledge Diffusion and Productivity", aims to examine the effect of labour mobility on structural change. In particular, they estimate the effect of geographical mobility of employees on diversification of the local economy, measured as gaining specialisation in new industries. They test the channel of knowledge spillovers by considering the industry mix in sending and receiving regions, and we also test whether structural change is related to productivity growth. Patterns of structural change 1997-2020 are found to change over time, but towards the end of the observation period, the most dynamic regions can be found around London, the South East and South West, already the most prosperous regions. In terms of the emergence of new specialisms. In particular, while there

has been more widespread structural change since 2008, it is still concentrated in the South and Midlands, with less change in the North of England and Scotland.

The various papers from the Knowledge Diffusion research agenda, which are already published in international journals, those which are forthcoming in international journals, and those which are still ongoing and in preparation, demonstrate that Europe, and the UK in particular, have found themselves in very different knowledge-diffusion situations than what was envisaged two or three decades ago. Moreover, in the particular case of the UK's industrial and regional policy architectures, the logics of which, until very recently, were based on knowledge-diffusion thinking from three decades ago, this has been demonstrated not to have served the whole country well. Indeed, on some dimensions, the geographical concentration of publicly funded knowledge-related investments has entrenched, or even exacerbated, these interregional problems. Indeed, prior to the paper by Raquel Ortega-Argilés and Pei-Yu Yuan (Ortega-Argilés and Yuan, 2026), the UK's public R&D-funding institutions were essentially 'flying blind' (HoC, 2026) in that they had no comprehensive knowledge or systematic evidence regarding the regional growth impacts of their own funding activities (HoC, 2026).

The evidence put forward and emerging from these strands of research points to a fundamental need for a serious rethinking of the UK policy logics and architectures as they relate to industrial policy and regional policy. While various strides forward have been made on the basis of the 2025 UK Industrial Strategy and also the 2025 Devolution White Paper, the draft legislation of which is still going though amendments stages of the Houses of Parliament, it is clear that in order to genuinely foster productivity-enhancing Knowledge Diffusion processes across the whole of the UK economy, finding ways to reorientate the policy and institutional settings in manner which genuinely promotes diffusion still remains a major challenge.

References

Badort, A., Caldarola, B., Ciarli, T., and Rony, S., 2026, "Skills Demand and Regional Productivity", Forthcoming

Bloom, N., Jones, C.I., Van Reenen, J. and Webb, M. (2020) 'Are ideas getting harder to find?', *American Economic Review*, 110(4), pp. 1104–1144. doi: 10.1257/aer.20180338.

Cicerone, G., McCann, P., and Venhorst, V., 2020, "Promoting Regional Growth and Innovation: Relatedness, Revealed Comparative Advantage and the Product Space", *Journal of Economic Geography*, 20.1, 293-316

Cicerone, G., McCann, P., and Venhorst, V., 2026, "Disentangling Relatedness: the Complementary Impact of Non-Specialized Related Technologies", *Spatial Economic Analysis*, Forthcoming

Cicerone, G., Losacker, S., and Ortega-Argilés, R., 2026, "Relatedness and Regional Specialization in Green, Digital and Twin Economic Activities: Evidence from the UK", *The Annals of Regional Science,* https://doi.org/10.1007/s00168-025-01445-8

Filippucci, F., P. Gal and M. Schief, 2024, "Miracle or Myth? Assessing the Macroeconomic Productivity Gains from Artificial Intelligence", OECD Artificial Intelligence Papers, No. 29, OECD Publishing, Paris, https://doi.org/10.1787/b524a072-en

Financial Times, 2020, "5G-Powered Automation Will Transform Work for the Better, 11 November

Gal, P., Nicoletti, G., Renault, T., Sorbe, S. and Timiliotis, C., 2019, "Digitalisation and Productivity: in Search of the Holy Grail – Firm-Level Empirical Evidence from EU countries", *OECD Economics Department Working Papers,* 1533, OECD Publishing, Paris

Gaspar, G. and Glaeser, E., 1997, "Information Technology and the Future of Cities", *Journal of Urban Economics,* 45.1, 136-156

Goldin, I., P. Koutroumpis, F. Lafond, and J. Winkler, 2024, "Why Is Productivity Slowing Down?", *Journal of Economic Literature* 62 (1): 196–268.

Goodridge, P., and Haskel, J., 2022, "Accounting for the Slowdown in UK Innovation and Productivity", Working Paper No. 022, The Productivity Institute, Manchester

Goodridge, P., Haskel, J., and Edquist, H., 2021, **"**We See Data Everywhere Except in the Productivity Statistics", *The Review of Income and Wealth*

Haldane, A., 2018, "The UK's Productivity Problem: Hub No Spokes", Speech by Andy Haldane, Academy of Social Sciences Annual Lecture, London, 28 June, See: https://www.bankofengland.co.uk/speech/2018/andy-haldane-academy-of-social-sciences-annual-lecture-2018

Haskel, J. and Westlake, S., 2018, *Capitalism Without Capital: The Rise of the Intangible Economy,* Princeton University Press, Princeton, NJ.

HoC, 2026, Flying Blind: Innovation, Growth and the Regions: Third Report of Session 2024–26 HC 538 HC 538, House of Commons Library, Westminster, 13 March

Ioramashvili, C., and Savona, M., 2026, "Labour Market Dynamics, Knowledge Diffusion and Productivity", Forthcoming

Ma, H., Ortega-Argiles, R., and Lyons, M., 2024, "UK Levelling Up R&D Mission Effects: A Multi-Region Input Output Approach. (pp. 3-51). Manchester Institute of Innovation Research. mioir.wp.2024-03.pdf

Ma, H., Ortega-Argilés, R., Lyons, M., and Kratena, K., 2026, "Regional R&D Spending, Absorptive Capacity and the Regional Innovation Paradox", *Spatial Economic Analysis*, 1–21. https://doi.org/10.1080/17421772.2026.2635379

McCann, P. and Ortega-Argilés, R., 2022, "Regional Innovation, Industrial Policy and UK Interregional Challenges", *Review of Public Economics- Hacienda Pública Española,* 243-(4/2022): 83-100 04_243_04_2022_McCann_Ortega-Argilés (hpe-rpe.org)

McCann, P. and Ortega-Argilés, R., 2026, "Technological Change, Knowledge Diffusion and the Growth of Cities and Regions: Analytical, Empirical and Policy-Making Challenges", *Spatial Economic Analysis*, DOI: 10.1080/17421772.2026.2619183

McCann, P., Ortega-Argilés, R., Thissen, M. and Hsu, M-W., 2026, "Mercantilist and Protectionist Shocks on Innovation, Growth and Economic Policy in European Regions", *Journal of Evolutionary Economics,* 36.3, https://link.springer.com/article/10.1007/s00191-025-00921-w

MGI 2018, Solving the United Kingdom's Productivity Puzzle in a Digital Age, McKinsey Global Institute

McKinsey Global Institute (2020) "How COVID-19 has Pushed Companies over the Technology Tipping Point—And Transformed Business Forever", See: https://www.mckinsey.com/

Neirotti, P., and Pesce, D., 2019, "ICT-based Innovation and its Competitive Outcome: The Role of Information Intensity", *European Journal of Innovation Management*, 22.2, 383-404

OECD, 2013, *Interconnected Economies: Benefitting from Global Value-Chains*, Organisation for Economic Growth and Development, Paris

OECD, 2018, *OECD Science, Technology and Innovation Outlook 2008: Adapting to technological and societal disruption*, OECD Publishing, Paris. https://read.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-innovation-outlook-2018_sti_in_outlook-2018-en#page3

Ortega-Argiles, R. and Yuan, P-Y., 2026, “Do Research Collaborations in R&I Promote Economic Prosperity and Levelling-up? An Analysis of UKRI Funding Between 2004-2021”, *Industrial and Corporate Change*, https://doi.org/10.1093/icc/dtag007

Quah, D. (1999) The Weightless Economy in Economic Development, Oxford University Press, Oxford

Rocchetta, S. and Iori, M., 2026, “Jumping the Ladder: the Role of Technological Unconventionality and Green Innovation in Shaping Regional Productivity”, Forthcoming

Rocchetta, S., Iori, M., Mina, A., and Gillanders, R., 2026, “Technological Diversification and the Growth of Regions in the Short and Long Run”, *Research Policy*, Forthcoming

Solow, R.M., 1987, ‘We’d Better Watch Out”, *New York Times Book Review,* 12 July, 36

van Ark, B., 2016, “The Productivity Paradox of the New Digital Economy”, *International Productivity Monitor*, (31), 1-15. http://www.csls.ca/ipm/31/vanark.pdf

Varian, H.R., 2001, “The Economics of Information Technology”, University of California, Berkeley. https://people.ischool.berkeley.edu/~hal/Papers/mattioli/mattioli.pdf

Varian, H.R., 2018, “Artificial Intelligence, Economics, and Industrial Organisation”, *NBER Working Paper 24839,* Cambridge MA

Wolf, M., 2018, “The Long Wait for a Productivity Resurgence”, *Financial Times,* 12 June