INSTITUTE FOR INDUSTRIAL STRATEGY

KING'S College LONDON

Gearing up for digital transformation

How the UK Digital Strategy can underpin productivity growth

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Executive summary

The UK Government's Industrial Strategy White Paper has emphasised the important role that digital technologies have in boosting productivity growth. Indeed, as technology evolves, going down the arduous path of digitalisation is not an option to address the long-standing slowdown in the UK's productivity growth.

This report outlines the existence of a 'digital divide' in the British economy. The country is performing well in technology creation, driven by a world-leading digital sector. On the other hand, it shows ample gaps in technology adoption, especially among small and medium-sized enterprises (SMEs). In our discussion, we introduce two definitions, i.e. *technology creation capacity* and *technology adoption capacity*, to identify the specific abilities that businesses require to create and adopt new technology. We believe this distinction will help clarify the nature of the digital divide, and inform policymakers of the specific measures to pursue in order to reduce this gap.

Building on the legacy of the Government's UK Digital Strategy 2017, this report proposes five policy recommendations that aim to build consensus and coordination across Government on the definition and implementation of a roadmap towards digital transformation. In so doing, the UK Digital Strategy can help reduce the existing gap between technology creation capacity and technology adoption capacity, and increase the contribution of late adopters to productivity growth.

Key policy recommendations

- Promote Digital Change Leadership projects to foster digital culture in UK businesses.

- Support existing public or private intermediary platforms to facilitate networking, while ensuring transparency and responsible communication.

- Introduce tailored digitalisation and growth programmes for businesses with different degrees of digital maturity.

- Facilitate access to funding, ensuring clarity among available funding schemes and adapting the application procedures to the new technology.

- Adapt regulatory frameworks in accordance with public policy objectives to encourage technology adoption.

Gearing up for digital transformation

1. Introduction

There is broad consensus among policymakers, academics, and even business leaders, on the pivotal role of advanced digital technologies (ADTs), such as artificial intelligence (AI), machine learning, big data analytics, and the Internet of Things (IoT), in underpinning innovation and improving productivity growth. Indeed, the use of ADTs is creating a spate of thriving businesses across the economy, not only in the digital sector, including manufacturing and service companies that *"capture, transmit and display data and information electronically"*[1], but also in other digitally-enabled sectors characterised by a high concentration of technology[2].

Despite this general enthusiasm, much less attention is usually paid to the overwhelming majority of companies that currently lack the capacity to tap into this digital revolution. So, rather than being a source of opportunities, ADTs can increase the market power of early adopters, pushing the top end of the productivity distribution even further away from the large base of underperforming companies. For this reason, a policy initiative is urgently needed to increase the rate of technology adoption and unleash the untapped potential of digitalisation.

This report aims to rekindle debate over the implementation of a digital strategy for the UK. In so doing, we build on the Government's UK Digital Strategy, which has never really come out of the starting blocks since its publication in 2017. This report calls for greater effort on a cross-departmental and comprehensive digital strategy, embracing all the key levers for a digitally-enabled society, as discussed in the next sections. Within the strategy, we recommend special attention be given to establishing an institutional structure that facilitates collaboration and open innovation within and across sectors. We expect this to help increase technology adoption among UK businesses and to boost productivity growth.

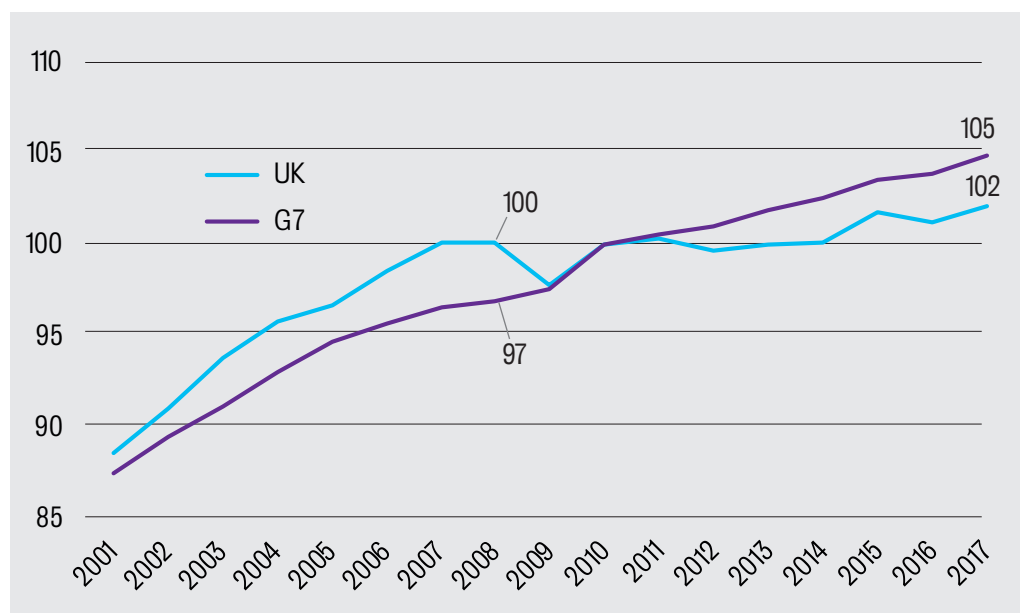## 2. The UK's productivity slowdown masks a widening distribution of productivity across regions and sectors

The publication of the Industrial Strategy White Paper in November 2017 responded to the long-standing debate on the slowdown in UK productivity growth and proposed a blueprint for addressing this challenge. Ten years after the global financial crisis, the level of labour productivity is 3 per cent lower in the UK than in other G7 countries, reversing the position in the years just before the crisis (Figure 1). This is mostly due to what Andy Haldane, Chief Economist at the Bank of England, would call *"a tale (tail) of two companies: a small set in the upper tail gazelling along the productivity high road and a much larger set in the lower tail snailing along the low road"*[3].

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1 We use the definition published by the Office for National Statistics, in ONS (2015). What defines the Digital Sector?, 8 October 2015. London: Office for National Statistics.
2 Tech Nation Report (2018) defines these thriving businesses as "high growth firms", characterised by one of the following conditions: "1) Completed an MBO, 2) Graduated from an accelerator, 3) Hit the OECD scaleup criteria, and 4) secured equity investment"
3 Haldane, A. The UK's Productivity Problem: Hub No Spokes speech, 28 June 2018.

Source: OECD (2019), GDP per hour worked (indicator). doi: 10.1787/1439e590-en (Accessed on 28 February 2019)

From a policy perspective, it is crucial to identify common patterns and specific aspects across regions and sectors that explain the productivity slowdown. Despite the widespread nature of the productivity growth shortfall[4], a number of studies report that regions and sectors have played a different role in the productivity puzzle.

In the last decade, the gap between the most and least productive regions has widened and is now one of the largest in the OECD[5]. In 2017, London is still solidly positioned at the top of the regional productivity distribution with a level of labour productivity 33 per cent higher than UK average (Figure 2). More broadly, regions outside the Wider South East of England still lag behind and struggle to catch up with the national average and with productivity levels of the other G7 countries.

Although the slowdown cuts across a broad range of sectors, some of them have had a greater impact on the UK's low productivity growth than others[6]. A recent ESCoE discussion paper highlights that the slowdown is largely dependent on the reduction of productivity growth in a number of sectors that registered positive trends before the crisis – namely, high skilled services, such as finance, insurance, information and communications technology (ICT), professional and scientific services, and manufacturing[7]. These sectors account for 80 per cent of the labour productivity growth gap between 2011 and 2015, and 35 per cent of market sector value added.

4   McKinsey Global Institute (2018). Solving the United Kingdom's productivity puzzle in a digital age. London: McKinsey & Company.

5   Gal, P. & Egeland, J. (2018). Reducing regional disparities in productivity in the United Kingdom, OECD Economics Department Working Papers, No. 1456, Paris: OECD Publishing.

6   Aradanaz-Badia, A., Awano, G., & Wales, P. (2017). Understanding firms in the bottom 10% of the labour productivity distribution in Great Britain:"the laggards", 2003 to 2015. London: Office for National Statistics.

7   Riley, R., Rincon-Aznar, A., & Samek, L. (2018). Below the aggregate: a sectoral account of the UK productivity puzzle. London: Economics Statistics Centre of Excellence Discussion Paper 2018, 6.

Age and size of the firm are responsible for differences within sectors, with small and young businesses representing the majority of firms in the lower tail of the productivity distribution[8].
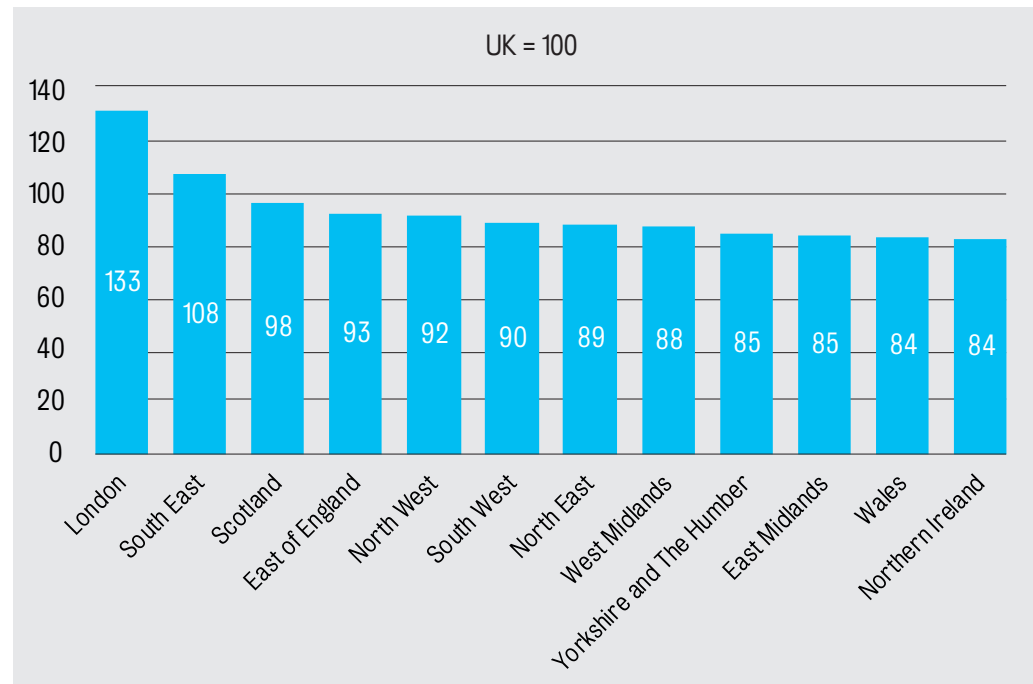
Source: Office for National Statistics (2017)

A report from McKinsey Global Institute, *Solving the United Kingdom's Productivity Puzzle in a Digital Age*[9], explains the long tail of underperforming companies as a consequence of weak capital investment and, relatedly, of delayed introduction of digitalisation compared to other advanced economies, such as Germany and France. This is consistent with the common explanation of the UK's low productivity growth, according to which the country was experiencing structural weaknesses since before the crisis.

3. The UK must bet on a digital strategy to boost productivity growth

The UK has a flourishing, world-leading digital sector, but it struggles to spread the benefits in terms of technology adoption and digital capacity across the economy. The delayed adoption of new technologies increases the risk of widening the gap between fast-growing and lagging sectors, between early adopters and late adopters, holding back productivity growth.

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8   Aradanaz-Badia, A., Awano, G., & Wales, P. (2017). Understanding firms in the bottom 10% of the labour productivity distribution in Great Britain: "the laggards", 2003 to 2015. London: Office for National Statistics.
9   McKinsey Global Institute (2018). Solving the United Kingdom's Productivity Puzzle in a Digital Age. London: McKinsey & Company.
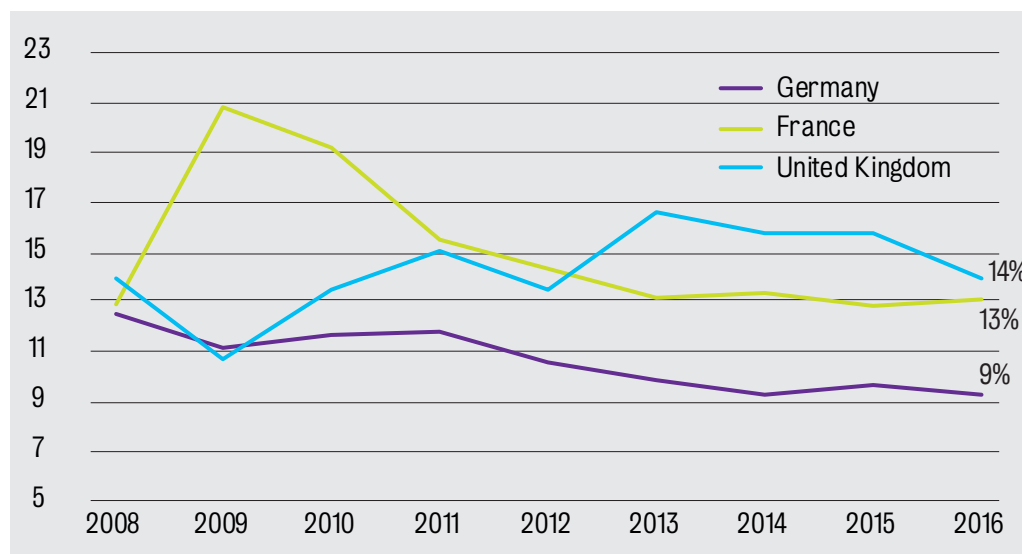
Source: Eurostat (data accessed on 4 March 2019) Note: Birth rate is calculated as the number of enterprise births in the reference period (t) divided by the number of enterprises active in t - percentage

Indeed, the UK's digital sector is growing at more than double the rate of the economy as a whole, driving entrepreneurship, employment and investment across the country. According to the Tech Nation Report 2018[10], the turnover of the digital sector increased by 4.5 per cent in 2017, compared with a 1.7 per cent rise in GDP. Employment rose by 13.2 per cent between 2014 and 2017, generating more productive and better paid jobs than the wider economy. The business ecosystem is also thriving and growing faster than other European countries (Figure 3), with an average birth rate of over 20 per cent between 2010 and 2015. In 2017, the digital sector generated a record £4.5bn in venture capital investment, almost double that generated the previous year[11].

Although the UK's digital sector is booming and pushing the frontier of technological development, the pace of digital adoption still lags behind other advanced economies. The UK ranks 7th out of the 28 EU Member States for its digital performance, according to the Digital Economy and Society Index (2018). Evidence on UK businesses shows wide adoption of most basic digital technology, including internet access, social media and cloud computing. However, they perform poorly in the integration of digital technology in some core business processes, such as enterprise resource planning, customer relationship management and supply chain management[12]. There are also significant gaps in the adoption of next-generation ADTs, like the Internet of Things (IoT), robotics and artificial intelligence (AI). Compared with the 2017 global share, UK businesses invested 12 per cent less in IoT and 8 per cent less in AI[13]. According to the 2017 World Robot Statistics, published by the International Federation of Robotics, the UK ranks 22nd for its robot density

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10 Tech Nation (2018). Tech Nation Report. London: Tech Nation.
11 https://www.ft.com/content/401955c2-58f1-11e8-bdb7-f6677d2e1ce8 (last accessed 18th March 2019)
12 https://ifr.org/ifr-press-releases/news/robot-density-rises-globally (last accessed 20th March 2019)
13 McKinsey Global Institute (2018). Solving the United Kingdom's Productivity Puzzle in a Digital Age. London: McKinsey & Company.

– a measure of the number of robots per 10,000 employees – with 71 units, which is below the global average of 74[14].

This aggregated overview masks a more nuanced approach to the adoption of ADTs across and within sectors, recalling Andy Haldane's *"tale of two companies"*, with early adopters clearly gaining the most from digitalisation. Based on the reclassification of these two groups of companies into *"Pioneers"* and *"Followers"*, the CBI survey *Embracing Digital in Every Sector* finds that the pace of adoption is different across sectors[15]. 70 per cent of companies in the technology sector define themselves as pioneers, compared to only 17 per cent of manufacturers, and only 19 per cent of companies in financial and professional service sectors. At the same time, the share of followers is highest among manufacturers (48 per cent), followed by the financial service sector (37 per cent) and the tech sector (17 per cent).

The discussion above highlights the existence of a 'digital divide' in the British economy. The country is performing well in technology creation, driven by a world-leading digital sector. On the other hand, it shows ample gaps in technology adoption, especially among small and medium-sized enterprises (SMEs)[16]. The lag in the adoption of ADTs suggests that the majority of UK businesses are still stuck in traditional business models, impeding cost reduction and thus holding back overall productivity growth.

The capacity of the UK to accumulate cutting-edge knowledge and technology is evident. Yet, the country is currently unable to unleash this potential within the rest of the economy, jeopardising competition as a result of higher market concentration, and thus leading to a widening productivity distribution. Through the implementation of a digital strategy, Government has a critical role in increasing adoption capacity among UK businesses and boosting productivity growth.

14 https://ifr.org/ifr-press-releases/news/robot-density-rises-globally (last accessed 20th March 2019)
15 CBI Survey (2016). Embracing Digital in Every Sector. London: CBI.
16 Industrial Digitalisation Review (2017). Interim Report, 6 July 2017.

Box 3.1 Spreading London's economic value through digital technologies

London's Tech City extends over the areas around Old Street, Hoxton and Shoreditch in East London. Once home to firms specialising in traditional manufacturing sectors, such as furniture, textiles and jewellery, the areas experienced dramatic deindustrialisation in the second half of the twentieth century[17]. This precipitated a *renaissance* of the whole area, driven by the expansion of professional business services and creative industries. Building on this long-standing heritage, London's Tech City grew exponentially after the turn of the century, becoming a centre of cutting-edge technology and innovation[18]. Today, London's Tech City absorbs about 29 per cent employment in high-tech services in Britain (Figure B.1) and is a world-leading cluster of technology firms, i.e. the Silicon Roundabout. In 2018, the cluster was the third global start-up ecosystem and the second most globally connected tech cluster after Silicon Valley[19].

Between December 2018 and March 2019, we talked with members of the London tech sector and the manufacturing sector in the North West, to collect information on the challenges and opportunities associated with connections between London and the regions. The aim of the study was to analyse whether the use of digital technologies is enabling stronger connections between London and the regions, and whether this is contributing to the transformation of supply chains in the rest of the country.

Value

London's economy is composed of a melting pot of specialisms, including finance, Information and Communications Technologies (ICTs), knowledge-intensive services, creative industries, and much more. These sectors are usually organised within business agglomerations, i.e. clusters characterised by the co-location of interconnected businesses and associated institutions. The presence of a diverse and concentrated industrial base generates a critical mass in skills, services, knowledge and institutions, which underpin innovation and economic competitiveness.

A closer look at the sub-sectors with a significant "Science and Technology" element shows that between 2003 and 2013, the number of jobs in these industries rose by 14.6 per cent in London alone, with the Digital technology sub-category experiencing the fastest proportional growth in employee job numbers (up 29 per cent)[20]. Technological developments span across a wide range of sectors, including manufacturing, with businesses specialising in 3D printing, automation and the Industrial Internet of Things, and financial, medical and environmental technology.

17 Nathan, M., Vandore, E., & Voss, G. (2018). Spatial Imaginaries and Tech Cities: Place-branding East London's digital economy. Journal of Economic Geography, 19(2): 409-432.

18 https://www.tech.london/news/a-short-history-of-tech-city (last accessed 22nd March 2019)

19 Tech Nation (2018). Tech Nation Report. London: Tech Nation.

20 The "Science and Technology" category includes: Digital technologies; Life sciences and healthcare; Publishing and broadcasting; Other scientific/technological manufacture; and Other scientific/technological services. Data and definitions are taken from Douglass, G. & Hoffman, J. (2015). The science and technology category in London. London: GLA Economics.

FIGURE B.1:
CONCENTRATION OF HIGH-TECH SERVICES IN BRITAIN BY LOCATION QUOTIENT

Concentration by location quotient
- High
- Medium-high
- Low
- Very low
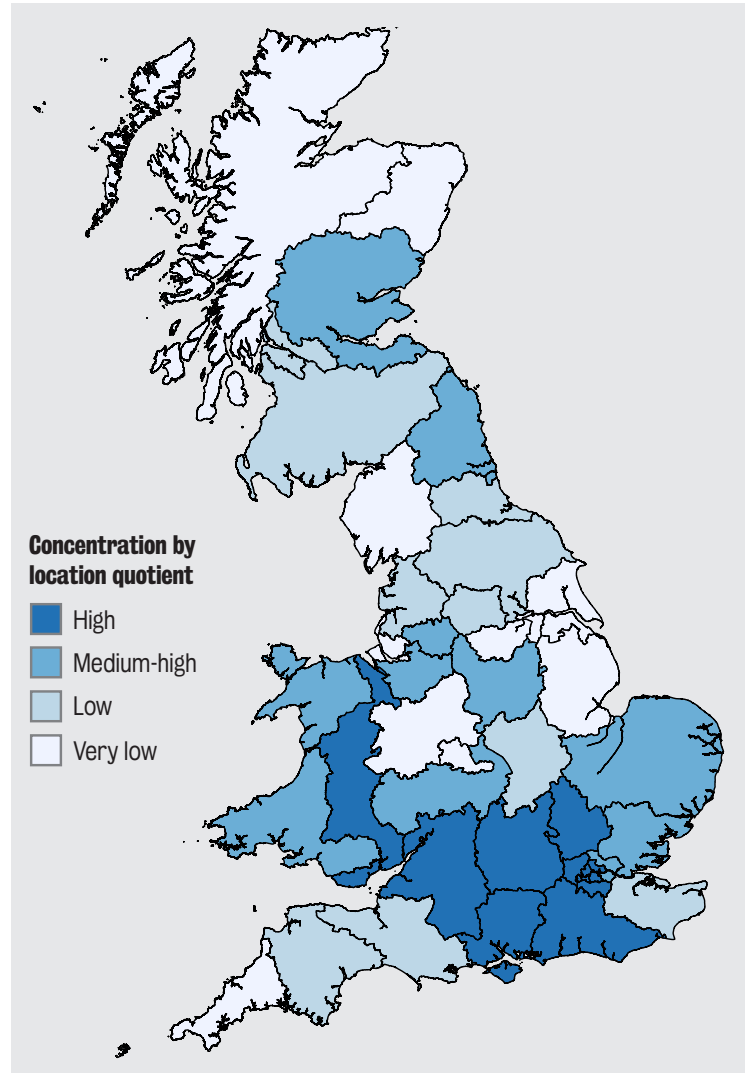
Source: Author's elaboration using Business Register and Employment Survey 2017 (NOMIS)

As can be seen from this overview, London's tech industry can generate significant economic value for the wider economy, driven by the concentration of science and tech expertise across businesses and other outstanding higher education and research facilities. For this reason, promoting stronger supply chain linkages between London and other regions of the UK has the potential to disseminate knowledge and drive innovation and growth across the country.

Challenge

Despite the ease of generating and transmitting information through the use of digital technologies, proximity still plays a key role in facilitating relationships along the supply chain. UK businesses located in the regions encounter some hurdles in interacting with London's tech companies, which make distant supply chain linkages more difficult to establish.

We identify three types of distance that particularly affect relationships

between London and the regions. First, *geographical distance* curtails intense and complex forms of communication, such as face-to-face interaction and context-specific language, that are crucial to disseminate knowledge and carry out scientific research. Second, respondents have described the presence of a "regional divide" across the country, emphasising the diversity and, in some cases, the rivalry between London and the regions (*cultural distance*). This is largely dependent on long-standing spatial economic imbalance and unsuccessful attempts to devolve decision-making power to the regions. The third type of distance refers to the lack of mutual understanding between London's technology offer and the needs of businesses along the supply chain (*cognitive distance*). This can depend on both the different level of digital maturity between these two sub-sets of companies and on the lack of awareness concerning the variety of technologies produced in London and how they can relate to other UK businesses.

Action

We encourage the Greater London Authority to engage with the regions, and in so doing, to reduce the distance constraint. In this regard, we propose two types of actions that look to create opportunities for interregional linkages between London's tech sector and other UK supply chains. This has huge potential in terms of knowledge and technology dissemination across the country, enabling the upgrading of supply chains and generating productivity gains in the wider economy.

The first action regards the organisation of a "London-for-the-UK" campaign, whose purpose is to inform the public about how London can contribute to regional economies, and more specifically, to increase awareness of the range of technologies produced in the capital. This can involve, for instance, TV advertisements promoting examples of collaboration between London and the regions, as well as exhibitions across the country in collaboration with the Catapult centres and London's tech sector, to give a real-life demonstration of the possible applications of technologies along the supply chain.

Second, we recommend a roundtable with the regions to explore any opportunities for interregional collaboration in common areas of interest. Among these, we encourage further discussion on the development of local digital strategies as an addendum to the local industrial strategy, and on the creation of partnerships within a strategic plan of investments in physical and digital infrastructure.

4. The UK's digital strategy should support technology creation capacity and improve technology adoption capacity to gain from digitalisation

ADTs are transforming the economy in radical ways, creating new businesses, renewing production and organisational models, and opening up new opportunities for networking and collaboration within and across sectors. The transformative power of ADTs derives from their ability to integrate the physical and digital worlds through cyclical exchange of data and information, redesigning the traditional process of making things and providing services. A whole range of new applications – for instance, in manufacturing, distribution, and logistics – can emerge from this physical-digital convergence. Indeed, the application of ADTs is multidisciplinary, as it cuts across many sectors, enabling connections between distant knowledge bases.

If it is true that digital transformation is broadening technological opportunity – that is, the possibility to trigger technological progress across a wide range of sectors[21] – it also comes with enormous challenges for companies. To benefit from ADTs, companies are forced to embrace a new organisational, digitally-oriented culture and to adapt their business models, not least with respect to increasing mass customisation and demand for enhanced services[22].

Based on this overview of the challenges and opportunities driven by digitalisation, this report introduces a fundamental distinction between the two objectives that a digital strategy should achieve to generate productivity gains from the use of ADTs: first, the capacity to design and develop new ADTs (*technology creation capacity*); and second, the capacity to integrate the technology in the operations of each company (*technology adoption capacity*).

Technology creation capacity is based on the ability of the company to[23]:

1. Engage with customers, suppliers and other strategic partners (e.g. universities, innovation centres) to enable collaboration and open innovation.

2. Explore internal (e.g. R&D unit, employees' technical competencies) and external sources of knowledge (e.g. scientific research), and transform them to generate new knowledge.

3. Apply new knowledge to the creation of technologically superior products through the use of highly-technical competencies and state-of-the-art technologies[24].

21 Nieto, M., & Quevedo, P. (2005). Absorptive capacity, technological opportunity, knowledge spillovers, and innovative effort. Technovation, 25(10), 1141-1157

22 Maier, J. (2017). Made Smarter. Review 2017. London: Department for Business, Energy and Industrial Strategy.

23 Santoro, G., Vrontis, D., Thrassou, A., & Dezi, L. (2018). The Internet of Things: Building a knowledge management system for open innovation and knowledge management capacity. Technological Forecasting and Social Change, 136, 347-354.

24 Tzokas, N., Kim, Y. A., Akbar, H., & Al-Dajani, H. (2015). Absorptive capacity and performance: The role of customer relationship and technological capabilities in high-tech SMEs. Industrial Marketing Management, 47, 134-142.

ADTs open up a whole new range of opportunities for companies to create knowledge and, potentially, to turn that knowledge into commercial innovation. Enhanced connectivity between diverse actors enables knowledge exchange and collaboration on a broader scale, supporting greater openness in innovation processes through the participation of customers, suppliers and other strategic partners in the joint creation and capture of value[25]. In this "open innovation scenario", technology creation capacity is increasingly dependent on the ability of the company to manage internal and external knowledge, and to apply it to the design and development of a new technology[26].

Local Motors, a car company based in Arizona, is an example of co-creative design and development in an open innovation scenario. The company has implemented a complex architecture of online platforms to involve external partners, including designers, customers and suppliers, into its process of value creation[27]:

> *"The strategic architecture of the Local Motors enterprise includes, for example, an automotive product design platform for a community of over 5,000 amateur designers worldwide (…) an open supply chain platform in which any supplier of components, parts, or sub-assemblies can participate (…) an online website, where the conventional "after-market" is now an open "in-market" through which any supplier can offer accessories for a particular automobile. Then there is the micro-factory with a car-building platform where the customer can be lead builder (…)."*
>
> *Ramaswamy and Ozcan (2013: 5)*

Digital transformation is also disruptive for companies, forcing them to transform organisational structure and operational procedures and adapt them to the new technology. To accomplish these changes, each company has to undergo a process of restructuring, involving *"preparation for change, adoption of change and institutionalization of change by embedding new modifications into the organizational norms"*[28]. Drawing on this description of organisational change, we refer to technology adoption capacity as to the ability of the company to:

1. Assess its current position in terms of digital transformation.

2. Identify potential areas which could benefit from the introduction of a new technology.

3. Explore the market for solutions that meet the company's needs.

4. Integrate the new technology into its business model, adapting organisational structures, operating procedures, corporate culture, and skill sets.

25 Kortmann, S., & Piller, F. (2016). Open business models and closed-loop value chains: Redefining the firm-consumer relationship. California Management Review, 58(3), 88-108.

26 An open innovation scenario *"assumes that firms can and should use external ideas as well as internal ideas and internal and external paths to market, as the firms look to advance their technology"*, in Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). (2006). Open innovation: Researching a new paradigm. Oxford University Press on Demand, p. 1

27 Ramaswamy, V., & Ozcan, K. (2013). Strategy and co-creation thinking. Strategy & Leadership, 41(6), 5-10.

28 Rusly, F. H., Corner, J. L., & Sun, P. (2012). Positioning change readiness in knowledge management research. Journal of Knowledge Management, 16(2), 329-355.

As discussed in the previous sections, evidence on the extent of technological development in the UK suggests a high level of technology creation capacity, thanks to the presence of a highly competitive digital sector and of supportive institutions, including the Catapult centres. On the other hand, the UK's private sector shows extensive weaknesses in terms of technology adoption capacity. For this reason, this report calls for an immediate and concrete policy response from Government to design and implement a digital strategy that sustains technology creation capacity and improves technology adoption capacity. The economic impact of this would be huge. An Oxford Economics report estimates a £92bn contribution to the economy by unleashing the digital potential of British companies[29].

5. To enable wider digitalisation, the UK's digital strategy must build technology capacity and create enabling institutions

A coherent and robust approach to digital transformation is crucial to boost technology creation and close the technology adoption gap. To do so, Government should commit to designing and implementing a digital strategy that brings direction and guidance to the country's digital agenda and develops a shared sense of purpose across departments. The strategy should identify the key areas of intervention for a digitally-enabled society, addressing existing barriers – including the lack of efficient and affordable infrastructure, a shortage of digital and technical skills, and limited access to financing for small businesses across the country.

In March 2017, the Department for Digital, Culture, Media & Sport published the Government's UK Digital Strategy, with the purpose of building a world-leading digital economy and ensuring wider access to the opportunities of digital transformation. The strategy sets out seven pillars to drive the change[30]:

1. Investing in physical and digital infrastructure to increase connectivity.

2. Developing an advanced skill base to enable wider participation in the digital economy and reduce the skills shortage.

3. Creating an innovation-friendly environment to encourage investment in the digital sector.

4. Promoting innovation and digital capacity in the wider economy.

5. Ensuring secure access to technology, data and networks for businesses, citizens and public services.

6. Advancing digitisation of public services to facilitate communication between Government and the public and improve efficiency in service delivery.

29 Oxford Economics (2016). The UK's £92 billion Digital Opportunity, London: Oxford Economics.
30 Department for Digital, Culture, Media & Sport (2017). UK Digital Strategy 2017, 1 March 2017. https://www.gov.uk/government/publications/uk-digital-strategy

7. Supporting the data economy to drive public services transformation, business growth and democratic engagement through the effective and safe use of data.

By addressing the key levers that will build a digital economy – infrastructure, research and innovation capacity, skills, regulatory framework, and the public sector – the strategy is designed to create an institutional structure that rapidly evolves to meet the challenges of digital transformation. In his Spring Statement 2019, Chancellor Philip Hammond MP reiterated the Government's ambition for the UK to *"lead the world in delivering a digital economy that works for everyone"*[31].

In recent years, digital transformation has become an imperative, cutting across ministries and policies. For instance, Government is undergoing a process of digitalisation of public services to improve the relationship between the citizen and state[32]. To meet the goals of the Industrial Strategy and strengthen the UK's research base and business ecosystem, the Industrial Strategy Challenge Fund is supporting digital technology development projects across the economy, such as in health care and the energy sector[33]. Despite the widespread attention to digital transformation across Government, we observe a lack of coordination among these programmes, which could potentially undermine the development of a shared vision, lead to overlapping of initiatives and impede progress evaluation. This is mostly due to the delay in implementing the UK Digital Strategy, which is slowing down the adoption of a coherent and coordinated plan of action towards digital transformation.

Building on the legacy of 2017 UK Digital Strategy, this report draws attention to the country's digital agenda and calls for greater commitment to the delivery of the strategy. This is crucial for at least three reasons. First, the delay in implementing a shared digital strategy is holding back Government's plan to build a digital economy and to ensure that the benefits are spread across society. Second, this report also recommends that policy initiatives are not delivered in isolation. Rather, they should be set within a broader and unified digital strategy, acting as a centre of leadership and coordination for all Government departments. Furthermore, the implementation of the strategy through concrete and concerted action would restore trust among UK businesses, whose investment decisions have been heavily affected by Brexit uncertainty.

In this report, we propose five policy recommendations based on primary data collected between December 2018 and March 2019. During this time, we interacted with companies, innovation centres, trade associations and public authorities, to collect information on the two abilities that the digital strategy must pursue to lay the foundations for a digital economy: the ability to create new technology (technology creation capacity) and the ability to adopt it (technology adoption capacity). We specifically focus on two categories of recommendations, according to the main recipient of the intervention (i.e. private companies or public institutions). The

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31 https://www.gov.uk/government/speeches/spring-statement-2019-philip-hammonds-speech (last accessed 19th March 2019)
32 https://www.gov.uk/government/publications/government-transformation-strategy-2017-to-2020 (last accessed 3rd April 2019)
33 https://www.gov.uk/government/news/9m-awarded-to-breakthrough-digital-health-technologies and https://www.gov.uk/government/news/four-leading-edge-demonstrators-to-jumpstart-energy-revolution (last accessed 3rd April 2019)

first category of recommendations has the goal to build technology capacity across the economy, broadly referred as to both the capacity to create and adopt new technology. These recommendations aim at improving digital culture, networking and innovative capabilities among UK businesses. The second category addresses the barriers to the creation of an innovation-friendly business ecosystem, focusing on the role of public institutions in updating regulatory frameworks and ensuring financial support to technology creation and adoption.

Building technology capacity

Recommendation 1: Promote Digital Change Leadership projects to foster digital culture

New technologies are transforming all aspects of business, from shop floor operations to organisational structures. To unleash the full potential of digital transformation, it is critical that companies foster a culture inclined to 'shake up' the *status quo* and embrace change. Developing the right digital culture means being bold on the decisions that prepare the organisation for digital transformation: it could mean adopting a flattened hierarchical structure to encourage self-driven employees, or redesigning departments and functions to enhance cross-functional interaction and flexibility across the organisation[34]. This is a long and difficult journey that has to start from top management and then involve every employee, so that the entire organisation is 'tuned towards digital'.

The lack of digital culture remains one of the biggest challenges for UK businesses in adopting new technologies. Our study shows that the majority of companies have a traditional approach to decision-making processes, with the owner-manager being in charge of every strategic decision concerning the adoption of a new technology (e.g. searching for a digital provider, managing the supply relationship). This is usually associated with a culture averse to risk and experimentation, slowing down investment in new technologies.

Given the complexity of the challenge, we propose that Government engage with trade associations and academia to organise "Digital Change Leadership" projects for UK businesses. Partner institutions will benefit from their close connection with the territory to ensure that the projects are delivered on a local basis and cut across sectors, involving a wide range of businesses in the wider economy. These projects will have the goal of informing businesses how ADTs can affect business models and help them develop the right skills to achieve digital transformation. The Made Smarter pilot scheme in the North West has recently introduced its Leadership Development Programme, aimed at raising awareness on the value of ADTs across the manufacturing sector. Drawing on this example, we encourage the delivery of similar initiatives across different sectors and places to support wider technology adoption.

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34 https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/the-strategy-and-corporate-finance-blog/digital-success-requires-a-digital-culture (last accessed 27th March 2019)

Recommendation 2: Support existing public or private intermediary platforms to facilitate networking, while ensuring transparency and responsible communication

A key characteristic of the digital age is the paradigm shift in research and innovation processes. ADTs enable the generation and diffusion of far more data and information than can be usefully captured by one company on its own. For this reason, it becomes increasingly important for the company to have permeable boundaries, and to combine internal research with the inputs absorbed from the external environment. This approach reflects the concept of open innovation, according to which the company can innovate more successfully and efficiently by acquiring, integrating and processing internal and external information. As recently put forth in the 2018 OECD workshop *"How to leverage the potential of the digital transformation for innovation and research?"*, research collaborations with external actors (e.g. suppliers, customers, universities) are key enablers of innovation in the digital age. Indeed, they can help the company to overcome its limitations in terms of technology and expertise, and to accelerate innovation.

> *"Innovation in the automotive industry increasingly requires strong capabilities in software engineering and AI, in addition to traditional core competencies in mechanical and electronic engineering. Research collaborations allow firms to gain access and exposure to a richer pool of expertise and skills that are complementary to their own competences."*
>
> *2018 OECD Workshop, Summary of discussions*

One way to facilitate collaborations and enable open innovation mechanisms is through the use of online platforms, including online marketplaces, social media and creative content outlets, application distribution platforms, price comparison websites and collaborative economy platforms[35]. These online intermediaries are multi-sided markets designed to facilitate interaction between the different sides of a specific transaction[36]. In so doing, they can lower search costs for users and improve the match between the agents involved in the exchange. Due to network effects which make the use of the platform more valuable as the number of users increases, *"more agents will be willing to participate (…) stimulating innovation and generating business opportunities for SMEs"*[37].

In light of this, we propose that Government establish a forum in partnership with the private sector – comprising both the developers and potential users of online platforms – to discuss and inform about new opportunities for collaboration and interaction in the digital age. Drawing on the 2016 report by the House of Lords Select Committee on the European Union, which looks at the challenges and opportunities of online platforms[38], we also recommend that Government engage in further discussion of

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35 https://ec.europa.eu/digital-single-market/en/online-platforms-digital-single-market (last accessed 28th March 2019)
36 Duch-Brown, N (2017). The Competitive Landscape of Online Platforms, JRC Digital Economy Working Paper 2017-04
37 Ibid.
38 House of Lords – Select Committee on European Union (2016). Online Platforms and the Digital Single Market, 20 April 2016. London: House of Lords.

the regulation needed to ensure the safe use of online platforms and the respect of competition rules in online markets.

Recommendation 3: Introduce tailored digitalisation and growth programmes for businesses with different degrees of digital maturity

As pointed out in a seminal paper by Cohen and Levinthal (1990), the capacity of a company to evaluate and use external knowledge is largely dependent on its level of prior related knowledge[39]. It is straightforward to see the implications this has for the ability of the company to adopt a new technology. In the first place, companies respond better to technological advancements when they possess an extensive set of capabilities – i.e. managerial, operational, technical and research-related – to undertake exploratory search of new-to-the-firm, state-of-the-art technologies and to select the one(s) most suitable to its operations. For instance, a company will be more prone to adopting next-generation technologies if it has a Chief Digital Officer co-ordinating the technology adoption process, a number of technology experts supporting technological change, and a high level of integration of information and communication technologies permeating the entire organisation (from administration to R&D)[40]. Second, the higher the amount of knowledge accumulated by the company, the higher the capacity to absorb the technology. Companies with long-standing research experience and higher investment in R&D activities will be more likely to adopt the technology.

Our study confirms that companies are not able to adopt the technology and to integrate it in its operations, unless they possess a sufficient amount of skills, competencies and expertise required to understand the value and use of the new external input. This depends on various aspects of the organisation, including management style, business structure, and skill sets. The lack of a supportive and digitally-oriented organisations is one of the key barriers to technology adoption, affecting the majority of UK businesses.

To allow greater inclusiveness in digitalisation processes, we encourage a more tailored approach to programmes supporting technology adoption and growth. These programmes would take into account the level of digital maturity of the company, providing *ad hoc* assistance to develop the right skills and embark on technological change. The role of knowledge intermediaries, such as the Catapult network, is essential to undertake cutting-edge research on next-generation technologies, such as blockchain, artificial intelligence and automation, and to push the frontier of technological development. However, companies have expressed a certain degree of cognitive distance between the knowledge required to adopt these technologies and the actual level of digital maturity of most UK businesses. Tailored growth programmes would help bridge this gap, raising their knowledge base up to the level required to engage with most advanced digital providers and innovation centres.

39 Cohen, W.M., Levinthal, D.A., 1990. Absorptive capacity: a new perspective on learning and innovation. Administrative Science Quarterly 35, 128–152

40 Bruque, S., & Moyano, J. (2007). Organisational determinants of information technology adoption and implementation in SMEs: The case of family and cooperative firms. Technovation, 27(5), 241-253.

Enabling institutions

Recommendation 4: Facilitate access to funding, ensuring clarity among available funding schemes and adapting the application procedures to the new technology

Investing in new technology implies a strategic decision over money sourcing and risk assessment that often prevents companies, especially SMEs, from taking the digital leap. The investment must cover not only the purchase of the technology, but also the upgrade of other organisational components, such as skills, processes, and complementary equipment. A 2017 Boston Consulting Group survey states that more than 60 per cent of UK respondents believe their company will not be able to afford more than 40 per cent of the expenditure needed to invest in technological change. Furthermore, approximately one third consider the search for sufficient financial resources a "big or very big" challenge[41]. For these reasons, facilitating access to public funding schemes can significantly improve the capacity of the company to implement digital transformation.

In line with the 2018 House of Commons Business, Energy and Industrial Strategy Committee report on *"Small businesses and productivity"*[42], our findings reveal widespread discontent among UK businesses regarding the complexity involved when attempting to access and apply for Government funding schemes. This puzzle is further compounded by the overlapping of similar initiatives at the local and national level (e.g. Made Smarter Programme and Liverpool City Region 4.0). As the committee's report states (p. 17):

> *"One SME told us:*
>
> *A multitude of different options become available and then are not available. Sometimes there is a very lengthy process to go through in order to obtain the help that is advertised, so very often—I have definitely had this myself—it is easy to give up and just plough ahead without taking advantage of that help."*

We recommend that Government ensure greater clarity as to the offer of public funding schemes available to businesses. This can be achieved through an online database that companies can easily access and navigate to find the most suitable funding solution. We also encourage better coordination across different levels of governance, i.e. Central Government and the regions, to increase confidence among applicants and allow a more efficient allocation of resources. The UK's withdrawal from the EU also calls for an urgent response from Government to explain how EU-funded projects for industrial growth and business innovation will be covered after Brexit.

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41 Cordes, F. & Stacey, N. (2017). Is UK Industry ready for the Fourth Industrial Revolution?, The Boston Consulting Group.
42 House of Commons – Business, Energy and Industrial Strategy Committee (2018). Small businesses and productivity, 5 December 2018. London: House of Commons.

Recommendation 5: Adapt regulatory frameworks in accordance with public policy objectives to encourage technology adoption

With the advent of ADTs, new business models and services have emerged, posing a number of questions with regard to the kind of policy framework that can best help businesses to thrive while at the same time ensuring the safety of workers and consumers. This report suggests that the role of policy-makers does not end with the adaptation of the current regulatory framework to the challenges of digitalisation. New regulations can also drive the adoption of new technology, becoming a key enabler of digital transformation. An example will help clarify how policy-driven initiatives can affect the rate and intensity of technological change[43].

> *"A clear example of the effectiveness of economic instruments (ed., as a form of environmental policy instruments) is provided by the diffusion of biological waste-water treatment plants in the Netherlands. The increase in the effluent charge from Dfl 5.42 in 1973 to Dfl 74.26 in 1991 per unit of `population equivalent' (the typical measuring rod) induced many firms to invest in biological effluent treatment systems. The diffusion speed was considerably higher for indirect dischargers who discharged their effluent into a collective effluent treatment plant than for direct dischargers."*

> *Kemp (2000: 44)*

We propose a whole-of-government approach to policy-making in response to the impact of the digital age on various policy areas, such as competition, the environment, workers' health and safety, and cybersecurity. As discussed above, we also believe that proactive policy development can play an important role in spurring businesses to create and adopt new technology. For this reason, we encourage further discussion on the long-term policy objectives that Government intends to pursue (e.g. reducing carbon emissions, promoting inclusive growth, improving safety in the workplace). We recommend that Government begin an enquiry into the potential impact of policy interventions on the pace and intensity of technology creation and adoption, consistently with its policy objectives.

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43 Kemp, R. (2000). Technology and Environmental Policy—Innovation effects of past policies and suggestions for improvement. In OECD Proceedings Innovation and the Environment, Paris: OECD, pp. 35-61. For a comparison, see also the case study describing the effects of the Clean Air Act (1957) on the Stoke-on-Trent ceramic district, discussed in Bellandi, M., Santini, E., & Vecciolini, C. (2018). Learning, unlearning and forgetting processes in industrial districts. Cambridge Journal of Economics, 42(6), 1671-1685.

Acknowledgements

References

Aradanaz-Badia, A., Awano, G., & Wales, P. (2017). *Understanding firms in the bottom 10% of the labour productivity distribution in Great Britain: "the laggards", 2003 to 2015*. London: Office for National Statistics.

Bellandi, M., Santini, E., & Vecciolini, C. (2018). *Learning, unlearning and forgetting processes in industrial districts.* Cambridge Journal of Economics, 42(6), 1671-1685.

Bounds, A. UK digital technology sector outpacing wider economy, *Financial Times*, 17 May 2018. https://www.ft.com/content/401955c2-58f1-11e8-bdb7-f6677d2e1ce8

Bruque, S., & Moyano, J. (2007). *Organisational determinants of information technology adoption and implementation in SMEs: The case of family and cooperative firms.* Technovation, 27(5), 241-253.

Bughin, J. Digital success requires a digital culture, *Strategy & Corporate Finance Blog*, 3 May 2017. https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/the-strategy-and-corporate-finance-blog/digital-success-requires-a-digital-culture

CBI Survey (2016). *Embracing Digital in Every Sector.* London: CBI.

Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). (2006). *Open innovation: Researching a new paradigm.* Oxford University Press on Demand.

Cohen, W.M., Levinthal, D.A., 1990. *Absorptive capacity: a new perspective on learning and innovation.* Administrative Science Quarterly 35, 128–152.

Cordes, F. & Stacey, N. (2017). *Is UK Industry ready for the Fourth Industrial Revolution?,* The Boston Consulting Group.

Department for Digital, Culture, Media & Sport (2017). *UK Digital Strategy 2017,* 1 March 2017. https://www.gov.uk/government/publications/uk-digital-strategy

Duch-Brown, N (2017). *The Competitive Landscape of Online Platforms,* JRC Digital Economy Working Paper 2017-04.

European Commission. Online Platforms, Last update: 14 February 2019. https://ec.europa.eu/digital-single-market/en/online-platforms-digital-single-market

Gal, P. & Egeland, J. (2018). *Reducing regional disparities in productivity in the United Kingdom*, OECD Economics Department Working Papers, No. 1456, Paris: OECD Publishing.

Douglass, G. & Hoffman, J. (2015). *The science and technology category in London*. London: GLA Economics.

Haldane, A. *The UK's Productivity Problem: Hub No Spokes* speech, 28 June 2018.

Hammond, P. MP. *Spring Statement 2019* speech, 13 March 2019. https://www.gov.uk/government/speeches/spring-statement-2019-philip-hammonds-speech

HM Government. £9m awarded to breakthrough digital health technologies, *Press Release*, 28 March 2019. https://www.gov.uk/government/news/9m-awarded-to-breakthrough-digital-health-technologies

HM Government. Four leading edge demonstrators to jumpstart energy revolution, *Press Release*, 3 April 2019. https://www.gov.uk/government/news/four-leading-edge-demonstrators-to-jumpstart-energy-revolution

HM Government. Government Transformation Strategy 2017 to 2020, 9 February 2017. https://www.gov.uk/government/publications/government-transformation-strategy-2017-to-2020

House of Commons – Business, Energy and Industrial Strategy Committee (2018). *Small businesses and productivity,* 5 December 2018. London: House of Commons.

House of Lords – Select Committee on European Union (2016). *Online Platforms and the Digital Single Market,* 20 April 2016. London: House of Lords.

Industrial Digitalisation Review (2017). *Interim Report,* 6 July 2017.

International Federation of Robotics. Robot density rises globally, *IFR Press Releases*, 7 February 2018. https://ifr.org/ifr-press-releases/news/robot-density-rises-globally

Kemp, R. (2000). *Technology and Environmental Policy—Innovation effects of past policies and suggestions for improvement.* In OECD Proceedings Innovation and the Environment, Paris: OECD, pp. 35-61.

Kortmann, S., & Piller, F. (2016). *Open business models and closed-loop value chains: Redefining the firm-consumer relationship.* California Management Review, 58(3), 88-108.

Mack-Smith, D., Lewis, J., Bradshaw, M., & Brown, D. (2016). *State of Digitisation in UK businesses.* Strategic Labour Market Intelligence Report, London: SQW and UK Commission for Employment and Skills.

Maier, J. (2017). *Made Smarter. Review 2017.* London: Department for Business, Energy and Industrial Strategy.

McKay, H. A Short History of Tech City, *Tech London News*, 17 October 2017. https://www.tech.london/news/a-short-history-of-tech-city

McKinsey Global Institute (2018). *Solving the United Kingdom's productivity puzzle in a digital age.* London: McKinsey & Company.

Nathan, M., Vandore, E., & Voss, G. (2018). *Spatial Imaginaries and Tech Cities: Place-branding East London's digital economy.* Journal of Economic Geography, 19(2): 409-432.

Nieto, M., & Quevedo, P. (2005). *Absorptive capacity, technological opportunity, knowledge spillovers, and innovative effort.* Technovation, 25(10), 1141-1157.

ONS (2015). *What defines the Digital Sector?,* 8 October 2015. London: Office for National Statistics.

Oxford Economics (2016). *The UK's £92 billion Digital Opportunity,* London: Oxford Economics.

Ramaswamy, V., & Ozcan, K. (2013). *Strategy and co-creation thinking.* Strategy & Leadership, 41(6), 5-10.

Riley, R., Rincon-Aznar, A., & Samek, L. (2018). *Below the aggregate: a sectoral account of the UK productivity puzzle.* London: Economics Statistics Centre of Excellence Discussion Paper 2018, 6.

Rusly, F. H., Corner, J. L., & Sun, P. (2012). *Positioning change readiness in knowledge management research.* Journal of Knowledge Management, 16(2), 329-355.

Santoro, G., Vrontis, D., Thrassou, A., & Dezi, L. (2018). *The Internet of Things: Building a knowledge management system for open innovation and knowledge management capacity.* Technological Forecasting and Social Change, 136, 347-354.

Tech Nation (2018). *Tech Nation Report.* London: Tech Nation.

Tzokas, N., Kim, Y. A., Akbar, H., & Al-Dajani, H. (2015). *Absorptive capacity and performance: The role of customer relationship and technological capabilities in high-tech SMEs.* Industrial Marketing Management, 47, 134-142.

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