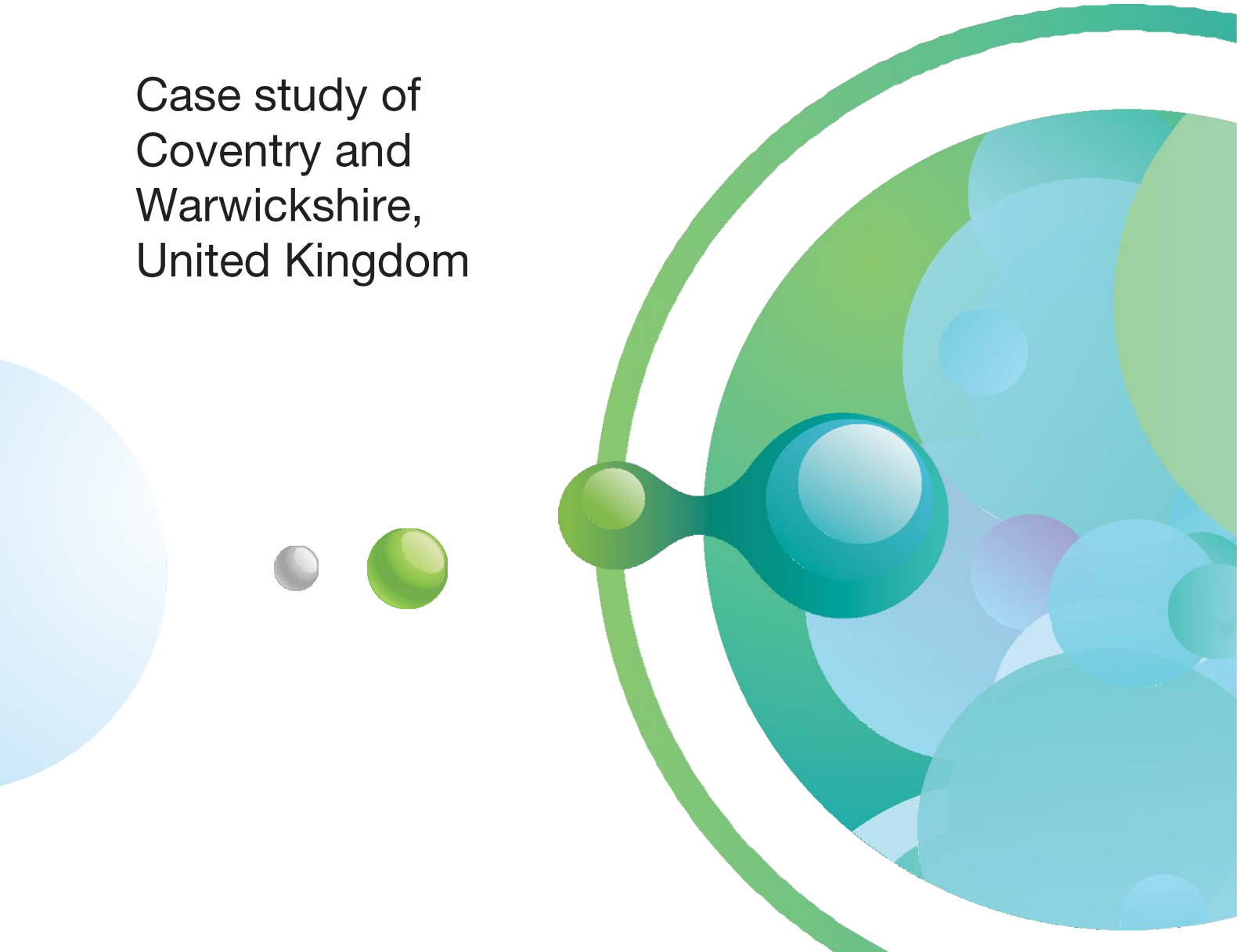
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LOCAL ENTREPRENEURSHIP ECOSYSTEMS AND EMERGING INDUSTRIES

Case study of Coventry and Warwickshire, United Kingdom



OECD Local Economic and Employment Development (LEED)
Working Papers

Local Entrepreneurship Ecosystems and Emerging Industries

Case Study of Coventry and Warwickshire,
United Kingdom

Final Report
March 2019

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This paper was authorised for publication by Lamia Kamal-Chaoui, Director, Centre for Entrepreneurship, SMEs, Regions and Cities, OECD.

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Foreword

This report examines the local entrepreneurship ecosystem of the Coventry and Warwickshire region in the United Kingdom and its capacity to promote productivity upgrading and industrial renewal. It forms part of the OECD's work stream on local entrepreneurship ecosystems and emerging industries. This work examines how policy at the local level can promote innovative start-ups, innovative scale-ups and innovation in existing enterprises for entrepreneurship and industrial diversification.

The OECD work stream examines the main dimensions of local entrepreneurship ecosystems that affect innovative start-ups, innovative scale-ups and innovation in existing enterprises in case study regions. It relates the policy development of local entrepreneurship ecosystems to the principle of regional smart specialisation, and how smart specialisation strategies are helping to strengthen entrepreneurship and innovation in regions.

Coventry and Warwickshire is a very interesting case study for a number of reasons. First, it hosts a significant part of the United Kingdom (UK) automotive cluster. The ability of the region to support this cluster is critical to the health of this key sector in the UK as a whole. Second, it has an active and effective Local Enterprise Partnership (LEP), which is playing a key role in identifying opportunities to stimulate industry development and overcome potential obstacles. Third, as part of the West Midlands Combined Authority area it is in the first wave of Local Industrial Strategy making in the UK. The local industrial strategy will provide a framework for analysing and prioritising policy initiatives in co-ordination across local and national stakeholders.

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The project was led by Jonathan Potter, Head of the Entrepreneurship Policy and Analysis Unit, CFE, OECD, and Sandra Hannig, Policy Analyst, Entrepreneurship Policy and Analysis Unit, CFE, OECD. The report was drafted by a team involving Karen Chapple (University of California Berkeley College of Environmental Design, USA – focus on the local entrepreneurship ecosystem), Johannes Glückler (Heidelberg University, Germany – focus on the role of institutions), Sandra Hannig (OECD), Helen Lawton Smith (Birkbeck, University of London – focus on the automotive cluster), Jonathan Potter (OECD) and Pier Paolo Saviotti (University of Utrecht, the Netherlands – focus on knowledge diffusion). Local diagnostic evidence was provided by Nigel Driffield and Jae-Yeon Kim (Warwick University, UK).

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Acronyms and abbreviations

AI	Artificial Intelligence
AME	Advanced Manufacturing and Engineering
APC	Advanced Propulsion Centre
ARC	Automotive Composites Research Centre
AV	Autonomous Vehicles
BEIS	UK Department for Business, Energy and Industrial Strategy
BGS	Business Growth Services
BVCA	British Venture Capital Association
CAD	Computer Aided Design
C-ALPS	Centre for Applied Low Carbon Propulsion Systems
CAV	Connected and Autonomous Vehicle
CBI	Confederation for British Industry
CBI	Confederation of British Industry
CBM	Confederation of British Metalforming
C-CAARC	Centre for Connected & Autonomous Automotive Research
CEO	Chief Executive Officer
CFE	OECD Centre for Entrepreneurship, SMEs, Regions and Cities
CMF	Cast Metals Federation
CoIC	Chamber of Industry and Commerce
CUE	Coventry University Enterprises
CWLEP	Coventry and Warwickshire Local Enterprise Partnership
DfE	UK Department for Education
DIRFT	Daventry International Rail Terminal
EEF	Engineering Employers Federation
EPSRC	Engineering and Physical Sciences Research Council
ERDF	European Regional Development Fund
ERDF	European Regional Development Fund
ESF	European Social Fund

EU	European Union
FSB	Federation of Small Business
GBP	British Pound
GVA	Gross Value Added
HEI	Higher Education Institution
HMRC	Her Majesty's Revenues and Customs
HS2	High Speed railway 2
HVM	High Value Manufacturing
IAG	Independent and impartial careers Advice information Guidance
ICT	Information and Communications Technology
IDL	International Digital Laboratory
IINM	International Institute for Nanocomposites Manufacturing
IIPSI	International Institute for Product and Service Innovation
IoT	Institute of Technology
IT	Information Technology
JLR	Jaguar Land Rover
LCVTP	Low Carbon Vehicle Technology Project
LEED	Local Economic and Employment Development
LEP	Local Enterprise Partnership
LEVC	London Electric Vehicle Company
MAA	Midlands Aerospace Alliance
MaaS	Mobility as a Service
MAS	Manufacturing Advisory Service
MEIF	Midlands Engine Investment Fund
MEIF	Midlands Engine Investment Fund
MGTS	Management Group Training Services
MIT	Massachusetts Institute of Technology
MTC	Manufacturing Technology Centre
MTC	Manufacturing Technology Centre
NAIC	National Automotive Innovation Centre
NBMDF	National Battery Manufacturing Development Facility
NEET	Not in Education, Employment or Training
NUTS	Nomenclature of Territorial Units for Statistics
NVQ	National Vocational Qualification

OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturers
PAYE	Pay As You Earn
R&D	Research and Development
RACeD	Research for Advanced Concept Development of smart and autonomous vehicles
RDA	Regional Development Agency
SEP	Strategic Economic Plan
SIA	Science and Innovation Audit
SME	Small and Medium Sized Enterprise
STEM	Science Technology Engineering and Mathematics
TMETC	Tata Motors European Technical Centre
UK BIC	UK Battery Industrialisation Centre
UK	United Kingdom
UKCES	United Kingdom Commission on Employment and Skills
UKIS	UK Innovation Survey
USD	United States Dollar
UTC	University Technical College
VAT	Value Added Tax
VEG	Vehicle Energy Facility
WBS	Warwick Business School
WIB	Workforce Investment Board
WMCA	West Midlands Combined Authority
WMCAP&SC	West Midlands Combined Authority Productivity and Skills Commission
WMG	Warwick Manufacturing Group
WMIB	West Midlands Innovation Board

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Executive summary

The ability of local economies to adapt to change and diversify into growing and higher productivity specialisations is critical for inclusive growth. Local economies can benefit from specialisation in clusters and emerging industries where they have comparative advantage. But these specialisations need to evolve over time together with the people, firms and institutions that support them.

This report examines industry evolution in Coventry and Warwickshire. The local economy has been performing well in recent years, with strong re-emergence in a globally significant local automotive cluster and growth in digital and culture/tourism specialisations. Industry development is supported by a policy environment in which links among stakeholders help the identification policy issues and the engagement of partners for co-ordinated responses. At the same time, there are a number of challenges and a need to increase productivity.

This report focuses on the enablers and bottlenecks to renewal of the automotive cluster and the emergence of key specialisations in the digital and culture/tourism industries and offers a number of policy suggestions for the national and local levels together with illustrations of international inspiring policy practices.

Main findings

Upgrading and diversification in the automotive cluster

The local automotive cluster is in renewal

The automotive cluster employs approximately 34 000 people directly in Coventry and Warwickshire, accounting for 10% of local employment. It contains the headquarters of key anchor firms (including Jaguar Land Rover [JLR], Aston Martin Lagonda and London Electric Vehicle Company [LEVC]); as well as the BMW Engine Plant at Hams Hall (Coleshill) automotive design and R&D centres (including Warwick Manufacturing Group, Tata Motors European Technical Centre, the Manufacturing Technology Centre, Coventry University, and HORIBA MIRA); and a highly skilled engineering and technical workforce. The area's two universities – Coventry University and the University of Warwick also play key roles in automotive research and training and collaboration with local industry.

The cluster declined in the 1970s-1990s, but started an impressive recovery in the early 2000s. A boost came with the purchase of Jaguar and Land Rover by the Tata group to create JLR; a low volume vehicle producer focused on niche and luxury brands. JLR and other companies in the cluster have invested strongly in R&D and design. Production is also reviving, including at the London Electric Vehicle Company (LEVC), JLR and RDM. New pressures are nonetheless emerging demanding continued adaptability and resilience in the cluster.

The automotive cluster is responding to global transformations

The local cluster is responding to dramatic evolution in the automotive industry and radical diversification into fields such as intelligent mobility services, navigation data and low carbon technologies. At the same time, local supply chain opportunities are growing for specialist suppliers and technology developers. JLR is also a key player in entrepreneurship and intrapreneurship, as illustrated for example by its investments in technology start-ups across the world through the JLR TechIncubator and JLR Venture Capital.

The main bottlenecks to renewal lie in the SME supply chain

Insufficient SME innovation capabilities

Not enough local automotive supply chain SMEs are actively engaged in research and innovation activity or collaboration with other firms for innovation. Many SMEs in the local supply chain also suffer from a shortage of management capabilities in terms of innovation and ability to grow.

Shortages of highly-skilled labour

Local automotive firms have to compete nationally and internationally in a limited pool of specialised, high skill workers. This is a particular challenge for SMEs, which offer lower wages and have lower reputational advantages than the cluster's anchor firms. At the same time, the limited numbers of high value jobs in the SME supply chain hinders the recruitment of local graduates into the cluster. This in turn is related to SME management practices and strategies that do not sufficiently emphasise innovation, productivity upgrading and company growth.

Shortages of technical labour

Whilst the Coventry and Warwickshire area has a well-developed training and apprenticeship system, local businesses report difficulties in recruiting technical staff. The issues include shortages in the numbers of apprentices available and doubts about the adequacy of their training. There is also a gap between the demand for skills and the supply of vocational training.

Finance and infrastructure constraints

Conditions for the continued growth and upgrading of the local automotive cluster could also be improved by addressing constraints in the areas of SME access to finance, digital connectivity, energy supply, and sites and premises for industrial expansion and inward investment.

Emergence of local digital and culture/tourism industries

Significant local digital and culture/tourism specialisations are emerging

Coventry and Warwickshire are home to an emerging digital industry. In particular 'Silicon Spa', located around Leamington Spa, already hosts more than 30 video gaming studios and 1 200 highly skilled workers. The culture and tourism sectors also account for significant employment and local growth potential, boosted by the Royal Shakespeare Company, many visitor attractions, and the designation of the City of Coventry as UK City of Culture in 2021.

Local entrepreneurship system strengths are underpinning this emergence

The local entrepreneurship ecosystem provides several very favourable conditions for innovative start-ups, scale-ups and SME innovation in these emerging sectors. Most notable are networks among entrepreneurs, connections of entrepreneurs to related university research (such as the Serious Games Institute at Coventry University and the Institute of Digital Healthcare at WMG), and local policy support for investments in culture and tourism.

There are also some local entrepreneurship ecosystem weaknesses

Areas of weakness in the local entrepreneurial ecosystem affecting these emerging industries include access to finance for innovative start-ups, digital infrastructure investments, digital skills supply, and entrepreneurship culture. For example, a significant supply of graduates and a strong supply of training policy initiatives, including entrepreneurship education and training, co-exist with pockets of worklessness and low entrepreneurial ambition.

Cross-cutting policy priorities

A number of cross-cutting policy actions are suggested to further strengthen local automotive cluster renewal and the emergence of new industry specialisations.

Entrepreneurship ecosystem

The Growth Hub is fulfilling a critical function through provision of finance and business advice to SMEs and entrepreneurs. However, more can be done to expand specialist business advice for supply chain SMEs, strengthen access to finance for innovative start-ups, promote residential and workplace attractiveness, develop shared industrial spaces and develop local entrepreneurial talent.

Knowledge exchange

The Growth Hub and the High Value Manufacturing Catapult are putting in place some important actions to promote knowledge exchange for cluster renewal and emergence. However, actions should be reinforced to promote the establishment of innovative start-ups, increase SME innovation capabilities and facilitate collaborative research and innovation projects. The Midlands Engine Science and Innovation Audit identifies a number of areas where future action is required to stimulate innovation in the region.

Skills

Several policy actions are strengthening local apprenticeship provision, including a Skills Strategy and Growth Deal financing for training facilities and training programmes. In addition, measures have been taken to ensure effective local implementation of the Apprenticeship Levy, which was created in 2015 by the UK government. However, more can be done to identify skill needs, strengthen the involvement of businesses in training, and strength collaboration and co-ordination across training providers.

Local institutions and governance

The LEP is a key intelligence and linking organisation

The Local Economic Partnership (LEP) is one of 38 local organisations with central government funding working across England. It plays a critical role in providing economic intelligence and strategic planning and channelling public and private funding to key cluster

and local emerging industry needs. It is a key 'linking organisation' for local business, universities and government helping co-ordinate, prioritise and stimulate action. However, it is hindered by its limited human and financial resources and complex geographies of economic development institutions. In addition, although the region has some significant business networks, such as the local Chamber of Commerce, there is no business network of the scale for example of the chambers of commerce in countries such as Germany where the membership system is compulsory, making it more difficult to mobilise existing business networks for skills and innovation collaborations.

Main recommendations

Actions for the local entrepreneurship ecosystem

- Strengthen the availability of finance to innovative start-ups, for example by spreading information about alternative sources of financing for start-ups and building local capital funds and networks.
- Promote local area attractiveness to help attract and retain entrepreneurial talent.
- Plan and develop attractive shared industrial spaces for digital and technology start-ups and SMEs, and explore options for the large automotive firms to provide or sponsor incubator space for start-ups.
- Introduce entrepreneurship training in apprenticeship curricula and support university-led entrepreneurship training initiatives through ensuring steady funding for local entrepreneurship competitions.

Actions for knowledge exchange

- Engage low productivity SMEs in knowledge exchanges within and across sectors and strengthen SME innovation management capabilities, for example with an SME Competence Centre.
- Provide stronger support to sectoral cross-fertilisation of knowledge.

Skills development

- Improve SME participation in defining existing and future skills needs and shaping training supply, for example with employer skills development councils.
- Strengthen local apprenticeship opportunities for SMEs, for example with incentives for large firms to over-train apprentices.
- Create a local training needs and training supply 'road map' identifying areas of commonalities, competition and gaps across training providers, spanning across sectors.
- Expand support for the development of digital skills.

Governance

- Increase stability, funding, and powers for the LEP, including reinforcing regional-local co-ordination of policy delivery and a stronger role for the LEP in regional spatial planning.
- Incentivise business stakeholders to participate in local cross-sector organisations.

1. Overall assessment and recommendations

The Coventry and Warwickshire economy

Key economic characteristics

Coventry and Warwickshire is a dynamic local economy

The Coventry and Warwickshire economy has significantly improved its productivity and employment performance in recent years. Its unemployment rate had fallen to 3.6% by 2016, and with 49 start-ups per 10 000 people in 2016, its business start-up rate was above the UK average. The area's gross value added (GVA) growth rate was 14.3% in 2012-2015, which exceeded the English LEP average (12.3%). Its recent success has been underpinned by its ability to supply and retain skills to support innovation and diversify into higher productivity activities.

It builds on a strong industrial heritage and central location

The Coventry and Warwickshire economy of today has been shaped by the area's key role in the Industrial Revolution, when coal mining and associated industries developed. The area continued to grow and prosper through an evolution of specialisations from sewing machinery manufacturing, to bicycle manufacturing and later to motor vehicle manufacturing and related industries. In the 1970s and 1980s it suffered from the decline of the British motor industry but has since begun an important recovery.

The Coventry and Warwickshire Local Economic Partnership (LEP) area contains a population of approximately 900 000 with approximately 310 000 private sector jobs. It is centrally located within the United Kingdom (UK). Its major population centre is the city of Coventry, England's ninth largest city with a population of approximately 350 000, which is combined in the LEP area with the county of Warwickshire, which comprises a number of prominent towns (including Rugby, Leamington Spa, Kenilworth, Warwick, Stratford-upon-Avon, Nuneaton and Bedworth), as well as market towns and rural areas.

Further strengthening is needed

Despite recent strong performance, GVA per worker stood at GBP 28.10 per hour worked in Coventry and Warwickshire in 2015, compared with a UK average of GBP 31.40. Furthermore, the share of enterprises scaling up from less than GBP 500 000 to GBP 1 million over three years is lower in Coventry and Warwickshire (1.4%) than the UK average (2%). The most commonly reported barriers to enterprise growth are in the areas of strategy and management, sales and marketing, and skills and staff (Enterprise Research Centre, 2015).

Automotive manufacturing cluster renewal

The nature of the cluster

A globally-significant automotive cluster

The automotive sector directly employs approximately 34 000 people in Coventry and Warwickshire. It accounts for 10% of employment in the local economy, and is endowed with a workforce that is 10% more productive than the UK average. The local cluster contains 10% of all UK automotive manufacturing jobs.

The automotive sector in Coventry and Warwickshire benefits from being part of a broader Midlands automotive cluster – the main automotive cluster in the UK – and a broader regional Advanced Manufacturing and Engineering (AME) industry, including aerospace and rail industries.

A strong critical mass

The automotive cluster in Coventry and Warwickshire contains a strong critical mass of related R&D, skills, and supply chains. It is home to 35 automotive and off-highway brands. It includes 12 vehicle manufacturing sites and a wide range of supply chain establishments.

Local anchor firms

The cluster includes key locally-hosted anchor firms in automobile manufacturing, including Jaguar Land Rover (JLR) and Aston Martin Lagonda. Both of these firms have a strong focus on research, development and design as well as on production. Other major local employers in the cluster include BMW (which produces the Mini brand), Ricardo, Lear Corporation, Unipart, Delphi, Geely, and GE Converteam.

Design and R&D centres

The area hosts 15 automotive design and research and development (R&D) centres. One of the area's key institutions is the Warwick Manufacturing Group (WMG) at the University of Warwick, which is home to the National Automotive Innovation campus and the UK's first simulator for the development and testing of autonomous vehicles. Other key design and R&D centres include Tata Motors European Technical Centre, the Manufacturing Technology Centre at Coventry University, and HORIBA MIRA, a world-class engineering, research and testing consultancy, which is developing an R&D campus focused on the automotive sector.

Local skills

Sustained specialisation in automotive manufacturing for several decades has helped the area to build a highly skilled engineering and technical workforce.

A range of specialisations

In addition to large-scale automotive manufacturing, the cluster includes:

- Vehicle makers in the premium and upper premium sector
- First tier suppliers adjacent to these remaining car makers
- Sports car manufacturers
- Niche vehicle manufacturers

- Engineering and engineering design consultancies
- Specialist high performance engineering suppliers to the motor sport industry.

The cluster is reviving

Until the beginning of the 1970s, the automobile industry in Coventry and Warwickshire enjoyed a period of post-war prosperity. However, with a rise in European and American competition, UK automobile output declined from second to fifth rank in the world by 1974, leaving Coventry's car makers in decline. Major factories began to close and by the mid-1980s only two assembly plants survived, Browns Lane and Ryton, producing Jaguar, Daimler and Peugeot vehicles.

An impressive recovery started in the early 2000s, with local growth in the automotive industry outpacing that of the UK automotive industry as a whole. The renewal started with the purchase by the Tata group (an multinational) of Jaguar and Rover to create JLR; a low volume vehicle producer focused on niche and luxury brands.

This investment included a GBP 500 million expansion of JLR's R&D and design activities at Whitley and Gaydon. Further major automotive design and R&D investments were made by other local anchor firms, notably Geely's investment of GBP 300 million in R&D facilities for LEVC (formerly London Taxi Company) at Ansty, and Red Sun Group's (a Chinese multinational) investment of GBP 300 million for a new energy and power complete vehicle R&D centre in CAD CAM Automotive, an automotive component manufacturer in Coventry.

Production is also reviving. For example, the London Electric Vehicle Company has created an electric vehicle manufacturing facility in Coventry, and Tata is further developing its site at Gateway North for production by JLR and its suppliers with the aim of producing 250,000 vehicles at the site. RDM is building driverless vehicles.

The revival is going hand in hand with major transformations in the industry

The cluster in Coventry and Warwickshire is currently responding to a dramatic evolution in the automotive industry. This is driven by a combination of growth in global markets, new regulations affecting vehicle emissions, and the emergence of radical innovations including electric vehicles, connected and autonomous (self-driving) vehicles, and artificial intelligence.

While diversification within the automobile industry has been largely incremental and mostly visible in the range of models produced, the current transformation is bringing massive and radical diversification into new and upcoming fields such as intelligent mobility services, navigation data and low carbon technologies. Forecasts suggest, for example, that in 2030, the share of electrified vehicles could range from 10 to 50 percent of new vehicle sales. Likewise, subject to progress on the technical, infrastructure, and regulatory challenges, up to 15% of all new vehicles sold in 2030 could be fully autonomous.

Coventry and Warwickshire's automotive cluster has already taken leading positions in the design and development of driverless technology and low carbon emission vehicles and powertrain. However, there is much uncertainty about which activities will thrive. Automotive manufacturers will therefore need to develop diverse knowledge bases in order to survive. As well as affecting anchor companies in the clusters, innovative entrepreneurs and 'entrepreneurial knowledge' will likely play a role in driving this process forward. Local design and R&D research operations will also be important in developing further

their specialisations in areas including electric vehicles, electric hybrid, fuel cells and hydrogen power systems technologies and lightweight materials. These changes imply a need for policy to anticipate, act upon and support restructuring and transformation.

Local supply chain interactions are potentially becoming more important

The local supply chain in Coventry and Warwickshire and its immediate surroundings includes all stages of the automotive production process – R&D, design and engineering services, and several niche production areas. JLR has a relatively large supply chain input, and is an important customer for many local firms, entering into close working relationships with them. Amison and CWEL (2014) point out that these specialisations have created a space for specialist suppliers and technology developers locally that so far have not been attractive for mega supplier firms to fill. Many of the local supply chain firms are working at the leading edge of their particular technological areas, often in areas that fall outside traditional automotive competences (Amison and Bailey, 2014). Moreover, these firms are also serving international markets – e.g. Japanese and German automotive firms – as well as local customers, adding to the resilience of the cluster.

The wider context for strengthening local supply chain interactions in the cluster has also been positive in recent years, and this may be expected to continue, notwithstanding the uncertain impact of Brexit. Some 44% of parts used to make UK cars now come from UK suppliers, up from 36% in 2011 (Holweg, Davies, Wood, 2017), and Original Equipment Manufacturers (OEMs) are increasingly seeking to co-locate with their Tier 1 suppliers in order to build partnerships for technology development. Uncertainties in technological advance have encouraged larger firms to collaborate with smaller firms, and there are also opportunities for the entry of new firms.

In this context, there are increasing opportunities for growth of those SME suppliers in the local supply chain with strong innovation capabilities. There is also potential for reshoring of supply chain activity to Coventry and Warwickshire in the shape of new inward investments. However, this will require the right local conditions for skills, SME innovation, and knowledge networks; representing a challenge for the local actors and the local industrial strategy.

Enablers of cluster renewal

JLR is a focus for exploitation of entrepreneurial knowledge

Following Tata's investment in Jaguar and Rover, and the company reorganisation, JLR has successfully adopted a strategy of niche specialisation in the low volume production of luxury and sports cars and research and entrepreneurship in advanced combustion and low carbon technologies and intelligent mobility services. It is actively responding to recent disruptive technology and market trends, as illustrated, for example, by the establishment of new JLR Divisions such as "Autonomous Vehicle Fleets and Services" and "Travel, Navigation and Data".

JLR is fully aware that the new knowledge that automotive firms need is very different from its original knowledge base and less well articulated. Exploration of this new type of knowledge is taking place more and more not only through its own research, but also through collaboration with research institutions, and support of technology intensive start-ups.

JLR is very supportive of intrapreneurial activities and creativity within the company. It also invests in start-ups in disruptive technologies in the automobile sector across the globe

through the JLR TechIncubator and JLR Venture Capital. In 2013, JLR invested GBP 3 billion in 'product creation'.

Other major companies are also active in local R&D and design

Total R&D expenditure and employment in the private sector in Coventry and Warwickshire is far higher than comparator LEP areas. For example, R&D employment is almost double that of Birmingham and Solihull despite Coventry & Warwickshire being smaller in size. Average in-house R&D expenditure per business in 2010 was GBP 15 000 in Coventry and Warwickshire compared to GBP 2 500 in Birmingham and Solihull. Coventry also produces the second highest number of patents per head of population of all UK cities, behind Cambridge. The majority of this R&D expenditure is concentrated within the area's OEMs, particularly automotive manufacturers.

In particular, the MIRA Technology Park offers a location to businesses for undertaking automotive R&D. Tenants include Bentley, Changan, Ashok Leyland, Aston Martin Lagonda, Lockheed Martin and Haldex.

Entrepreneurial universities are key players in knowledge exchange

The LEP area contains two entrepreneurial universities – the University of Warwick and Coventry University, both engaged in multiple, often intense, knowledge exchange collaborations with businesses.

At the University of Warwick, a key anchor for the automotive industry is the Warwick Manufacturing Group (WMG), which is home to the National Automotive Innovation campus and the European Technical Centre of Tata Motors. WMG invests in R&D to address the priority automotive areas identified in the government's Strategy for Growth and Sustainability in the UK Automotive Sector (intelligent vehicles, lightweight vehicles, and greener vehicles). It is involved in a wide range of research collaboration initiatives with industry. WMG is one of seven partners in the High Value Manufacturing Catapult, with a focus on low carbon mobility. WMG's Energy Innovation Centre comprises a battery materials pilot line, battery characterisation laboratory plus abuse testing chambers and an electric / hybrid powertrain testing facility. WMG includes an SME team within the International Institute for Product and Service Innovation (IIPSI), which has worked closely with a number of automotive sector SMEs to support investment and growth of innovation across the supply chain. Announced in November 2017, the UK Battery Industrialisation Centre (UKBIC) will bring together academics and businesses to work on new forms and designs of batteries, as well as their chemistry and components. The Vehicle Energy Facility (VEF) is a research and test facility for hybrid vehicle powertrains, components and subsystems, which has partnered with Astheimer for example to develop a new prototype electric vehicle for the home delivery market. The Automotive Composites Research Centre (ARC) provides local industry with expertise and equipment to develop manufacturing capability for polymeric composites. A number of these initiatives have had special government funding, in addition to standard university research funds and LEP support.

Coventry University is also known as an entrepreneurial university with a strong focus on knowledge exchange with industry. It includes a number of specialised institutes that contribute strongly to the automotive cluster. The Institute for Advanced Manufacturing and Engineering (AME) involves collaboration between the University and Unipart Manufacturing Group. It is supported by the Catalyst Fund of the Higher Education Funding Council for England, where academics and students work alongside industry professionals in the UK's first 'Faculty on the Factory Floor'. It secures employment for

its graduates and commercialisation of several new technologies for lightweight and low/zero carbon powertrain applications. Other key initiatives are the Institute for Future Transport and Cities, including the new National Transport Design Centre, the Centre for Connected and Autonomous Automotive Research working in collaboration with HORIBA MIRA, and the Centre for Applied Low Carbon Propulsion Systems, in collaboration with FEV (a Germany-based international engineering service provider).

The universities are also developing strategies that allow them to get involved in automotive knowledge exchanges in a collaborative way with other universities, for example through the West Midlands Combined Universities network (including Coventry University) and the Midlands Innovation network (including the University of Warwick).

Several private R&D and design institutions also make major contributions to knowledge exchange

Independent R&D and design institutions are making further major contributions to knowledge exchange in the cluster. The Manufacturing Technology Centre (MTC) develops bespoke manufacturing system solutions in partnership with industry and universities. HORIBA MIRA provides research and test services to automotive and other advanced manufacturing sectors, employing some 2 500 engineers. The Advanced Propulsion Centre partners with WMG and manufacturers including AMG Batteries Ltd to develop next generation battery packs. Tata Motors European Technical Centre (TMETC) provides R&D for Tata Motors and various automotive industry partners. Furthermore, work has started on construction of the National Automotive Innovation Centre, which will provide design studios, collaborative working spaces and research facilities in collaboration with JLR, Tata Motors European Technical Centre, WMG and the University of Warwick and a network of supplier companies.

There is strong industry-relevant skills training provision

Coventry and Warwickshire has a strong history of skills and apprenticeship provision in the automotive industry. The universities, training colleges and private companies are all playing a strong role.

A number of key recent initiatives are further strengthening the skills supply to the automotive cluster. For example:

- CU Coventry (linked to Coventry University) has launched the Uni@Work, which works with employers to provide training and assessment for Higher and Degree Apprenticeships (Level 4 and above) in areas such as management, engineering and manufacturing.
- The University of Warwick and WMG have opened a University Technical College – the WMG Academy for Young Engineers – with a site in Coventry (and another outside the local LEP area in Solihull). This exposes 14-19 year olds to technical college training to prepare them for careers in engineering and digital media, sponsored by leading employers and the University of Warwick.
- The University of Warwick and WMG has established the WMG Applied Engineering Programme in partnership with JLR and Warwickshire College group. This provides training up to degree level for higher and degree apprentices in the automotive sector who wish to combine study with work.

- The JLR Apprenticeship Scheme provides salaried vocational training in control engineering, electrical engineering, product design, and manufacturing engineering.
- The Coventry and Warwickshire LEP has established the Trident Centre at Warwickshire College (a Further Education college), which provides courses and apprenticeships in manufacturing and engineering.
- The collaboration between Coventry University and Unipart Manufacturing Group through the Institute for Advanced Manufacturing and Engineering also provides work-relevant training to students.
- The High Value Manufacturing Catapult, based at WMG, operates a Catapult Reach programme that includes degree-level accreditation for competences in conjunction with industry. As part of the Catapult, the public sector and businesses have invested the creation of the Advanced Manufacturing Training Centre (MTC) in Coventry, with the target of developing more than 1 000 manufacturing apprentices, graduates, and engineers by 2020.
- The MIRA Technology Park has developed a Skills Plan designed to address the needs of the firms it hosts, including better collaboration and coordination, better careers information, advice and guidance, better work-based progression routes, poor retention of graduates, problems of recruitment into STEM occupations, and transport (CWLEP, 2015).

The research institutions are also helping to address the shortage of skilled R&D staff across the automotive supply chain, as skilled research and engineering staff move between research institutions and industry.

Bottlenecks to cluster renewal

Insufficient supply chain innovation

R&D activity in the local economy and knowledge exchange between businesses and universities are dominated by a few large companies (mainly OEMs). In 2015, approximately 89% of R&D employment and 94% of in-house R&D expenditure in Coventry and Warwickshire was accounted for by the top 5% largest R&D spending firms, which comprise just 0.05% of the business base (Department for Business, Innovation and Skills, 2015). When compared with these large firms, local SMEs have more limited involvement in research and innovation.

It should be recognised that the Coventry and Warwickshire LEP area is above the average for LEPs on some key broader innovation measures including the proportion of firms undertaking product or service innovation, introducing new business practices, introducing new methods of work organisation, undertaking marketing innovation, or undertaking design investment for innovation (CWLEP, 2016a).

However, to restructure and build a globally important automotive cluster, this relative performance advantage with other LEPs may not be sufficient. Furthermore, Coventry and Warwickshire is only in the third quartile of LEPs for collaboration with other firms for innovation, suggesting a need to do more to build networks in the cluster. High levels of innovation are likely to be needed throughout the supply chain to enable the cluster to renew.

Insufficient skills in the supply chain

Whilst Coventry and Warwickshire has a relatively strong training and apprenticeship system, local businesses report that difficulties in recruiting technical staff are a barrier to growth. As identified in the Skills Strategy (CWLEP, 2015), SMEs face particular problems in addressing skills needs. Because of the costs and time involved they find it relatively harder to afford to train their staff, or to offer good quality apprenticeship places or work placements. Moreover, while JLR and other major employers are involved in training, they also recruit heavily locally, competing for skills in the local supply chain, especially with SMEs. This implies an important role for publicly-supported training.

There are four particular areas of concern concerning the availability of skills in the local supply chain (see WMCA 2017):

- Under provision of technical skills, particularly apprentices;
- Competition for high level digital skills;
- Changes in the demography of the skill base particularly an ageing profile of engineers;
- Lack of clear labour information identifying current and future skills demands.

Despite recent initiatives, there remains a gap between the demand for skills and the supply of vocational training in local further education colleges. This requires better planning of skills supply with local businesses. Furthermore, the adequacy of training is sometimes questioned. Firms often report that the younger generation of workers do not have the same practical skills as their older colleagues. In addition, new types of skills are needed as industry technologies evolve. Firms are requiring skills that combine old and emerging technologies, and indeed are finding it more difficult to predict skills needs in specific areas far in advance.

The automotive sector has high demand for digital skills as a consequence of the development of autonomous vehicles. There is strong competition for these skills. CWLEP (2016b) points out that the number of digital job vacancies tripled in the Warwick and Stratford-upon-Avon areas in 2014/2015 and estimates that within Warwickshire, jobs requiring the study of Mathematical & Computer Sciences and Technologies are projected to grow by 5% during the period 2015-22 (equating to an increase of nearly 1,000 jobs).

Furthermore, the skilled automotive workforce that has built up over many years in the area is gradually ageing and Coventry and Warwickshire is expected to need up to 25 000 Level 2 and Level 3 engineers to replace the existing workforce (Amison and Bailey, 2014).

There are also weaknesses in demand for higher level skills from SMEs (Keep 2016, Green and Martinez-Solano 2011). While the expanding range of highly skilled jobs in the CWLEP region means that increasing numbers of people from outside the region are recruited, retention of locally-trained high-skilled graduates is hindered by a lack of high value jobs in the SME supply chain. Therefore, increasing local skills supply is not sufficient to upgrade skills in the supply chain – efforts are also needed to increase innovation in local SMEs to stimulate demand for skills.

Uneven management skills and knowledge exchange activity

One of the bottlenecks to industry upgrading in the UK in general is that management and leadership skills and the adoption of best management practices are uneven across SMEs and there remain many businesses with poorly developed management skills and practices

(BIS, 2015). Furthermore, not enough SMEs invest in R&D, which limits their innovation absorption and collaboration opportunities. Indeed SMEs often do not know that they need to engage with others, or what is available in terms of knowledge exchange opportunities with partners such as universities.

Lack of finance for investment

More than 20% of firms in Coventry and Warwickshire reported access to finance as a barrier to growth (Enterprise Research Centre, 2015). Although the proportion reporting a finance problem was slightly lower than in England as a whole, this is nonetheless a significant issue. Clayton and Sivaev (2013) argue that shortages in private equity and venture capital investment is a particular constraint, particularly for capital-intensive manufacturing firms such as those in the automotive supply chain.

Some SMEs are experiencing problems with digital connectivity

Some SMEs in the supply chain are experiencing problems of lack of digital connectivity and a lack of high-speed broadband access. Connection to high-speed broadband is not always included in existing commercial space or the space offered on the market, and SMEs have often had to put in their own broadband on an ad hoc basis.

Limitations in energy supply

One of the important transformations the automotive cluster is going through involves the development of autonomous electric vehicles. However, constraints have been experienced in delivering the power supply needed for battery testing.

Lack of land for expansion and inward investment

The supply of vacant employment land has reduced significantly in recent years, to the point where enterprises in the automotive industry are identifying constraints in obtaining suitable sites and premises. There are relatively few sites now available within the City of Coventry. Significant land is potentially available in the county of Warwickshire, but may be unavailable because of green belt or other zoning regulations or because it is not equipped with adequate transport and energy connections for automotive manufacturers.

Emerging digital and tourism/culture specialisations

The nature of the specialisations

A growing digital cluster

Coventry and Warwickshire is home to an emerging digital industry. In particular, 'Silicon Spa' – based around Leamington Spa in Warwickshire – hosts one of the most vibrant gaming software clusters in the UK. More than 30 video gaming studios employ approximately 1 200 highly skilled workers, accounting for approximately 10% of the UK workforce in this sector. The cluster also includes serious games firms (for use in sectors including education, retail, marketing, advertisements and healthcare sectors) and virtual reality firms. The digital applications these firms produce could have benefits for other strategic sectors of the local economy, including the automotive cluster.

Key culture and tourism strengths

Likewise, the culture and tourism industry is growing. It spans Stratford-upon-Avon, Kenilworth and Warwick (i.e. "Shakespeare's England") in addition to the attractions in Coventry, supporting some 40 000 jobs in Coventry and Warwickshire (CWLEP 2016a).

One of the anchors for the sector is the Royal Shakespeare Company in Stratford-upon-Avon. There are also several visitor attractions such as Kenilworth Castle, Warwick Castle, Coventry Transport Museum, and the British Motor Museum in Gaydon. A further stimulus is being provided by the designation of the City of Coventry as UK City of Culture in 2021.

Enablers of industry emergence

Networks among entrepreneurs

The connectedness of businesses is helping to support new value creation in the digital and tourism/culture industries. Coventry and Warwickshire Chamber of Commerce is actively facilitating for networks in these fields. Informal networking is also supported in various ways, including through a Digital and Creative co-working space.

New knowledge in local universities

New knowledge that can be exploited through digital entrepreneurship is being generated and transferred from key research and innovation centres within both Coventry University (including the Serious Games Institute and SG International) and the University of Warwick (including the International Institute for Product and Service Innovation and the Institute of Digital Healthcare).

Strong local support to invest in tourism and culture promotion

There is a local consensus that it is important to increase tourism and culture promotion to better exploit the density and breadth of tourism/culture assets in Coventry and Warwickshire. The City of Culture designation is an important step forwards to put Coventry on the map and to leverage more money for infrastructure and development for the local tourism/culture industry.

Bottlenecks to industry emergence

Access to finance for innovative start-ups and scale-ups

There is a widespread financing gap in the UK and other countries affecting the availability of finance to innovative start-up and scale-up enterprises. This also affects Coventry and Warwickshire, despite a number of national, regional and local public initiatives to address it. As set out in CWLEP (2016a), the issues include gaps in supply in a number of areas of the market including micro-loans, loans for business expansion, equity finance for start-ups and early stage expansion, and the development capital (equity/mezzanine) of up to GBP 2 million. At the same time as acting on finance supply, it is also important to strengthen the skills entrepreneurs need to access available finance.

Access to finance for entrepreneurship is a particular barrier for the digital and creative industries, which tend to have low levels of fixed capital for collateral and uncertain revenue streams that can make traditional loan-based financing problematic.

Digital infrastructure investments

Significant infrastructure investments are needed in digital clusters, such as in Leamington Spa. Although existing studios have made important investments, it is important that continued investments are made in digital infrastructure to enable new studios to set up.

Shortages of digital skills

The continued growth of the digital sector in Coventry and Warwickshire will place a lot of demand on digital skills. Many roles such as programmers and software developers have

already been proving difficult to fill given national digital skills shortages. The challenge of obtaining workers with digital skills is shared with the automotive cluster.

Entrepreneurship culture

The economy in the north of the LEP area (Coventry, North Warwickshire and Nuneaton and Bedworth) historically has been dominated by a small number of large companies, which has had a negative impact on entrepreneurial culture in these areas, where start-up rates are below the national average. On the other hand, local universities are active in seeking to build entrepreneurial mindsets and strengthen start-up activity among graduates. For instance, at the Institute of Applied Entrepreneurship in Coventry University, students can develop their business ideas through entrepreneurship modules while studying for their degrees.

Existing policies

The above assessment of enablers and bottlenecks to cluster renewal and emerging industries in Coventry and Warwickshire stresses the importance of knowledge exchange and skills development processes and of a healthy local entrepreneurship ecosystem. A number of policies are already operating successfully in the Coventry and Warwickshire LEP area to support these conditions.

Local entrepreneurship ecosystem initiatives

The LEP's Growth Hub provides important business support services

Coventry and Warwickshire LEP established a Growth Hub in 2014 to facilitate access to public and private sector business support for SMEs and start-ups. The Growth Hub is playing an important role in ensuring that businesses can obtain advice on finding land and premises, workforce development and recruitment, supply chain access, and market access and other topics.

Several actors are supporting access to financing

The Growth Hub is also playing an important role in improving access to financing for start-up and scale-up enterprises. In addition, the British Business Bank is supplying GBP 1.2 billion of finance to Midlands businesses. Examples of important policy initiatives in Coventry and Warwickshire include:

- The creation of a Midlands Engine Investment Fund (MEIF), supplying funding of GBP 250 million across the Midlands to provide debt, equity and proof of concept finance to small businesses, with funding support from the British Business Bank, the European Structural and Investment Funds and European Investment Bank.
- To complement the Midlands Engine Investment Fund, it has been proposed to establish a Local Micro Loan Fund that will provide debt-based loans of up to GBP 50 000 to SMEs in Coventry and Warwickshire to directly complement grant finance. This will be particularly important for start-ups in the emerging digital and culture-tourism sectors, which are typically seeking small investments and have often been unable to access traditional forms of finance.

Knowledge exchange initiatives

Many policy initiatives have been developed to support local knowledge exchange

A number of policy initiatives have been developed to promote knowledge exchange among universities, research institutions, large 'anchor' firms, SMEs and innovative start-ups, supporting the automotive cluster and the digital and tourism/culture sectors.

Key local actions include:

- Development of the High Value Manufacturing Catapult (some of which is located within WMG and the Manufacturing Technology Centre) to help commercialise research in local universities.
- Preparation of Science and Innovation Audits for the Midlands Engine for Growth area. The Audits have mapped out local research, innovation and infrastructure strengths in order to help pinpoint investment opportunities for the public and private sectors in innovation.
- The Coventry and Warwickshire LEP Growth Hub is encouraging open innovation in the automotive cluster by helping businesses to identify external partners (including universities, research institutions and other firms), and sources of funds to support innovation collaboration projects.

National actions with important local impacts include:

- Knowledge Transfer Partnerships and Innovation Vouchers, both aimed at improving knowledge exchange between universities and research centres and innovative start-ups and existing SMEs.

These interventions have been important in supporting innovation and innovation collaboration involving SMEs and in helping SMEs enter supply chains.

There are several specific examples of successes from these policies in Coventry and Warwickshire:

- In January 2016, the LEVC, Morgan Motor Company, AMG Batteries Ltd, JLR and Parker Hannifin, alongside other consortia partners, were awarded GBP 31 million of government investment to deliver innovation in areas including lightweight advanced diesel engines and high energy density batteries.
- The UK Battery Industrialisation Centre was awarded GBP 80 million of government funding to provide a new open access R&D facility for battery manufacturing development.
- The WMG SME Group is currently delivering funded support to the manufacturing supply chain. Between 2011 and 2015 the SME Group delivered an European Regional Development Fund (ERDF) programme which provided assistance to 1 400 businesses.

Skills initiatives

The LEP is shaping skills and training provision

Coventry and Warwickshire LEP is strengthening local apprenticeship provision in several ways:

- It has developed a Skills Strategy that covers school leavers, shop floor apprenticeships and higher level skills.
- It is fostering collaboration between local Further Education and Higher Education Institutions and employers to better align education systems with the needs of employers.
- It is working with local partners, including employers and education providers, to maximise effective use of the upcoming Apprenticeship Levy, including Higher and Degree Apprenticeships. This is helping expand private sector investment in training as well as steering skills supply.
- It has channelled Growth Deal financing to investment in training facilities and training programmes for technical workers for the automotive cluster and emerging industries and involved local employers and education institutions in identifying and providing for existing and future skills needs.

Examples of key policy initiatives in the Coventry and Warwickshire area include:

- Creation at Warwick College (a Further Education college) of the Warwick Trident College Centre for Product Creation, which trains advanced and higher apprentices. Over 200 apprentices from JLR and local SMEs have been recruited. The Centre was partly funded with GBP 1.3 million from a Skills Capital project funded by the Growth Deal.
- Warwickshire County Council has channelled Skills Challenge funding to a project with HORIBA MIRA offering work experience placements in HORIBA and the MIRA Technology Park to students from local schools, colleges and other businesses.

Policy governance arrangements

Strengths in policy governance

The LEP's strategic documents identify priorities for emerging industries

Coventry and Warwickshire LEP, one of 38 LEPs in England, is a partnership between local authorities and businesses to help identify and mobilise resources and actions to respond to local economic development priorities.

One of its key instruments is the local Strategic Economic Plan (SEP), which covers five strategic pillars – Unlocking Growth Potential, Advanced Manufacturing and Engineering, Growing the SMEs, Growing the Talent, and Culture and Tourism.

In addition, the Skills Strategy for Coventry and Warwickshire LEP (CWLEP, 2016a) outlines key areas of strength and weaknesses in the provision of skills and outlines planning frameworks for actions to take for the period 2014-2019. Its implementation is supervised by the LEP Jobs and Skills Business Group.

The LEP has also developed a number of other key strategy documents that are very valuable in steering policy. They include a number of sector plans covering the automotive cluster and key emerging industries.

The LEP Board provides further rich and early warning intelligence

LEPs are driven by a Board, which in the case of Coventry and Warwickshire in October 2017 involved 8 members from the private sector (2 of which are SMEs), 6 from the public

sector and 2 from universities. The Board is supported by the Joint Committee, the Growth Deal Sub-Committee and the Executive and Secretariat Group. It benefits from business intelligence and progress reports from the Coventry and Warwickshire Growth Hub.

The LEP provides rapid intelligence on issues and needs in the local economy via the direct knowledge and networks of the Board members spanning universities, local government and business.

The LEP helps channel public and private funding to industry challenges

Coventry and Warwickshire LEP has also been very successful in channelling public and private funding to key initiatives to address bottlenecks in the upgrading, diversification and emergence of the key clusters, including investments in infrastructure, training and enterprise development.

For example, the LEP has led and co-ordinated successful local bids for national government funding through three Growth Deals, including GBP 131 million to enhance the transport infrastructure, develop new R&D and business support facilities in the automotive cluster, and invest in further education colleges and new skills facilities targeted at key growth sectors. In addition, the LEP was successful in a GBP 31 million Regional Growth Fund award for provision of infrastructure to encourage private investors to commit to key employment sites, and a GBP 2.4 million Rural Growth Fund award to support business start-ups and growth with a focus on women-led enterprises. It is also one of the ten LEP partners in the Midlands Engine Investment Fund, which is providing a GBP 250 million fund across the Midlands to provide debt, equity and proof of concept finance funded through the ERDF and the European Investment Bank.

With additional private sector and other public sector contributions, the LEP has channelled GBP 454 million to local projects for physical and digital infrastructure investments, training centres and apprenticeship academies, and entrepreneurship and small business development in the period 2011-2017.

The LEP strategies and plans are well aligned with related strategies and plans

There are two major regional level strategic initiatives that have taken into account the Coventry and Warwickshire LEP SEP and have been reflected in the pillars prioritised in the LEP's SEP 2016 Update.

First, the Midlands Engine for Growth initiative, launched in 2015 to increase regional productivity and skills, is backed by all the ten LEPs in the region, including Coventry and Warwickshire. It includes a Science and Innovation Audit developed in collaboration with all the LEP partners.

Second, a new West Midlands Combined Authority (WMCA) has been created involving seven metropolitan authorities (including Coventry), three Local Enterprise Partnerships (including Coventry & Warwickshire LEP) and other Local Authorities. WMCA has negotiated a GBP 1.1 billion Devolution Deal with national government that will invest in productivity, skills, transport and homes. Its objectives and prioritise are also in line with those of Coventry and Warwickshire LEP.

As a result, the objectives in the WMCA and Coventry and Warwickshire LEP SEPs are closely aligned, particularly in terms of growing the manufacturing and digital/creative sectors, raising skills levels as a means of both supporting growth of key economic sectors and increasing employment rates, and enhancing the transport infrastructure as an enabler for economic growth.

At the more operational level, alignment of actions between the WMCA and Coventry and Warwickshire LEP is facilitated in a number of ways. Board members of Coventry and Warwickshire LEP, as well as the LEP's Operations Director, sit on key Combined Authority Boards and Working Groups. Coventry and Warwickshire LEP's Chair sites on the overall WMCA Board, along with the Leaders of Coventry City Council, Warwickshire County Council, and Leaders of local District and Borough Councils. The leader of Coventry City Council is portfolio lead for Skills and Productivity, while the leader of Warwickshire County Council, a non-constituent member, is portfolio lead for Finance and Investments.

The WMCA will further be supported by a Productivity and Skills Commission, established in April 2017, which will provide advice to the Authority in developing actions. This will have representation from Coventry and Warwickshire LEP.

Constraints in policy governance

Local policy organisations have non-aligned geographies

Coventry and Warwickshire LEP combines a major urban area that is part of the WMCA area (Coventry) and a more rural part of the LEP (Warwickshire) that is a non-constituent part of the WMCA area. While the strategies and policies of the LEP and the WMCA have so far been consistent, there may be gains of coherence to be had by reviewing again these geographies. For example, a realignment of local organisational boundaries or additional methods of co-ordination could help ensure that the policies of the LEP and the WMCA remain aligned and mutually-enforcing going forward.

Links with some relevant partners need to be reinforced

Some of the key potential partners of Coventry and Warwickshire LEP are not represented on the LEP Board or its sub groups. This includes certain education and training providers in the area and in neighbouring areas and many employers. Stronger mechanisms may be needed to include these agents in active partnership working through the LEP.

Recommendations for policy development

Recommendations for the local entrepreneurship ecosystem

Major players in implementing actions:

Coventry and Warwickshire LEP, Coventry and Warwickshire Growth Hub, Coventry City Council, Coventry University, University of Warwick.

Key proposed actions:

Continue to strengthen access to finance for innovative start-ups

Coventry and Warwickshire LEP would benefit from adding a representative for finance to its board to improve understanding of access to finance issues for innovative start-ups and potential policy responses, such as businesses in the digital creative and culture industries.

The LEP should also further actively advocate alternative sources of finance such as crowdfunding which can complement other sources of finance. Information on existing crowdfunding platforms or organisations across the UK which provide innovative finance for the digital and creative businesses (such as the Arts Council initiative Creative United)

need to reach a large number of local businesses through the LEP and its communication channels.

Initiatives could also be taken to experiment with building local capital funds and creating networks for patient and inclusive investments.

Promote local residential and workplace attractiveness

One of the important factors in the ability of a local entrepreneurship system to stimulate innovative start-up and scale-up companies is the attractiveness to talented people, as entrepreneurs and entrepreneurial employees. Coventry and Warwickshire is well provided for in terms of residential and workplace amenities that matter to individual entrepreneurs and their workforces. However, more needs to be done to promote positive perceptions of the area. It is important to embrace the Coventry City of Culture designation as a means of strengthening a creative milieu for innovation and entrepreneurship to thrive. In addition, the LEP is well positioned to support and co-ordinate public and private initiatives to support the development of a regional brand (as has been done in Leamington Spa for the gaming cluster) and should continue to strengthen connections and collaboration between large firms and local SMEs in tourism-related matters. It could also envisage launching a broader conversation on the regional identity as part of the regional spatial planning process.

Develop new and shared industrial spaces

The automotive and digital clusters are both experiencing a shortage of industrial space, together with difficulties in attracting mobile, highly-skilled management, science and technology employees, and lack of opportunities for cross-fertilisation of knowledge across businesses in different technology and market areas.

An approach to addressing all these issues together could involve provision of attractive shared industrial spaces. There are several large developments in the pipeline that might help meet the need of digital and technology companies for space (e.g. the City Centre South development in Coventry) if planned with this in mind.

To foster connections with the digital industry, the large automotive firms could provide or sponsor incubator space for start-ups, perhaps in return for selected services that enhance their own technological capabilities.

Another course would be to work on planning and developing an additional ‘innovation district’-type space that will be attractive for mobile automotive and related technology-based firms and their knowledge workers, for example as part of urban regeneration efforts. Attention would be paid to branding and marketing of the area, ensuring public transport connections, creating an attractive hub, and including a variety of types of space to accommodate businesses of all sizes, including workspaces for entrepreneurs.

Inspiration can be drawn from how the City of Fremont created an Innovation District by rebranding, redeveloping and improving transport connections to an existing industrial area, as discussed in Chapter 3 Box 3.3.

Develop local entrepreneurial talent

Entrepreneurship training initiatives are provided through Coventry University and Warwick Business School. These initiatives could be further leveraged by the LEP by ensuring that there is steady funding for local entrepreneurship competitions, typically raised through donations from large local firms and engagement of the region’s larger firms in support entrepreneurship training. Provision should also be made for entrepreneurship

space and premises at the universities. In parallel, entrepreneurship training could also be used in the apprenticeship system to encourage more people to start businesses.

Knowledge exchange recommendations

Major players in implementing actions:

Local universities (Coventry University, University of Warwick), Coventry and Warwickshire LEP, Coventry and Warwickshire Growth Hub, the West Midlands Combined Authority, Warwick Manufacturers Group.

Key proposed actions:

Strengthen actions for innovative start-ups in the automotive cluster

Much of the recent policy action to promote knowledge exchange has involved investing in research initiatives that can promote diversification of the automotive cluster into new technological fields. Much of this investment is likely to pay off only in the long term. In the short term, there needs to be complementary action to foster innovation-led start-ups in automotive and related industries.

Promote engagement of automotive supply chain SMEs in local knowledge exchange

Additional initiatives could be introduced to engage more low productivity SMEs in knowledge exchange with other firms and with universities and research institutions. Growth Deal projects could be developed with universities around SME innovation to get more automotive suppliers involved in innovation.

Expand specialist business advice to build innovation capabilities in automotive supply chain SMEs

Although the Growth Hub has a critical function to play in facilitating access to business support, it draws on limited funding channels. Furthermore, in 2016, an important national agency that played an important role locally in identifying and supporting SMEs in scale up challenges – the Business Growth Services agency – was disbanded. These interventions have not been fully replaced by the local Growth Hub.

There is scope for Coventry and Warwickshire LEP, in conjunction with the WMCA, WMG and Coventry University, to explore how to provide specialist business advice in the region, in complement to the existing single gateway function of the Growth Hub.

Initiatives are needed to proactively identify SMEs in the automotive supply chain that would be ready to engage with management advice to help them to develop and implement company growth plans. In addition, public support will be needed to finance the provision of specialist advice to these firms. Such initiatives could potentially be organised through the establishment of new SME competence centres.

Provide stronger support to sectoral cross-fertilisation of knowledge

The branching out of the automotive cluster into new activities will increasingly involve the combination of knowledge across traditional sector specialisations. For example, digital and creative industries will have a key impact on the development of automotive products and processes. Policy interventions have often traditionally been conceived of at the level of specific sectors. More attention is needed to the linkages that can be developed in knowledge exchange across different sector specialisations.

Skills recommendations

Major players in implementing actions:

Coventry and Warwickshire LEP, local universities (Coventry University and University of Warwick), local colleges of further education, local private sector training providers, local businesses (large firms, SMEs, start-ups).

Key proposed actions:

Strengthen efforts to identify skills needs in collaboration across training actors

The roles of all the universities, colleges and private sector training providers in catering to the training needs of the automotive cluster and emerging industry specialisations should be clarified. This can be done by creating a roadmap that identifies areas of commonalities and competition and where greater coordination is most needed. The roadmap should also be used to ensure that local colleges, universities and training providers include shared local priorities in their development plans.

In undertaking this mapping, it is important to take a regional view that corresponds to the labour market area of the key clusters, involving engagement with neighbouring LEPs to agree a joint approach to supporting skills development. In the case of the automotive cluster, a dedicated effort will also be needed to engage with neighbouring LEPs to agree a joint approach to supporting skills development in the cluster.

The Coventry & Warwickshire City Deal has adopted what was described in the original funding submission as a 'Clearing House' focus to bidding for funding for training provision, characterised by a mainly sector-based approach to skills development. It is also important to enlarge from a sector-based skills development approach to more cross-cutting analysis and actions on skills development that are less focused on specific sectors.

Create stronger mechanisms for business participation in skills needs analysis

It is important to increase SME participation in defining existing and future skills needs and in shaping training supply in key automotive cluster areas and local emerging industries

Employer Ownership Pilots have been proposed to increase the influence of employers over the publicly-funded education and training system. Employers will be able to bid for funds to develop innovative approaches to meeting skills needs. Coventry and Warwickshire LEP should play a key role in helping develop and prioritise proposals with employers.

New employer councils could play an important role in guiding training in automotive, digital, and tourism/culture professions. This would support employers from these fragmented industries to get engaged, and to jointly develop curricular standards. Existing institutional structures for sector skills groups at various government levels should be utilised to define these new groups of emerging skill sets.

Inspiration can be drawn from the ICT Committee at the Workforce Investment Board in San Francisco, where representatives of local technology employees advise local training providers on training curricula and resources in the area of digital skills (see chapter 3, Box 3.4).

Further develop local apprenticeship opportunities for SMEs

A number of anchor companies in the automotive cluster are major suppliers of apprenticeships and have developed excellent training programmes. In order to increase the local supply of trained workers, these firms could be incentivised to over-train apprentices – i.e. to train significantly more apprentices than they plan to hire. Tax or other incentives could be used for this purpose.

The Apprenticeship Levy is seen by some employers as a tax going to central government. In order to increase the engagement of local firms in this process, efforts are needed to provide local control of the use of these resources and to build the perception that the levy is used for local skills projects.

Attention should also be paid to including a wide set of large manufacturers, start-ups, scale-ups, and SMEs in apprenticeship programmes where trainees gain skills in broad areas like digital marketing. This could help address skill shortages, such as in emerging IT specialisations, for multiple industries, while also reducing poaching.

Expand support for the development of digital skills

Digital skills are strongly demanded across the automotive, digital and culture/tourism sectors and are in short supply. It is therefore important to increase the local supply of STEM skills and to encourage digital skills in existing apprenticeship and training schemes.

Policy governance recommendations

Major players in implementing actions:

Coventry and Warwickshire LEP, Department for Business Energy and Industrial Strategy, Department for Education, West Midlands Combined Authority, Coventry and Warwickshire Chamber of Commerce, Coventry and Warwickshire First.

Key proposed actions:

Increase LEP resources and powers

The LEPs have important responsibilities for economic strategy making at local level to ensure that public investments match with the local priorities of public, private and civic sector stakeholders. However, the financial resources and control over the use of these resources remain largely centralised. The LEP largely accesses funding through competitive bids for funding that is allocated for short periods of a few years. This can make it difficult to work towards long-term targets with long-term strategic decisions at local level.

The tension between local responsibility for strategy development and central power and resources is visible in the reform of skills policies. Although the government has moved from a centrally-driven system to one of employer ownership of the skills agenda, national regulations and funding policies are still too rigid to be made locally effective.

Secure regional-local coordination of policy delivery

Both Coventry and Warwickshire LEP and WMCA are likely to have key roles to play in the development of a local industrial strategy as part of the UK Industrial Strategy process. Although both are well aligned in their strategies, a key issue will be how funding, e.g. from the planned UK Shared Prosperity Fund (the proposed successor to European Structural and Investment Funds in the UK), will be allocated. If funding is allocated

through the LEP then a more local focus might be achieved on the priorities of the LEP. If the funding is allocated through the WMCA, then broader regional scale priorities might be favoured and the internal cluster links between Coventry and Warwickshire might be harder to maintain. Careful attention will be needed to the design of funding and co-ordination arrangements in order to achieve both local and regional priorities.

Strengthen business networks

Formal and informal business networks could be further promoted in the local economy in order to support knowledge exchange across sectors, including between the automotive cluster and the digital cluster, and collective actions for skills, innovation and entrepreneurship. This effort can build on the role of the LEP as a linking organisation across businesses, universities and local government authorities and on some existing business networks including the Coventry Chamber of Commerce (which has a voluntary membership of 6 500 businesses) and the Coventry and Warwickshire First forum for knowledge intensive business services. Efforts could be made to seek to combine the existing networks and bring in new businesses around specific activities related to skills development and knowledge exchange, which would incentivise participation by businesses.

Inspiration can be drawn from the regional business development networks that have grown up in the Heilbronn-Franconia region in Germany, which include pooling of economic development resources by five local authorities, a regional network of business angels, and collaboration to create a local training campus of the Technical University of Munich. The experience is discussed in Chapter 5, Box 5.1.

Ensure a strong role for the LEP in supporting a Single Spatial Strategy for Coventry and Warwickshire

In regions without a strong role for the public sector in regional planning, the private sector has often stepped in to lead and support the development of a regional vision on issues including access to physical infrastructure, energy, broadband, affordable housing and key local networks. An example of this kind of co-operation is the Joint Venture in Silicon Valley, which convenes business leaders to discuss issues related to regional competitiveness, jobs-housing imbalances and traffic congestion.

As part of the Growth Deal, a commitment was made to move towards a single spatial strategy for the Coventry and Warwickshire area to guide further development related to employment, housing, infrastructure and environmental considerations. Such a strategy would provide for a coherent framework underpinning strategic investment decisions and providing confidence to businesses. The LEP has a key role to play in the creation of the strategy as an advisory board and a linking organisation between different local government authorities and private sector stakeholders.

Stabilise regional governance arrangements

The recent rescaling of devolution in the UK has led to the creation of new organisations at different spatial scales with multiple partnerships between the private and public sector. The four-scale structure of the Coventry and Warwickshire LEP, the West Midlands Combined Authority, the Midlands Engine and the national government, and partially overlapping geographies and responsibilities. This increases complexity for businesses to decide where to go and with whom to commit. The national government needs to ensure continuity and increase the credibility of the current local economic policy governance arrangements in order to build business confidence in the current regional policy structures.

Lessons for the new UK Industrial Strategy

The UK produced an Industrial Strategy White Paper in 2017 focused on strengthening the foundations of productivity at national and local levels (HM Government, 2017). The strategy follows a vision for the UK to become "the world's most innovative economy" and centres around five foundations of productivity to enhance innovation, employment and skills, entrepreneurship and the flourishing of SMEs and world-leading industries. One of the key priorities detailed in the White Paper is to "agree Local Industrial Strategies that build on local strengths and deliver on economic opportunities". The Industrial Strategy notes that innovation flourishes in clusters, including networks of firms, driving universities and research centres, and local specialised skills. Local Enterprise Partnerships will be one of the key players helping to design and deliver Local Industrial Strategies, bringing together businesses, universities and research organisations, and skills and training suppliers to determine local growth needs. Local Enterprise Partnerships may be enhanced to deliver enhanced local leadership for this purpose.

Coventry and Warwickshire LEP offers an example of how a LEP is already working well to identify local priorities and channel local and national funding to improve skills and knowledge exchange in such a way as to strengthen business and productivity growth in a key national cluster and to help the emergence of new clusters. Its experience suggests a number of approaches that could be applied more generally. It also suggests areas where new approaches may be beneficial.

Summary of key recommendations

Box 1.1. Summary of main policy recommendations

The local entrepreneurship ecosystem

- Strengthen the availability of finance to innovative start-ups by (i) adding a finance representative to the LEP board, (ii) spreading information about crowdfunding options for start-ups and other alternative sources of financing, and (iii) building local capital funds and creating networks for patient and inclusive investments.
- Promote a positive image of residential and workplace attractiveness and build local amenities to attract and retain entrepreneurial talent.
- Plan and develop attractive shared industrial spaces for digital and technology start-ups and SMEs, and explore options for the large automotive firms to provide or sponsor incubator space for start-ups, perhaps in return for selected services that enhance their own technological capabilities.
- Plan and develop an additional industrial space that will be attractive for mobile automotive and related technology-based firms and their knowledge workers, for example as part of urban regeneration efforts. *(As per the development of the City of Fremont Innovation District in Silicon Valley – see chapter 3, Box 3.2)*
- Leverage university-led entrepreneurship training initiatives through efforts by the LEP to ensure that there is steady funding for local entrepreneurship competitions, including from contributions by local employers. Ensure provision of appropriate premises for entrepreneurs.

- Expand apprenticeship curricula with entrepreneurship modules to encourage establishment of new enterprises by apprenticeships where relevant.

Knowledge exchange

- Increase support for innovative start-ups connected to regional research outputs.
- Engage more low productivity SMEs in knowledge exchange with other firms and with universities and research institutes. Incentivise larger firms to undertake more intensive innovation interactions with other local players than currently and promote open innovation.
- Offer more support for innovation management capabilities in low productivity SMEs, for example through a local SME Competence Centre.
- Engage more businesses in mentoring.
- Provide stronger support to sectoral cross-fertilisation of knowledge, including between digital and automotive, e.g. by linking researchers with similar competences in different industries to work on new product and process models.

Skills and education

- Create a stronger training needs and supply mapping:
  - Create a road map clarifying the roles of all the universities, colleges and private sector providers in catering to the training needs of the automotive cluster and local emerging industries, including management training as well as technical skills. Identify areas of commonalities, competition and where greater co-ordination is most needed.
  - Engage with neighbouring LEPs to agree a joint approach to supporting skills development in the automotive cluster.
  - Develop more cross-cutting analysis and actions on skills development that is less focused on specific sectors.
- Increase SME participation in defining existing and future skills needs and shaping training supply in key automotive cluster areas and local emerging industries:
  - Introduce employer councils to guide training in automotive, digital, and tourism/culture professions. *(As per the ICT Committee at Workforce Investment San Francisco – see chapter 3, Box 3.3)*
  - Help develop and prioritise proposals for Employer Ownership Pilots.
- Further develop local apprenticeship opportunities for SMEs:
  - Incentivise anchor firms like JLR in the automotive cluster to over-train apprentices, possibly through the tax system.
  - Provide local control of the use of Apprenticeship Levy resources and build the perception that the levy is used for local skills projects.
- Expand support for the development of digital skills:
  - Increase support for the STEM pipeline from elementary school to higher education level to address skills shortages in emerging IT specialisations.

- Pay attention to including both large manufacturers and start-ups in taking apprentices from apprenticeship programmes where trainees gain skills in broad areas like digital marketing.

Governance and institutions

- Secure longer-term project funding to be controlled by LEPs.
- Ensure that the design of funding and co-ordination arrangements for the local industrial strategy will support both local and regional players.
- Incentivise business stakeholders to participate in local cross-sector organisations and networks for collaborations on skills, entrepreneurship and innovation. *(As per the business development networks in the Heilbronn-Franconia region in Germany – see chapter 4.)*
- Ensure a strong role for the LEP in supporting a Single Spatial Strategy for Coventry and Warwickshire.
- Develop stability in the local economic policy governance arrangements.

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2. The Coventry and Warwickshire economy

Introduction

Coventry and Warwickshire is a globally-significant hub in the UK automotive and related industry cluster, with business and research links across the world. It has a strong focus on research and design led activities but also in niche manufacturing with a strong local automotive industry supply chain. It has strong potential for further growth through a strengthening of its place as a global leader in several emerging areas of the automotive industry – including driverless technology and low carbon technologies – and reshoring of a number of supply chain activities. At the same, time the area is home to a significant digital cluster based in and around Leamington Spa ('Silicon Spa') with a strong focus on the gaming industry and a growing culture and tourism specialisation, based on assets such as the Royal Shakespeare Company. Providing the right conditions for the development of these industries locally will be critical to economic development locally and also have national impacts by facilitating the development of nationally important industrial specialisations.

Population and employment

Coventry and Warwickshire incorporates the Districts of North Warwickshire, Nuneaton and Bedworth, Rugby, Stratford-upon-Avon and Warwick and the City of Coventry, which is England's ninth largest city with a population of approximately 350 000. Coventry and Warwickshire has approximately 910 000 residents, with a growth rate of 1.1 % in 2016 (above the UK average of 0.8%).[1] While the population growth can be attributed to several factors, the main reason for the rise (75.0%) is net international immigration. This is partly due to the increase in the number of overseas students attending local universities.

The unemployment rate was 3.6% in Coventry and Warwickshire in 2016, down from 8.4% in 2011. Its unemployment rate is below the England and Great Britain average (both standing at 4.8% in 2016).

Growth and productivity

Productivity is a key challenge for the UK economy as a whole, productivity growth having stalled since around 2006 compared the OECD and G7 averages (OECD, 2017). The Office of National Statistics (ONS) estimated the growth of Gross Value Added (GVA) in the UK at 3% from 2010 to 2014. In comparison, over the same time period the Coventry and Warwickshire area grew by 3.75%.

[1] ONS Population estimates 2017.

GVA per worker in Coventry and Warwickshire was only 90% of the national average in 2015 (see Table 2.1). However, productivity has been growing more rapidly in Coventry and Warwickshire than the rest of the country in recent years. This change has been predominantly driven by the economic performance of Warwickshire, which has seen strong acceleration since 2009.

Table 2.1. GVA per worker, selected geographies

	GVA per worker	
	2015	Growth 2009-2015
West Midlands	44 612	13.64%
The UK	50 830	13.35%
Coventry	49 735	15.12%
Warwickshire	45 952	19.58%

Source: ONS

Accessibility

Coventry and Warwickshire is centrally located within the UK. It is well-served by a motorway network including the M6, M40, M42, M45 and M69 and close proximity to the M1 and M5. This network, along with the A14 and A5, provides access to all parts of the UK.

The area also has good rail links. For example, the passenger journey time to from Coventry to London is around 60 minutes. In terms of freight, for example, the ABP Hams Hall Rail Freight Terminal at Coleshill connects with the ports of Southampton, Felixstowe and Ipswich and the Channel Tunnel, while the Daventry International Rail Terminal (DIRFT) near Rugby is expanding. This network provides crucial links between ports, production facilities and distribution terminals.

Coventry and Warwickshire also has easy access to air connections through its close proximity to Birmingham Airport offering direct connections to major European cities and to London's four major airports (Heathrow, Gatwick, Stansted and Luton). Coventry Airport is a successful freight airport, offering commercial, corporate, business aviation and cargo services. Coventry Airport is also just 35 minutes from London via helicopter transfer.

Industrial specialisations

Coventry and Warwickshire has a long and significant economic history, which continues to shape and influence the performance of the local economy. The Warwickshire Coal Field in the north of the area supported important coal mining and associated industries during the Industrial Revolution. The area's main economic specialisations then evolved from sewing machinery manufacturing, to bicycles and then the motor industry. However, the decline of coal mining after the Second World War, and the decline of the British motor industry in the 1970s and 1980s led to rising unemployment, particularly in the north of the region. A renewal is now underway in the key automotive sector, and other local industry specialisations are emerging.

The key current specialisations of the Coventry and Warwickshire area are outlined below.

Automotive

Coventry and Warwickshire host important automotive activities within a broader Midlands automotive cluster, the main UK automotive cluster. The cluster directly employs 34 000 people in Coventry and Warwickshire, accounting for 10% of local employment, with a workforce that is 10% more productive than the UK average.

The area is also home to 35 automotive and off-highway brands, 12 vehicle manufacturing sites, several OEM R&D centres, and an important supply chain in automotive design and engineering. Major automotive industry employers include; Tata, Jaguar Land Rover, Aston Martin, BMW, Rolls Royce, Alstom, Ricardo, Lear, Meggitt, Unipart, Delphi, Geely, GE Converteam and Bosch.

Among the assets of the area for the automotive cluster are a number of major R&D and innovation centres. These include Coventry University, the University of Warwick, WMG (home to the National Automotive Innovation campus and Tata Motors European Technical Centre) and Horiba MIRA (an independent vehicle engineering consultancy and leader in CAV technology, which is developing a 2m sq. ft. R&D Campus just outside Nuneaton).

The area is particularly strong in the design, development and deployment of low carbon electric, electric hybrid, fuel cells and hydrogen power systems and lightweight materials, Connected and Autonomous Vehicles (CAV) and software. Coventry is also a test site for driverless vehicles including the Coventry-built Lutz Pathfinder by RDM Group and vehicles from Ford and JLR. Coventry has a network of publicly available third generation electric vehicle points, boasts the UK's first all-electric bus service, as well as the UK's first simulator at WMG (Warwick Manufacturing Group) for the development and testing of autonomous vehicles.

There have been major recent investments in state of the art R&D facilities by flagship automotive manufacturers, including:

- Geely's £300m investment in a new R&D facility at London Taxi Company at Ansty.
- Jaguar Land Rover's £500m expansion of its engineering and design activities at Whitley and Gaydon.
- Red Sun Group's £300m investment into CADCAM Automotive for a new energy and power complete vehicle R&D Centre.

Overall, the automotive cluster in Coventry and Warwickshire, and the wider West Midlands, can be described as mature, but undergoing a dramatic evolution, not only driven by the growth of global markets (particularly Asia) but regulatory changes on emissions and air quality, and advances in technology.

There is now a unique opportunity to grow the cluster in Coventry and Warwickshire, particularly through the commercialisation of new products and technologies. Furthermore, supply chains are very uncertain right now due to Brexit. Should the UK choose a hard Brexit, there are likely to be considerable opportunities in the automotive supply chain for new start-ups and scale-ups (Bailey and De Propris, 2017). However, for this potential to be realised, the business support, innovation and skills infrastructures all require enhancements to respond to the sector's growth dynamics.

There are particular opportunities for development of innovative SMEs in the automotive supply chain in the area, reflecting changes in the way in which major OEMs seek to

interface with their Tier 1 suppliers. It is now becoming increasingly common for OEMs to co-locate with suppliers in order to build partnerships focused on developing a particular technology. This, along with the major R&D investments of OEMs based locally, has created major opportunities for Coventry and Warwickshire SMEs operating within the supply chains.

Aerospace

The automotive industry is closely linked to a broader local advanced manufacturing and engineering sector, which includes a significant aerospace specialisation. Local aerospace businesses are supported by major R&D facilities such as The Manufacturing Technology Centre (MTC) and research in Coventry University and the University of Warwick. The area is also home to the Midlands Aerospace Alliance (MAA), which is the largest aerospace cluster organisation in Europe.

Digital

Coventry and Warwickshire has some 2,500 digital businesses (mainly hardware, software, digital content and gaming). This is often referred to as 'Silicon Spa', which is centred in the towns of Royal Leamington Spa, Southam and Warwick. It hosts 30 gaming studios, which employ over 1 200 highly skilled people, equating to over 10% of the UK workforce in games development. They have produced a number of globally-recognised titles including console games like Forza Horizon and Guitar Hero Live, mobile games like Warhammer, Sonic Jump and Freeblade, and PC games such as LA Cops. Coventry and Warwickshire also hold a strong position within the serious games and virtual reality sector.

The scale of this cluster is frequently not recognised, and with other progressive digital clusters in the UK delivering significant investment in infrastructure, it is important that continued investment takes place to enable new studios to set up, and retain the area's competitive advantage. It is also important to note that digital applications influence other strategically important economic sectors of the Coventry & Warwickshire economy

Culture and tourism

Coventry and Warwickshire is also a centre for culture and tourism activities. This cluster draws on assets such as the world-renowned Royal Shakespeare Company based at Stratford-upon-Avon, which receives more than 5 million visitors per year, visitor sites such as Kenilworth and Warwick castles and museums such as Coventry Transport Museum and the British Motor Museum in Gaydon. The area's ambitions in culture/tourism activities have been given a boost with Coventry's award as the UK City of Culture in 2021, which showcase the region on a national and international stage.

Business services

Coventry and Warwickshire has a large Business, Professional and Financial Services sector, involving 12 000 companies and 80 000 employees. There is an important office concentration in Coventry, which is creating a new professional quarter at Friargate in the city centre.

Entrepreneurship

Coventry and Warwickshire have a large and diverse business base, with over 40 000 registered businesses in 2015, an expansion from 36 000 in 2013. It had a start-up rate of

approximately 49 start-ups per 10 000 people in 2016, equal to the England average and slightly above that of the UK. The start-up survival rate was also above the England and UK rates, with 56.5% of 2013 start-ups in Coventry and Warwickshire surviving to 2016, compared to 53.6 in England and 53.7 in the UK (Enterprise Research Centre 2017).

However, Coventry and Warwickshire had a below average in their proportion of "fast-growing businesses," firms that have an annualised average growth in employment of 20% or more over a three-year period, and the "high growth firm incidence rate". Some 14.7% of businesses were categorised as fast-growing over the period 2011-2014 compared to the national average of 16% (Enterprise Research Centre 2017). It also had below average "break-out" growth of new start-ups achieving GBP 1 million turnover within three years of starting (6.1% compared to 6.5% in England and the UK). Similarly, the rate of start-ups scaling, or growing from less than GBP 500 000 to over GBP 1 million in three years, is slightly lower (1.4%) than that for all of England and the UK (2% for both). On the other hand, the rate of continued scaling (GBP 1-2 million firms growing to GBP 3million over 3 years) is slightly higher than that of England.

Skills

One of the factors contributing to the productivity lag affecting Coventry and Warwickshire is the level of skills within the workforce. As discussed in OECD (2017), the need to raise the competencies of low skilled workers is a wider UK problem holding back productivity growth, particularly in UK regions that are lagging in productivity. When examining the education assets in the locality, Coventry and Warwickshire is potentially in a strong position, with two leading global universities (with a total of 54 000 students); further education colleges and world-class R&D institutions. However, although the skills levels of the local population have improved in recent years, they are still poor compared to the national average.

Although the proportion of Coventry & Warwickshire residents educated to NVQ Level 4+ (degree level) increased by 5.2 % between 2011 and 2014 (compared with 3.2% nationally) to 34.7%, this remained lower than the English average of 35.7% in 2014[2]. Furthermore, a recent assessment of long-term (1981-2015) trends in high-skilled employment finds that growth in Coventry (0.9% per year) and Birmingham (0.77% per year) significantly lags that in London (1.3%), Leamington Spa (1.9%), and Milton Keynes (3.8%) (Sunley et al. 2018).

A relatively low graduate retention rate is one of the contributing factors, which could potentially be addressed through attracting greater levels of investment from knowledge-intensive sectors and the creation of higher value jobs. Similarly, although Coventry &

[2] Nomis (2016) data

NVQ 1 Equivalent e.g. fewer than 5 GCSEs at grades A-C, foundation GNVQ, NVQ 1, intermediate 1 national qualification (Scotland) or equivalent.

NVQ 2 Equivalent e.g. 5 or more GCSEs at grades A-C, intermediate GNVQ, NVQ 2, intermediate 2 national qualification (Scotland) or equivalent.

NVQ 3 Equivalent e.g. 2 or more A levels, advanced GNVQ, NVQ 3, 2 or more higher or advanced higher national qualifications (Scotland) or equivalent.

NVQ 4 Equivalent And Above e.g. HND, Degree and Higher Degree level qualifications or equivalent.

Warwickshire witnessed a reduction of 2.7% in the overall number of adults with no qualifications (which decreased from 14.2% to 11.5% between 2011 and 2014 against an English average reduction of 1.9%), the area still has significantly more residents with no qualifications than the English average (8.6%).

It is notable that qualification levels are significantly lower in Coventry, Nuneaton and Bedworth and North Warwickshire than in Southern Warwickshire. These skills deficiencies are also causes of significant pockets of unemployment within the LEP area. Coventry's unemployment rate is significantly in excess of the national average and Nuneaton and Bedworth's is slightly above the national average. These concentrations of worklessness hinder the performance of the local economy.

The skills problem also presents a barrier to growth in local businesses. For example, 25 000 vacancies across the Midlands Engine area are hard to fill due to a lack of suitably skilled applicants. Moreover, Coventry and Warwickshire is expected to need up to 25 000 Level 2 and Level 3 engineers to replace the workforce in the automotive sector alone. As a result, the Midlands Engine's aspiration to increase the provision of apprenticeships by 100% and the number of higher apprenticeships by 40% appears pertinent to address key barriers to local business growth and reducing unemployment. Indeed, Coventry and Warwickshire LEP has set a target for 5 000 new Level 2 and 3 Apprenticeships (around 200 starts per year). The LEP is already:

- Fostering collaboration between the Further Education and Higher Education Institutions within and around the area to better align education systems with the needs of employers;
- Working with local partners including employers and education providers to maximise effective use of the upcoming Apprenticeship Levy, including Higher and Degree Apprenticeships.

Digital skills is an important specific area for intervention, given a high demand for digital skills in the local labour market. The Warwick and Stratford-upon-Avon areas tripled the number of digital job vacancies in 2014/2015; however, many roles are proving difficult to fill, reflecting national digital skills shortages. Within Warwickshire, jobs requiring the study of Mathematical & Computer Sciences and Technologies are projected to grow by 5% during 2015-22; equating to an increase of nearly 1,000 jobs across Warwickshire[3].

Programmers and software developers are most in demand. It is therefore imperative that the Coventry and Warwickshire workforce is well-equipped with the digital skills that businesses across a wide range of sectors require to expand and operate competitively.

Innovation

R&D indicators suggest that Coventry and Warwickshire's business base is among the most innovative in the country, with the area ranked in the top 10 of UK sub-regions (136th out of 1 310 sub-regions internationally) in terms of patents produced relative to the size of the population. Total R&D expenditure and employment in private sector in the area is also far higher in the sub-region compared to comparator LEP areas. For example, R&D employment is almost double that of Birmingham and Solihull despite Coventry & Warwickshire being smaller in size, and average in-house R&D expenditure per business in 2010 was GBP 15 000 in Coventry and Warwickshire compared to GBP 2 500 in

[3] Labour Insight Data (2016)

Birmingham and Solihull. In addition, Coventry produces the second highest number of patents per head of all UK cities, behind Cambridge.

On the other hand, the majority of this R&D expenditure is concentrated within the area's large Original Equipment Manufacturers (OEMs – a company that makes a part or subsystem that is used in another company's end product), particularly automotive manufacturers, which is likely an artefact of its industrial structure (particularly the concentration in automotive manufacturing). Some 89% of R&D employment and 94% of in-house R&D expenditure in the area accounted for by the top 5% largest R&D spending firms, which comprise just 0.05% of the business base.[4] This concentration of R&D in large firms could impede local innovation spillovers to smaller businesses (Acs, Audretsch, and Feldman 1994). There is also significantly less R&D activity within rural areas, where enterprises tend to be a smaller size, and show tendencies to remain small and not achieve significant growth[5].

One of the more general challenges for increasing productivity and positive industry evolution in the economy is insufficiently high SME participation in innovation activities in the local economy. Coventry and Warwickshire falls into the top quartile of LEPs for percentage of firms engaging in R&D, sales of innovative products and services, and proportion of firms undertaking product or service innovation. However, it has second-quartile results for the introduction of new business practices, introduction of new methods of work organisation, marketing innovation, and undertaking design investment for innovation, and only third-quartile results for collaboration with one another for innovation (Entreprise Research Centre 2017c).

The WMCA Strategic Economic Plan recognises as a Priority Action the need to increase the number of businesses adopting innovation, investing in R&D and commercialising new products and services. As recognised in the Midlands Engine Science and Innovation Audit, this should include enabling more businesses to build stronger relationships with universities and the wider knowledge base.

Knowledge base

Coventry and Warwickshire host several important research institutions contributing to the local knowledge base for industry upgrading, diversification and emergence. Some of the key institutions are outlined below.

University of Warwick

The University of Warwick is one of the prestigious Russell Group universities, with a strong reputation for excellence in research, innovation and teaching. It supports a number of types of connections with business across a range of key sectors for the local economy including automotive, advanced manufacturing, IT, and financial services.

It offers business access to its research equipment through dedicated Research Technology Platforms. It also supports student internships, placements and projects with local businesses and support for graduate recruitment. Almost a quarter of Warwick's graduates

[4] Mapping Local Comparative Advantages in Innovation, BIS, July 2015

[5] Coventry & Warwickshire LEP (2016), Coventry and Warwickshire European Structural and Investment Funds Strategy: ERDF, EAFRD and ESF Priority Descriptors

remain in the West Midlands after graduation, with 14% of these in Coventry and Warwickshire.

The University has opened two University Technical Colleges, the WMG Academies for Young Engineers, in Coventry and Solihull (the latter just outside the Coventry and Warwickshire LEP area). It also established the WMG Applied Engineering Programme, which in partnership with Jaguar Land Rover and Warwickshire College group, provides training up to degree-level for higher and degree apprentices in the automotive sector, who wish to combine study with work. In addition, the University is continuing its longstanding partnership with National Grid to provide training for young people in the region who are not in education, employment or training (NEETs), through the Get Skilled programme.

It also delivers executive education through WMG and Warwick Business School (WBS). In 2017, it introduced an entrepreneurship specialisation into its MBA, designed for students who wish to develop their entrepreneurial, innovation and creativity skills.

The University has also recently launched a vision for the development of a new Innovation Campus at Wellesbourne. This aims to create a centre for collaborative working with industry, including inward investment, for the development, demonstration and testing of innovation.

The University is also about to undertake a significant redevelopment of Warwick Arts Centre, the largest Arts Centre outside of London, which, in addition to improving the performance spaces, will introduce new innovations to support the region's digital and creative sectors.

Warwick's campus is also home to the University of Warwick Science Park, hosting 135 SMEs and providing advice and support on finance and incubation, research and development and knowledge transfer. The Science Park manages the Minerva network of business angels, who provide angel investment to start-ups in need of funding. It also recently started Business Ready in partnership with Warwickshire County Council and the ERDF. This support programme is designed to help companies achieve and exceed their growth potential, boosting the region's economy through the creation of highly skilled jobs.

Coventry University

Coventry University is known as an Entrepreneurial University with strong engagement with business, enterprise and the community. The University has multiple activities in the areas of knowledge exchange, intellectual property exploitation, social enterprise, consultancy, professional learning and development, offering access to facilities and equipment, and supporting new business start-ups and developing existing businesses. One of its outstanding initiatives for research collaboration with industry is the Institute for Advanced Manufacturing and Engineering (AME), which is a collaboration with Unipart Manufacturing Group. Academics and students work alongside industry professionals in the UK's first 'Faculty on the Factory Floor', which allows industry to benefit from the knowledge of academics and the innovative nature of the syllabus, whilst also allowing students to gain real and relevant work experience.

Manufacturing Technology Centre

The Manufacturing Technology Centre (MTC) develops and proves innovative manufacturing processes and technologies in an agile, low risk environment, in partnership with industry, academia and other institutions. Its focus is on delivering bespoke manufacturing system solutions for its customers, working with businesses of all sizes,

including SMEs. The MTC is part of the High Value Manufacturing Catapult, which is supported by Innovate UK (formerly the Technology Strategy Board), the innovation agency of the UK government.

HORIBA MIRA

HORIBA MIRA is a global provider of engineering, research and test services to the automotive, defence, aerospace and rail sectors. The organisation works in close collaboration with vehicle manufacturers and suppliers around the world, providing comprehensive support ranging from individual product tests to turnkey engineering design, development and build programmes. It has recently been involved in the creation of MIRA-Technology Park near Nuneaton, which includes an R&D Campus including 2 500 engineers and key OEM tenants such as Bentley, Ashok Leyland and Aston Martin.

Policy governance

Coventry and Warwickshire LEP

Coventry and Warwickshire LEP is a key institution in developing local economic strategy and engaging local players in local economic development initiatives. It has set the objective of transforming the region into the "Knowledge Capital of the UK," and becoming a "high growth economy and global hub for knowledge-based industries," with particular emphasis on advanced engineering and digital sectors (CWLEP Strategic Economic Plan 2016; Growth Deal Bid Round 3).

The LEP is governed by a Board comprising members, including 8 from the private sector (2 of which are SMEs), 6 from the public sector and 2 from universities. The Board is supported by the Joint Committee, the Growth Deal Sub-Committee and the Executive and Secretariat Group. It benefits from business intelligence and progress reports from the Coventry and Warwickshire Growth Hub.

As the Accountable Body, Coventry City Council is legally accountable for receiving funding, making payments, and for overseeing compliance to the Assurance Framework. In cases where it is alleged the LEP is neglecting its responsibilities, there is a complaints procedure, which can be escalated to the Local Government Ombudsman if required.

The West Midlands Combined Authority (WMCA)

The WMCA was recently created together with the election of a mayor for the region, Andy Street. The WMCA links closely to three LEPs, namely Greater Birmingham and Solihull LEP, the Black Country LEP and Coventry and Warwickshire LEP.

There continue to be discussions about the types of economic development interventions that should be covered at the Coventry level and those that should be covered at the WMCA geography level, given that they could deliver strong pan-regional benefit, with potentially some transfer upwards from LEPs or local authorities.

Coventry City Council is a constituent authority of the WMCA, while the Warwickshire Councils of North Warwickshire, Nuneaton and Bedworth Borough Council, Rugby Borough Council, Stratford-upon-Avon District Council and Warwickshire County Council, along with Coventry and Warwickshire LEP "non constituent members". The level of engagement in the case of Warwickshire County Council appears strong, as its Leader, Councillor Izzi Seccombe, is also at the time of writing, WMCA Portfolio Lead for Finance & Investment.

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3. The local entrepreneurship ecosystem for start-ups, scale-ups and SME innovation

Introduction

In recent years, the idea of the local entrepreneurship ecosystem has gained traction as a way to conceptualise a supportive business climate. As a shift from "cluster" or "industrial district" approaches, the notion of the entrepreneurship ecosystem focuses on the individual entrepreneur rather than the firm, pursuing high-growth or "high aspiration" entrepreneurship (Autio 2011, Stam 2015, Stam and Spigel 2016). This has recast policy from strategies targeting firms to actions creating a system or a context (Thurik et. al 2013, Mason and Brown 2014). Fostering ecosystems means considering the setting within which entrepreneurs work, as well as the conditions that are helping their activity emerge (Malizia & Motoyama 2016; Zahra et al. 2014). This chapter thus considers the extent to which Coventry and Warwickshire provides an environment in which ambitious entrepreneurs can thrive.

Successful entrepreneurship ecosystems – or what Grillitsch (2018:5-6) calls sophisticated systems – support the actors, networks, and institutions that facilitate innovation and entrepreneurship, and by extension, start-ups and scale-ups.[6] Actors will be plentiful and diverse, with high capabilities and access to financial resources, in a state of "organizational thickness" (Grillitsch 2018:5). Networks between actors will foster both learning within sectors and innovation across sectors. Institutions encompass both governance, or the ability to coordinate action across multiple actors and scales, and a culture of risk-taking. Increasingly, motivating individual entrepreneurs also requires a place-based focus on the local quality of life and how transportation infrastructure connects the residences, workplaces, and amenities that matter to individual entrepreneurs and their workforces (Audretsch and Belitski 2017, Stangler and Bell-Masterson 2016). Together, these factors create the dynamism, or entrepreneurial recycling – in terms of worker mobility and firm formation – that can facilitate industrial diversification in a region (Grillitsch 2018, Mason and Brown 2014).

A series of recent reports suggests that the local entrepreneurship ecosystem in Coventry and Warwickshire needs development (see, for instance, CWLEP 2017; Department for Business, Energy, and Industrial Strategy 2016; SQW 2017). Despite the strength of local anchor institutions (such as the universities) and the advanced manufacturing and engineering (AME) sector (particularly the automotive industry), there are suggestions that the ecosystem itself may fall short when attempting to generate innovative start-ups and scale-ups and SME innovation to drive local productivity growth and industry upgrading,

[6] It should be noted that the literature on ecosystems to date is mostly descriptive and prescriptive. There is no systematic evaluation of whether local economies with ecosystem characteristics generally considered to be associated with success actually perform better than other local environments, and no systematic analysis of what factors actually cause entrepreneurial ecosystems to emerge (Stam 2015, Stam and Spigel 2016, Mason and Brown 2014).

diversification and emergence. Despite organisational thickness, rich networks, and rescaled governance structures, the region does not excel in fostering ambitious and innovative entrepreneurship and SMEs. The challenge, then, will be to leverage the region's strengths and learn from its successes in order to fortify the ecosystem.

This chapter is organised as follows. The next section examines in an overall manner key components of the local entrepreneurship ecosystem in terms of their strengths and weaknesses (enablers and bottlenecks) and suggested policy actions, covering access to resources conditions and institutional conditions in the local entrepreneurship ecosystem. Next, we examine the issues affecting start-ups, scale-ups and SME innovation in the specific cases of the automotive cluster and digital and culture/tourism specialisations. The conclusion offers an overall assessment of the entire entrepreneurship ecosystem and makes policy recommendations for supporting start-ups and scale-ups, drawing on examples of cross-fertilization of sectors, talent development and retention, financial diversification, and regional branding and connectivity. Together these will allow a greater variety of entrepreneurs to connect effectively to the region's considerable assets.

Access to resources conditions

Local leadership of firms committed to the region

Enablers and potential

Managers in successful large automotive firms

One of the major success stories of the Coventry and Warwickshire area is its automotive cluster, with some 34 000 employees, high skill levels, and large investments made in local firms such as Tata's investment in JLR. This provides a potential base of managers and leaders who could support innovative entrepreneurship in the area.

Private sector leaders in the LEP

In addition, local economic development governance through the LEP involves a strong component of private sector leadership, which understands the case for the support of business and entrepreneurship.

Bottlenecks and challenges

Limited numbers of local scale-up entrepreneurs

There are limited entrepreneurs who have created successful scale-up businesses who could invest further in the area in a form of serial entrepreneurship and business angel type investment support, although there are certainly examples of this type of leader.

Access to finance

Enablers and potential

Many existing investment initiatives

Several initiatives have been established in the Coventry and Warwickshire LEP area in an attempt to address business finance gaps. For example, Coventry and Warwickshire LEP is one of the ten LEP partners in the Midlands Engine Investment Fund, which is providing a GBP 250 million fund across the Midlands to provide debt, equity and proof of concept finance funded through the ERDF and the European Investment Bank. Another example is the Coventry and Warwickshire Enterprise and Business Growth package, which provides grants of up to GBP 100 000 to local businesses. Financial support for business innovation

is also available through national agencies, such as Innovation UK. There is also a significant business angel network, the Minerva network based at Warwick Science Park which makes local risk capital investments. Starting in 2015, small and microloans have been provided by Warwickshire County Council to support SMEs through Growth Fund support and the Coventry and Warwickshire Reinvestment Trust.

Bottlenecks and challenges

Access to smaller loans

Though the struggles of SMEs to obtain finance are well established, challenges have grown in the UK since the 2008 crisis (Armstrong et al. 2013). According to the UK Innovation Survey (UKIS), 12% of firms in Coventry and Warwickshire cited lack of finance as a barrier to innovation in the period 2006-2008, suggesting that access to finance is a long-standing problem, rather than a result of the financial crisis.

In particular, SMEs in Coventry and Warwickshire struggle to find access to small loans (under GBP 150 000), a problem that is common across regions. This problem is especially acute for new SMEs and SMEs in less capital-intensive sectors (CWLEP 2016b, 26). Although local government is aware of this challenge and has taken some steps to address it, as a structural problem it persists.

Lack of patient capital

Stakeholders suggest that a lack of funding for long-term projects could stifle innovation, with shorter-term funding (around three years) being more common. In these situations, funders may require short-term outputs, with the goal of quickly increasing returns or getting a product to market. This is not ideal for supporting the early-stage R&D that could lead to scale-ups.

Nationally, private equity investment remains heavily concentrated in London and the South East, with only 17% of companies invested in per 1 000 VAT registered local units, the West Midlands remain the British region with the second lowest density in venture capital investment (BVCA, 2017). It can be difficult in particular for digital businesses to obtain finance because of their lack of tangible assets.

Talent and skills

Enablers and potential

Strong workforce of highly skilled employees

Coventry and Warwickshire has a strong pool of high skilled employees. The automotive industry in particular houses its engineers and R&D in the region (CWLEP 2016a, 16). This pool of trained employees holds potential for the kinds of innovation-spurring ideas exchange and worker churn that has been linked with successful entrepreneurship ecosystems elsewhere (Stangler and Masterson 2016), although there is no evidence that significant activity of this sort is happening in Coventry and Warwickshire.

University activity in stimulating entrepreneurs. The area is home to two universities that are both highly active in encouraging entrepreneurship among graduates.

Local apprenticeship programmes. Several apprenticeship programmes have been funded through public private partnerships between universities, further education colleges and private industry, and through Coventry and Warwickshire LEP via the Growth Deal. The automotive cluster has actively developed a wide array of training resources, and new college programmes are emerging in the digital/creative sector as well. Box 3.1 describes the various programmes and partnerships to provide apprenticeships.

Box 3.1. Examples of apprenticeship and training programmes in Coventry and Warwickshire

Manufacturing Technology Centre

- An independent Research and Technology Organisation established in 2010 through public funding by University of Birmingham, Loughborough University, University of Nottingham and TWI Ltd. It provides about 100 apprenticeships per year with plans to expand to 300 by 2020, and was recently placed on the 'Register of Apprenticeship Training Providers,' which means that employers can spend their Apprenticeship Levy on the MTC's training programmes.

WCG/Warwickshire College

- Works with seven colleges that provide study programmes on vocational and academic subjects (Royal Leamington Spa College, Moreton Morrell, Rugby College, Pershore College, Warwick Trident College, Evesham College, Malvern Hills College). It trains and provides over 2 000 apprenticeships per year and works with 1 100 employers.

Advanced Manufacturing Training Centre at the Manufacturing Technology Centre

- This involves a partnership between Lloyds Bank and MTC funded through the Department of Business, Energy and Industrial Strategy. It aims specifically to address a shortfall in skills in UK manufacturing industry. It aims to support 1 000 apprenticeships annually.

The Warwick Trident College Centre for Product Creation

- An extension to the Engineering Centre at Warwick Trident College to provide workshop, classroom and lab space. Trains 'advanced and higher' manufacturing apprentices. It has had more than 2 000 apprenticeships since opening in late 2016. It is funded partially through Growth Deal, channelled via the LEP, and through Warwickshire College.

The Institute for Advanced Manufacturing and Engineering

- A collaboration between Coventry University and Unipart Manufacturing Group (private). It also receives funding from the Higher Education Funding Council for England. It provides Bachelors and Masters degrees in Manufacturing Engineering and links with internships and apprenticeships at Unipart.

The WMG Academy for Young Engineering

- A joint initiative of Jaguar Land Rover and the University of Warwick, which exposes teenagers to technical college training to prepare them for careers as engineers.

Jaguar Land Rover Apprenticeship Scheme

- This provides salaried vocational training in control engineering, electrical engineering, product design, and manufacturing engineering.

Mira Academy

- HORIBA MIRA, a private engineering and research entity, partners with the Nuneaton Academy, the Midland Studio College, and North Warwickshire and Hinckley College, as well as Bradford, Coventry, Leicester, Loughborough and Aston universities. It sponsors MSc and PhD programmes that include time in industry training at MIRA.

Warwick Manufacturing Group SME Project Internships

- This supports a series of internships to help SMEs overcome innovation challenges and summer internships for Warwick high school students.

The LEP acknowledges a lack of (appropriately) skilled workers and a lack of graduate retention in its 2016 Strategic Plan. It is requesting funding through the Growth Deal Round 3 bid for teaching facilities, expansion of the Institute for Advanced Manufacturing and Engineering, and the development of a new, GBP 20 million High-level Apprenticeship Academy to expand automotive training further.

Bottlenecks and challenges

Regional disparities in skills

At the same time as Coventry and Warwickshire has large numbers of people with high skills, it also has an 'inactivity' rate higher than the national average. While some areas perform well in workforce participation and income indicators, others, especially rural areas, do not (Department for Communities and Local Government 2017, 15).

Poor outcomes in schools

As indicated in the Midlands Engine Strategy, "outcomes in schools in the Midlands are below the national average" (Department for Communities and Local Government 2017, 16). More than 25% of secondary schools in the Midlands are not reaching required standards, and West Midlands is one of the three worst performing regions for primary school outcomes.

Poor rates of retention

Although the West Midlands' universities turn out large numbers of skilled graduates, many of these graduates do not remain in the area for work. Only 55.4% of graduates in the West Midlands who are working six months following their graduation are working in the region, compared to 69.2% for London graduates.

Disconnect between schools, apprenticeships, and enterprises.

There also appear to be some mismatches between school and training curricula and the actual skills and qualifications requested by industry – a common complaint in emerging, rapidly changing sectors like the digital/creative sector (Chapple, 2006). Some SMEs argue that large firms offering generous benefits, such as JLR, often poach workers from SMEs.[7]

[7] A quick scan of job adverts for an IT project manager, comparing JLR and smaller firms in Leamington Spa, suggests that salaries are comparable or slightly higher at JLR than at competitors.

In addition, uncertainty related to Brexit is causing some of the skilled EU workforce to leave the UK.

New knowledge generation

Enablers and potential

Significant R&D and innovation centres, and public-private collaboration

Coventry and Warwickshire has several major R&D and innovation centres, including public and private institutions and collaboration between the two sectors. In addition, the University of Warwick and Coventry University have extensive collaborations with private entities and actively seek out cross-fertilisation across sectors.

The following are some of the area's large R&D and innovation centres:

- **Coventry University Enterprises** provides grants, technical expertise, and knowledge to SMEs engaged in developing new products, services, and processes. It provides grants of up to GBP 10 000 to SMEs that are collaborating with at least two other businesses to innovate, provide grants to cover proof of concept research and production, and support 75 SMEs with funding for R&D and innovation related to the adoption of low carbon technologies. It receives funding from the ERDF and is part of the European Innovation Council Pilot.
- The **National Transport Design Centre** operates within the Coventry University Centre for Mobility and Transport and provides businesses with staff expertise and student assistance, subsidises training, and provides access to equipment. It also provides business assistance.
- The **Manufacturing Technology Centre** was established with public funding in 2010 as an independent Research and Technology Organisation, with the objective of bridging the gap between academic work and industry. It is part of the High Value Manufacturing Catapult (HMVC), a programme supported by Innovate UK, and is one of 7 HVMC centres in the UK. It has 500 employees and covers R&D, advanced manufacturing management and factory design. Among its programmes is the "Product Manufacturing Incubator," which aims to provide a 'de-risked environment' for start-ups, with support for building prototypes and developing supply chains.
- The **Warwick Manufacturing Group** is an academic department at the University of Warwick with an annual programme of GBP 200 million in 'industrial and in-kind support.' It hosts 2 200 Masters students and 250 doctoral students and has 600 staff. It provides support for firms facing 'product development challenges' and has a number of research and study programmes, including partnerships with private industry. Among these are the Research for Advanced Concept Development of smart and autonomous vehicles (RACeD), a partnership with Jaguar Land Rover that involves five engineering doctoral students researching specific JLR challenges. It also hosts the UK Connected Intelligent Transport Environment, a partnership with JLR, Highways England Company Ltd, Huawei Tech UK, Coventry City Council and Coventry University, that is converting 40 miles of Coventry and Warwickshire roads with new mobility technologies so researchers can trial new connected vehicle technology. WMG is also part of the High Value Manufacturing Catapult.

- The **National Automotive Innovation Centre** is a 'long term commitment' between Jaguar Land Rover, Tata Motors European Technical Centre, and WMG. Currently under construction, the centre is planned to house approximately 1 000 scientists, engineers, academics, technicians and support staff.
- **MIRA Technology Park** is a private research campus of the Japanese-based company HORIBA MIRA. The Technology Park houses multiple companies in the automotive sector and provides R&D facilities and testing support for automotive innovation.
- Other major R&D facilities include the **Serious Games Institute** and **SG International** at Coventry University (founded in 2007 as part of regional development funding), and the **International Institute for Product and Service Innovation** and the **Institute of Digital Healthcare** at the University of Warwick.

Bottlenecks and challenges

Lack of connectivity

Coventry and Warwickshire LEP identifies a lack of connectivity – both between businesses and between businesses and institutions – that stifles the level and spread of innovation in the region (CWLEP 2016b, 6). Although that report provides no additional detail, and there is no systematic evidence about the level of connectivity in this region compared to others, stakeholders also suggest that network connectivity can be problematic. It is not uncommon even in specialised regions that firms lack information about potential partnerships or have difficulties coordinating R&D activities outside of their in-house processes. Intermediaries like the LEP may need to focus on facilitating communication and fostering networks.

Private R&D concentrated almost entirely in large firms

As noted above, within Coventry and Warwickshire, R&D is contained disproportionately within the manufacturing sector and within large firms. Some 95% of R&D expenditure occurs in manufacturing (versus 45% nationally) and most R&D employment is accounted for by a few leading firms. As a result, there is a lack of R&D activity occurring in other industries or in smaller firms, which slows regional innovation. SMEs in Coventry and Warwickshire may need extra support to engage in R&D efforts.

Business support services

Enablers and potential

Support provision, signposting and co-ordination is offered by the Growth Hub

Coventry and Warwickshire LEP has established a Growth Hub, that works with Coventry and Warwickshire local authorities to strengthen current business support by combining funding streams into a Business Innovation and Growth Hub. The Growth Hub was established to be a single point of contact for information, advice and support for growing businesses. It provides advice for businesses on finding land or premises, workforce development and recruiting, supply chain access, investor and market access and other topics. Programmes at the Growth Hub include Coventry and Warwickshire Business Support Programme, Innovative Coventry and Warwickshire, Skills 4 Growth and the Green Business Programme for example. The Growth Hub also encourages open innovation by helping business identify external partners and funds to support collaborative projects, predominantly through supply chains and interactions with research centres and

universities. In addition, the West Midlands "Growth Company" has been established to help create jobs, expand businesses, and attract inward investment and encourage tourism. The West Midlands Growth Company is owned by the WMCA and its Constituent Members, and has brought the region's LEPs, Local Authorities, Growth Hubs universities and key businesses together to achieve this mission.

Multiple additional local business support providers

A number of other organisations are also active in providing business support in the area. For example, the Coventry University Enterprises (CUE) Business Solutions programme provides 'detailed support' to SMEs and disburses small grants to support innovation and internationalisation, to cover product development costs, encourage collaboration, and cover capital costs. It draws funding from the EU ERDF and Horizon 2020 funding programmes. The Manufacturing Technology Centre provides back office support to SMEs, including human resources, legal, and accounting support. The Warwick Manufacturing Group, supported by the Catapult Reach Programme funded by Innovate UK, provides support for business strategy, supply chain setup, collaboration networks, and design verification. In addition, the LEP's Growth Deal Round 3 request included a bid for a 'National Low Carbon Centre' that would deliver incubation to start-ups in low carbon and clean-tech and provide connections between apprentices, students, and SMEs.

Bottlenecks and challenges

Threats to public funding due to EU concerns and Brexit

The planned departure of the UK from the European Union could put access to EU funding sources at risk. Much of the funding for SME support comes directly from EU funds like the ERDF. While EU funding may be replaced by the Shared Prosperity Fund there may be some disruption to the multiple initiatives currently receiving EU funding support.

Access to programmes and resources for SMEs

Stakeholders point out that most SMEs cannot afford to take advantage of assets like the WMG and Manufacturing Technology Centre, nor the Catapult programme supported by national government, as entry costs are too high for many start-ups. There is also a lack of awareness of the various public business support programmes despite the useful role of the Growth Hub in raising awareness and co-ordination.

Low usage of mentoring services

SMEs can benefit from external business advice, but SMEs in general appear to under-value the potential benefits of business advice and find it difficult to know what is available, how they could benefit from it, or how to access it (CWLEP 2016b, 23).

Physical and connectivity infrastructure

Enablers

Geographic centrality

Coventry and Warwickshire is located in the geographic centre of the U.K., and the Midlands Engine Strategy refers to this as an 'inherent geographic advantage.' Most of the country's population can reach Coventry and Warwickshire within four hours' travel.

Transport connectivity.

Major transportation corridors connect Coventry and Warwickshire with the rest of the country. The M6, M40, M69, M45 and M42 motorways pass through Coventry and Warwickshire, as do two major railway lines. Although not within the Coventry and Warwickshire area itself, the proximity of the Birmingham and East Midlands airports for passenger and freight air travel connects the area with international markets. The Birmingham airport is England's 6th busiest in passenger travel, and East Midlands is England's 2nd largest freight airport.

Public regeneration initiatives

Significant investments are planned to 'unlock' commercial and housing developments through improving transport connectivity, building new housing stock, and developing broadband infrastructure. Coventry and Warwickshire LEP is a partner in these regeneration, infrastructure, and planning initiatives and connects development projects to the goals in its Strategic Economic Plan.

Bottlenecks and challenges

Local connectivity challenges

Research carried out as part of the City of Culture 2021 bid suggests that while Coventry is well connected nationally through a central position in road, rail and air links, elements of both Coventry and Warwickshire are not well served by local connectivity. It is also true that improved connectivity to some of the regions "headline businesses" needs to be improved. In this respect, the new high speed rail line from London to the north, HS2, is controversial, with people in both urban and regional areas concerned that HS2 will rather pass them by, and connectivity to its terminal will be limited.

Congestion is a further issue. The Midlands Engine Strategy identifies slow and congested transport options as a particular challenge in the West Midlands due to a dispersed population, which makes connectivity especially crucial. Congestion and inefficiency raises the cost of exchanging goods, commuting and job searching for workers, and exchanging ideas and networking. Moreover, stakeholders point to the lack of connectivity on the local level as diminishing local quality of life and impeding the attraction and retention of talent. Improving connectivity also increases agglomeration effects within the local economy, both within Coventry and Warwickshire, and across the broader Midlands area (CWLEP 2016a).

Lack of digital connectivity and power supply

In a knowledge economy, high-speed broadband becomes an increasingly crucial factor in a region's economic success. In addition to prioritizing the continued improvement of broadband connectivity, the CWLEP observes that small and medium sized enterprises could take better advantage of broadband connectivity and ICT (CWLEP 2016b, 13). This is a particular issue for SMEs, which, due to the lack of appropriate commercial space, often have to put in their own broadband on an ad hoc basis. As the development and implementation of autonomous electric vehicles has been identified as an important economic driver, improved power supply to support this will be needed (CWLEP 2017, 9). While other regions also face this issue, Coventry and Warwickshire must address it if they hope to become the national leader in advanced manufacturing and intelligent mobility.

Available land for large development

One of the biggest challenges that Coventry as a city has in terms of its economic development is one of employment land. Where this exists, the transport infrastructure locally is lacking.

Coventry and Warwickshire has a shortage of land available for large projects (Department for Business, Energy, and Industrial Strategy (DBEIS n.d.). The Coventry and Warwickshire Chamber of Commerce, the CWLEP, and various stakeholders attribute this to a failure in local planning to set aside/earmark land for industrial development and development in general (DBEIS n.d., 1). A lack of sites for new housing developments has also been identified by the CWLEP, as well as the need to secure developer interest in constructing new housing (DBEIS n.d., 1).

Uneven development. Uneven development and/or investment is a consistent theme throughout assessments of Coventry and Warwickshire's assets and challenges. Coventry and Warwickshire struggles with inequality within the region, with indicators like unemployment, qualification levels, and job density varying significantly. Market-based development patterns can exacerbate this inequality, such as broadband development that naturally prioritizes stronger markets like those in urban areas, allowing a digital divide between urban and rural areas to grow (CWLEP 2016b, 14).

Institutional conditions

Entrepreneurship culture

Enablers and potential

Entrepreneurship training and incubation

Both Coventry University and the University of Warwick provide support for entrepreneurship among graduates. In addition, Coventry University Enterprises Ltd (CUE), a subsidiary of the Coventry University Group, operates an Institute of Applied Entrepreneurship that provides business training for aspiring entrepreneurs. There are also non-university initiatives. For example, the National Transport Design Centre provides access to funding, advice on starting and growing businesses, and leasable office space.

Bottlenecks and challenges

Localities where entrepreneurship culture is more limited

Larger employers have tended to dominate the economy in the north of the Coventry and Warwickshire area (including Coventry). This type of structure tends to generate a 'dependency' rather than an 'entrepreneurship' culture. At the same time, there are significant levels of economic inactivity and deprivation in parts of the region, which again tends to hinder vocations in ambitious and innovative entrepreneurship. The local differences in entrepreneurship culture within the area can be picked up by significant local differences in start-up rates.

Networks among entrepreneurs

Enablers and potential

Well-functioning existing formal business networks

Coventry and Warwickshire Chamber of Commerce is seen nationally as one of the most active and better performing Chambers in the country, offering a potential focus for networking among businesses and entrepreneurs that can help entrepreneurs obtain the resources they need for survival and growth.

Equally there are bodies such as Coventry and Warwickshire First, whose members are available to advise and support entrepreneurial start-ups and scale-ups and SMEs. They include leading local accountancy, legal, banking, property, insolvency and recovery, and PR and communication firms as well as both the main local authorities and the Coventry and Warwickshire Chamber of Commerce. Their activities include:

- First Friday lunchtime networking
- Quarterly Keynote breakfast briefings
- Social meetings including cross sector dinners
- The FirstPro and YoungPro Awards

The Confederation for British Industry (CBI) is also active in business networking. The CBI's Region for the West Midlands and Oxfordshire has a regional council of some 40 members, many from Coventry and Warwickshire. The Federation of Small Business (FSB) is also active. It has an important regional presence across Coventry, Warwickshire and Solihull with networking and business events regularly being held across the area.

Bottlenecks and challenges

No single large-scale business network

In the UK, regulations do not require SMEs to be members of chambers of commerce. This contrasts with countries such as France, Italy or Germany, where membership of chambers of commerce (and financial contributions that support their activities) are compulsory. There are advantages and disadvantages of compulsory membership. However, one of the issues identified by the research team for this project is that more upfront work is required to create business networks around key common interests, such as training or innovation, if a large scale network and established structures are not already in place as a basis for creation of common actions.

Ecosystem issues in the context of the key clusters

The key clusters and their needs in Coventry and Warwickshire

The Coventry and Warwickshire SEP identifies the automotive industry, and advanced manufacturing and engineering more generally, as the key driver of local growth. The region is diversifying its automotive industry through processes both of 'related variety' and 'unrelated variety'. The former involves incremental technological and market change in the industry, whereas the latter involves disrupting the existing technologies and markets through radical innovation that draws upon unrelated knowledge in the areas of electric vehicles, AI, and big data, among others. Box 3.2 discusses these two concepts.

At the same time, the SEP also mentions other sectors: IT services, digital and creative industries, logistics, culture and tourism, professional and financial services, and healthcare (CWLEP 2016a). Developing further some of these sectors would help provide more resilience to the regional economy. In particular, there are important opportunities in the digital/creative and culture/tourism sectors. Although they are too small to drive the economy, they have significant potential in the long term, including for generating inter-sectoral knowledge spillovers in 'unrelated variety' diversification.

Box 3.2. Concepts of related and unrelated variety

Increasingly, scholars see firms, industries and regions as diversifying into either "related variety" or "unrelated variety" (also known as "diversified specialisation").[8] Local entrepreneurship ecosystems need to support both types of diversification. Diversification through "related variety" refers to the development of activities with complementary inputs, knowledge bases, or products/services (Boschma 2016), whereas diversification through "unrelated variety" refers to cross-fertilisation across different forms of inputs, knowledge bases or products/services (Farhauer and Kröll, 2012; Grillitsch 2018). Numerous studies carried out in the last ten years seem to indicate that although all types of diversification enhance growth, the most successful regions tend to follow a path focusing mainly on related variety (Frenken et al 2007; Boschma, 2017; Boschma and Iammarino, 2009). Furthermore, we can expect the difficulty and investment required for a firm, industry or region to diversify through unrelated variety to be greater, and the probability of success to be lower.

The immediate policy implication is that firms, industries and regions need to diversify their outputs in order to keep growing, but that they are more likely to succeed if they diversify towards output types related to their present ones. Such a conclusion fits well with the growing policy area of 'smart specialisation', which likewise advises regions to start from their present production base and to increase their knowledge intensity (Boschma and Gianelle 2014; Foray, David and Hall, 2009, 2011).

However, diversification through unrelated variety, using new types of knowledge very different from the ones currently used, can sometimes lead to very high rates profit, the creation of new markets and the partial or complete substitution of existing ones. Furthermore, unrelated variety often needs to be exploited to achieve some radical innovations in an existing industry in a region to help it shift forward or to build a wider portfolio of industries in a region, so as to increase its resilience to industry-specific economic shocks.

Thus, it appears that both related and unrelated variety are required to support the economic development of regions over extended periods of time. If a focus on related variety can be superior over short time horizons, unrelated variety, which involves longer lead times to become profitable, but which can become the basis of future economic development, needs to be nurtured in advance. In other words, if a focus on related variety can be advisable to support short-term growth, a parallel focus on unrelated variety is equally advisable to

[8] Other paths for regional development include upgrading of existing industrial paths and fostering emerging industry through path importation (e.g. through inward investment) (Grillitsch 2018).

support resilience over a long time horizon (Saviotti and Frenken, 2008, Grillitsch, Asheim and Trippl, 2017).

A recommended policy approach for a region would therefore be to focus on a parallel diversification around existing technologies (related variety) and on the simultaneous exploration of promising new types of knowledge that could lead to more radical innovations enhancing unrelated variety and preserving growth in the longer term (Saviotti and Frenken, 2008; Grillitsch et al 2017).

Thus the entrepreneurship ecosystem in Coventry and Warwickshire needs to help to build both the automotive industry through start-ups, scale-ups and SME innovation that will bring innovations into the automotive industry and the digital/creative and culture/tourism industries. Whether entrepreneurs will reuse their core competencies in new industries (related variety) or connect to dissimilar knowledge (unrelated variety), the entrepreneurship ecosystem must support connectivity among diverse actors and knowledge bases: e.g. between entrepreneurs, investors and customers (Roundy et al. 2017). This section will examine first conditions for the automotive sector and second conditions for the digital/creative and culture/tourism sectors.

Start-ups, scale-ups and SME innovation in the automotive cluster

A key challenge for the future success of the local automotive cluster is to diversify into both related and unrelated variety, such as products and services in sensor technology, energy, and lightweight metal manufacturing. There have been a small number of recent start-ups and scale-ups in areas related to automotive manufacturing, such as manufacturers of solar shades and hoses, however the start-up and scale-up rates in these areas are still limited and SME innovation rates are not as strong as might be expected in a world-class cluster. A generally supportive entrepreneurship ecosystem is in place to support diversification of the cluster, but without the variety of SMEs that would create the requisite organisational thickness. Acting on a number of bottlenecks in the local entrepreneurship ecosystem that are particularly affecting the automotive cluster could help turn this around, as discussed below.

Talent

Despite the concentration of a skilled workforce in the region, talent is possibly the biggest weakness of the local entrepreneurship ecosystem for start-ups, scale-ups and SME innovation in the automotive and related industries. Across firm sizes, businesses report skill shortages, particularly in manufacturing and logistics (Warwickshire County Council 2017). Even though the region's population is relatively young, the automotive workforce is aging, meaning that most new demand will be for skilled, experienced replacement workers rather than new employees (Applerley 2015). Adding to these retirements, the challenges in attracting and retaining talent have created intense competition among firms. The lack of amenities and challenges with connectivity within the region hinder the ability to retain skilled graduates of the universities, who increasingly value urban quality of life and convenience (Florida 2017). One potential source of labour is local youth, often disadvantaged youth. However, despite the existence of numerous training and apprenticeship programmes, most are connected directly to the region's larger automotive firms – leaving a dearth of new skilled workers for start-ups, scale-ups and SMEs. Furthermore, many young people are unclear about which areas they would like to train in

and where the future demand and best opportunities are likely to lie, and automotive occupations appear to suffer from a poor image locally reflecting past problems.

Network connectivity

Poor network connectivity, particularly among firms in different sectors, is a related challenge.

On the positive side, there is some evidence of dynamism in the form of labour mobility between sectors, for instance as gaming industry workers move to the automotive industry, or creative and digital workers work in automotive marketing, sales, and website divisions. Large automotive firms are also active in fostering start-ups and spinouts in related industries (for instance JLR's InMotion Accelerator for mobility start-ups). Furthermore, the reorganisation of economic development actors to create the LEP and the Coventry City of Culture designation the chance to boost convenings, initiatives, and business leadership to support networking.

In addition, the LEP is playing an important role here as a linking organisation, supporting innovation and ambitious entrepreneurs by linking actors with different knowledge bases and connecting them more effectively to R&D assets. For example, the Growth Hub has many offerings explicitly focusing on connecting SMEs to networks and resources.

On the other hand, the concentration of R&D among just a few large manufacturers impairs the dynamism of the entrepreneurship ecosystem, although the very extensive university initiatives for innovation collaboration help compensate for this concentration, and bring potential for cross-fertilization across automotive and other industries, as well as the engagement of ambitious young entrepreneurs.

In addition, there are weaknesses in connections between large firms and local supply chain SMEs. Although local large automotive firms express a preference for local suppliers, they source where prices are competitive and may not reach out to local SMEs (Amiston & Bailey 2013).

Business support services

Intermediaries, such as the Coventry and Warwickshire Chamber of Commerce, University of Warwick Science Park Business Ready Programme or the LEP's Growth Hub, provide important mentoring services for start-ups, scale-ups and SME innovation. However, some entrepreneurs seem unaware of them. Other SMEs are unwilling to use them due to a perceived lack of mentors specialised in cutting-edge areas, particularly in information technology.

In general, the business support system (e.g. the universities and the LEP's Growth Hub) already orients many of its programmes towards the automotive sector. Yet, several stakeholders suggest that resources could be better targeted towards innovative SMEs, rather than all entrepreneurs. In the automotive cluster some of the business resources available to the large automotive companies, like the Manufacturing Technology Centre and the Catapult, may not be accessible or affordable to SMEs, as high membership charges present a barrier to participation (Harris 2014).

Access to finance

Access to finance will be critical to support start-ups and scale-ups in the automotive cluster. In particular, stakeholders report challenges in accessing smaller loans and patient capital, despite the variety of investment and loan funds available.

Physical and connectivity infrastructure

The physical assets and support infrastructure to support automotive start-ups and scale-ups seems to be mostly in place. Overall, the region's centrality and connectivity, as well as planned public investment in high-speed rail and urban regeneration, serve cluster and related industries well. However, some specific bottlenecks may impede the growth of the cluster, including the lack of available land and local connections, as well as access to sufficient power. One obstacle facing SMEs generally is lack of appropriate space, and this especially impacts firms in production, distribution, and repair industries who need "dirty" or "messy" space – small, low-cost space that can be used alternatively for production, storage, or parking. A recent experiment in providing such a facility has proven to be very costly relative to its return on investment, so there is little momentum to build more. More broadly, however, the region also lacks instruments to address its growth barriers related to spatial planning, particularly the lack of connectivity and small business space.

Entrepreneurship culture

It remains to be seen whether the region can foster the key "high-aspiration" entrepreneurs that will boost the diversification of the automotive cluster. Ultimately, this will depend on the ambition of local entrepreneurs. If it is absent among the current local business owners – as some observers suggest – it will be important to attract and retain new, more youthful entrepreneurs. Even lacking specific tools to create an appealing environment for mobile young entrepreneurs, the LEP and other actors can play a role by encouraging a more entrepreneurial culture in the region, for instance via targeted events held in coordination with local universities.

The digital and culture/tourism specialisations

Another path to industrial diversification is via unrelated variety or diversified specialisation, which in this case might take the form of developing several strong sectors in addition to the automotive industry, capitalising on different knowledge bases. In this regard, two sectors in particular stand out: the digital/creative industries and culture/tourism. Although these sectors are distinct from automotive, there are linkages: for instance, virtual reality technology appears in both gaming and autonomous vehicles, and of course attractions like the Coventry Transport Museum take advantage of the area's automotive identity and history as well as its capabilities in digital technology. Some argue, in fact, that this is key to the branding of Coventry and Warwickshire: it is a region that is focused on transportation, where design engages with technology, potentially leading to the radical transformation of a traditional industry. Another regional asset, in this view, is the region's cultural diversity (with 140 languages spoken in the region), and the relative youth of the population, which together could support a more entrepreneurial culture.

The digital/creative and culture/tourism industries have a growing presence in Coventry and Warwickshire. Although the best known component of the digital creative industry is the gaming cluster in Leamington Spa, Coventry itself hosts over 1 000 enterprises employing almost 4 000 workers, with a six percent annual growth in the last ten years (Roper et al. 2017). Likewise, the culture and tourism industry, which spans Stratford-upon-Avon and Warwick Castle in addition to the attractions in Coventry, supports some 40 000 jobs in Coventry and Warwickshire (CWLEP 2016a). It is therefore important that the local entrepreneurship ecosystem also supports these sectors. Of all the bottlenecks in the entrepreneurship ecosystem, the culture/tourism sector is impacted mostly by the lack of connectivity and physical space, while the digital/creative industry suffers from

challenges in skills training and access to finance in addition. We discuss these issues below.

Physical and connectivity infrastructure

In the case of tourism, one of the issues faced by visitors is a lack of transport (e.g. train connections to Stratford-upon-Avon), a shortage of facilities (particularly the lack of high-quality hotels in Coventry), and the poor quality of the public realm generally. As a result tourists spend less than the typical UK visitor. The City of Culture designation should help remedy this in two ways: putting Coventry on the map and leveraging more money for infrastructure and development to change the feel of the city. Still, there will need to be a major marketing effort to brand the region, given its diverse assets.

The need for appropriate space spans both the culture/tourism and digital/creative sectors, and addressing it could serve both sectors. Digital creative businesses in the region, particularly Coventry, suffer from the lack of small commercial spaces and lively urban places (Roper et al. 2017). With no space to expand in Leamington Spa, there is an opportunity to leverage the planned regeneration of Coventry (e.g. the Centre South development) to stem the creative brain drain and attract new tourists (ibid.).

Talent and skills

Skills challenges in the digital creative sector centre on recruitment and pipeline issues. Though entrepreneurship ecosystems seek dynamism, worker churn among IT workers in the region tends to be one way; digital sector stakeholders report that their workers, after gaining experience, are tempted to shift to the automotive industry for more lucrative jobs, but automotive workers rarely seek out employment in the digital creative sector. Recruiting new skilled workers from elsewhere is challenging given competition from Birmingham and London, as well as the lack of vibrancy in many of Coventry and Warwickshire's commercial hubs (Roper et al. 2017).

Stakeholders – specifically, actors such as the Ukie gaming trade association and universities – are working to develop a pipeline for IT and digital workers, as exemplified by degree programmes related to gaming and data science emerging at several local universities (for instance, Warwickshire College's Games Art degree), which are engaging local SMEs in curriculum development. Organisations such as UK Interactive Entertainment are working also on the computer curricula at the primary and secondary school levels. However, this timeframe is too slow to meet current or short-term demand. One alternative might be apprenticeship programmes such as those offered in the automotive sector, modelled on IT apprenticeship programmes elsewhere (see Box 3.4, below). The implementation challenge is the fragmentation of the digital creative industry, with many smaller firms and different skill needs.

Access to finance

The digital creative sector suffers from poor access to finance. Many public sources of funding are not readily available to the gaming industry in particular. Even in digital manufacturing, the EU and UK government funds are too restrictive, focusing heavily on funding capital investments that are less important right now than capacity building and training. Many smaller creative businesses, headed by entrepreneurs right out of university, do not know where to look for investment. Soon-to-be-launched funds, such as Creative

United's Creative Industries Finance initiative (now called Prosper), offer an opportunity that local actors will eventually be able to capitalise on.[9]

Conclusion and policy recommendations

Coventry and Warwickshire is a region with high system sophistication that lacks diversity in the form of unrelated variety. The automotive industry is highly entrepreneurial, rapidly adjusting to new ways of using mobility and data, as exemplified by JLR's global start-up accelerator to support the development of new knowledge bases. Other industries, such as gaming, are slowly emerging as smaller but still important sectors in the region. Dominated by strong actors in the thriving automotive industry, the region's supply of labour and land is tight, making diversification challenging or even unattractive (Grillitsch 2018). The region benefits – and suffers – from a homogeneous knowledge and skills base, which limits the opportunities for diversification. These factors enhance the possibility of lock-in; actors within the automotive industry and its supply chain may struggle to adapt their production processes to incorporate new forms of knowledge (Grillitsch 2018). This then suggests the need to support unrelated variety, but with the willing engagement of actors in the automotive and related industries.

Should the region's economic development leadership (and more specifically, the LEP) choose to focus primarily on fortifying the automotive cluster, it is likely that actors such as the city and county governments, the WMCA and Midlands Engine, and area universities will still continue to provide much-needed support for the digital/creative and culture/tourism sectors. Yet, if leadership dedicates new effort to building these sectors there could be synergies with more radical diversification in automotive. For instance, a competitive digital/creative sector that develops new technologies and shares its knowledge base and workers could cause some disruption in the automotive industry, and the cultivation of new knowledge bases in mobility and big data in the automotive industry could likewise spur more innovation in the local gaming industry.

Support for both automotive sector diversification and the emergence of new specialisations in the digital/creative and culture/tourism sectors will be provided by addressing bottlenecks in the local entrepreneurship ecosystem for ambitious entrepreneurs. Some specific suggestions are offered below and are summarised in Table 3.1.

[9] https://www.creativeindustryfinance.org.uk/

Table 3.1. Pillars, bottlenecks, and proposed solutions

Pillar	Bottlenecks	Solution
Skills and talent	Shortage of high-skilled workers and mismatch between training and new demand for IT workers	Skills training and apprenticeship Entrepreneurial talent
Innovation and R&D	University-led innovation system inaccessible to some SMEs	Entrepreneurial talent Access to finance
Entrepreneurship	Lack of SME support outside of specialized areas	Cross-fertilization of sectors Access to finance
Physical assets and infrastructure	Lack of appropriate space for firms and attractions for workforce	Cross-fertilization of sectors Entrepreneurial talent City of Culture designation Regional spatial planning

Source: Author's elaboration.

Fostering cross-fertilization of sectors

Coventry and Warwickshire benefits from a mature and vital automotive industry, a fragmented but rich tourism sector, and an emerging digital creative industry. Interesting connections have emerged among the industries – for instance, digital manufacturing draws IT workers into the automotive industry, and local museums utilize cutting-edge digital and video technology – but there are few deliberate strategies in place to build connections. The Serious Games Institute, which combines IT, gaming, and health, provides an excellent example of how this could work; organizations like Coventry University Enterprises can help bring faculty from different areas together with entrepreneurs to foster start-ups for technology transfer and advice. A model for this is the Berkeley SkyDeck, which makes available a team of faculty-in-residence to advise start-ups, both affiliated with the university and not.[10] The role for the LEP would be to act as a promoter and intermediary, helping to raise investment funding and brokering connections among actors from different sectors via its events (such as the business festival), as well as its Growth Hub.

Another path to help cross-fertilization would be the provision of space. Many start-ups in the digital creative industry lack affordable commercial space. There are several large developments in the pipeline that might help meet this need: for instance, the City Centre South development in Coventry, or the planned expansion of JLR and other firms outside the city. To foster connections with the digital creative industry, the large automotive firms could provide or sponsor incubator space for start-ups, perhaps in return for selected services that enhance their own technological capabilities. Another course would be to work on developing more of an industrial district, with a variety of types of space, including shared workspaces to accommodate businesses of all sizes. An example of how this can work is how the City of Fremont has repurposed a former Toyota-GM plant to become the centerpiece of the Fremont Innovation District in Silicon Valley (Box 3.3).

[10] See http://skydeck.berkeley.edu/

Box 3.3. City of Fremont Innovation District, USA

Description of the approach

Concerned about the potential loss of jobs and local suppliers from the 2010 closure of the Toyota-GM plant, the City of Fremont (in Silicon Valley) has successfully built a Fremont Innovation District around Tesla, connecting it to the tech industry and autonomous vehicles research. Tesla models itself after Apple or Google, organising its production entirely around product design (rather than considerations of management or logistics). It has also transformed the automotive employment model to rely largely on workers skilled in a variety of areas, from production to engineering to IT, as well as contract labour. It refers to itself as 'the technology company that makes cars'.

Inspired by the approach of Tesla, the City of Fremont has sought to attract a diverse set of automotive firms and skilled employees to the Innovation District through a combination of rebranding and marketing of industrial sites near to Tesla, improving transport connections to firms on the sites, and creating an attractive mixed-use hub including workspaces for entrepreneurs.

The City of Fremont worked on the marketing and rebranding of the district by engaging consultants to develop marketing materials that unify its industrial area, such as window decals and publicly accessible branding for businesses. Such materials have helped to create a sense of self-identity and rebrand industrial space in Fremont. As one city official reported: "It doesn't take a lot to really make these areas more visible, for people to take pride in them. We went from a situation where people were sort of embarrassed about our industrial space to really being proud of it."

The city also planned, lobbied for, and facilitated the construction of a new transit line extension and creation of a liveable mixed-use hub, with high-density employment near the station and larger plants (like Tesla) at the edge, just two kilometres away (connected via an employee shuttle). This has created working environments that are desirable to not just the older large manufacturers, but to small firms as well. Dozens of shared and on-demand workspaces have emerged within excess offices to fill demand from entrepreneurs.

Success factors and challenges

Due in part to the Innovation District initiative of the City of Fremont, the city now actually has more jobs and a larger and more diverse supplier base than before the Toyota-GM closure, including attraction of enterprises in specialisations from machine equipment to IT.

The success is due to the combination of rebranding, transport improvements for employee access and development of a central mixed use hub. These initiatives succeeded in better connecting the industrial area to the region and making it a more distinctive and attractive place for mobile firms to locate.

Relevance for Coventry and Warwickshire

To become technology companies that make cars, JLR and other companies in the local automotive cluster would benefit from a built environment that is attractive to workers and entrepreneurs in technology industries. It may not be possible or desirable to construct an Innovation District in Coventry or Warwickshire, but as planned urban regeneration efforts

proceed, there is an opportunity to create spaces that work well for the knowledge workers that will be leading the transformation of the automotive industry.

For further information

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Leveraging Coventry and Warwickshire's successes in skills training and apprenticeship

Coventry and Warwickshire suffers from shortfalls in some areas of skills training, particularly the STEM pipeline at the college level. Yet, its larger companies and institutions know how to do training very well: both the WMG Academy and JLR Apprenticeship Scheme receive high praises. How might the region better learn from its own successes? In particular, stakeholders expressed a desire to see more skills training and apprenticeship opportunities for SMEs in both the automotive and digital creative sectors.

One approach would be to expand these successful existing programmes. The LEP might start by encouraging the programme boards, currently dominated by the large manufacturers, to expand to represent SMEs and the digital creative industry, particularly the scale-ups, which are most in need of labour. Over time, the programmes could expand the curricula to include issues of entrepreneurship and/or the digital industry. In the apprenticeship programmes, when trainees gain skills in broad areas like digital marketing, they could be shared between large manufacturers and start-ups. This could then help address skill shortages, such as in emerging IT specialisations, for multiple industries, while also reducing poaching.

Another strategy would be developing employer councils to guide training in the digital/creative and/or culture/tourism sectors, such as the Information and Communications Technology Committee at Workforce Investment San Francisco (Box 3.4). The area experiences challenges in engaging actors from these fragmented industries, as well as developing curricular standards. Yet, the institutional structure for sector skills groups already exists at various government levels and could be utilised for new groups on emerging skillsets.

Box 3.4. ICT Committee at Workforce Investment San Francisco (TechSF), USA

Description of the approach

Workforce Investment Boards (WIBs) are one of a long series of U.S. workforce training reforms aimed at connecting training supply more effectively to employer needs. They consist of a mix of stakeholders, at least 50% from business (including both larger firms and SMEs across sectors) and others representing local educational institutions, unions, and disadvantaged communities. WIBs often create subcommittees to guide training curricula and resources for specific industries. This is the case with the ICT Committee at San Francisco's WIB. TechSF includes representatives from local tech companies (Jawbone Health, Microsoft, Pinterest, LinkedIn, and Autodesk), legal and financial services, and University of California San Francisco.

The ICT Committee advises a group of local technology training providers that has trained thousands of disadvantaged San Francisco residents since the late 1990s dot-com boom. Most recently, TechSF has connected these training programmes to local employers via the TechSF Apprenticeship Accelerator. Not only do board members and their networks sponsor apprenticeships, but also the city asks tenants of city-owned space to consider apprentices to meet First Source (local hire) requirements.

Success factors

The existence of the ICT Committee has allowed for the development of a collaborative effort to solve problems. For instance, at the instigation of committee member LinkedIn, training provider staff are now investigating the feasibility of using LinkedIn for graduate tracking.

Remaining challenges

There is more demand than public funding to pay for training. Furthermore, the participation of tech employers should be greater given the size and nature of the local agglomeration. The participating training programmes also suffer from challenges in tracking graduates in terms of identifying outcomes and providing support for further training or employment options.

Relevance for Coventry and Warwickshire

A Coventry and Warwickshire employer council for the digital skills could be very effective in organising training for the digital sector and the digital skill needs of other sectors locally. Although Coventry and Warwickshire lacks the very large IT employers that participate on this particular committee in San Francisco, it could be effectively populated by including both local digital sector SMEs and start-ups and IT leaders from within large automotive cluster and advanced manufacturing and engineering firms. At the very least, it could provide an arena to help organise the fragmented digital sector.

For further information

Patrick Mitchell, TechSF Programme Manager, Patrick.Mitchell@sfgov.org.

Sources:

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TechSF website: http://oewd.org/tech-sf

The UK approach to training and employer councils has been judged by some commentators as overly driven by supply rather than demand (Kraak 2013). In the USA, this is done via Workforce Investment Boards, where employers advise investment in training and small employers can benefit from government-subsidised workers. Even more promising models exist in The Netherlands, where employers give extensive input and 100% of trainees get jobs, and Singapore, where training is closely linked to technical universities (Kraak 2013). The LEP and other local players can use the flexibilities provided by recent reforms of the UK system to learn from these examples in trying to create a more effective local skills ecosystem.

Developing and retaining entrepreneurial talent

Another key concern is entrepreneurship training at the university level and beyond. This will mean both connecting start-ups and skilled university graduates more effectively to entrepreneurship training and creating a place for talent to blossom.

The Massachusetts Institute of Technology has created an entrepreneurship ecosystem both within and adjacent to the university. The Entrepreneurs Club provides a forum to discuss start-up ideas, offers a business planning class during winter term, and helps members practice for the MIT USD 100K Competition. The Competition itself is three contests offering more than USD 350 000 in prizes for business ideas and plans. Also of note are the Sloan Entrepreneurs for International Development, an organisation focusing on sustainable global development through entrepreneurship; the MIT Global Startup workshop, which brings together budding entrepreneurs from around the world to learn from MIT students; the Venture Capital and Private Equity Club, which connects students to the venture capital industry via networking events; and the MIT Entrepreneurship Review, an online publication. Adjacent to the university is the Kendall Square Innovation District, housing a variety of large companies (such as Google and Novartis) in addition to the Cambridge Innovation Center, an MIT-owned building that rents office space to start-ups.

This kind of initiative does not have to be university-led, but could leverage resources of large firms locally or internationally. For instance, Hewlett-Packard has developed the Learning Initiative for Entrepreneurs, which develops technology skills in 27 free online courses in seven languages. These new tools help entrepreneurs and small business owners to develop more commercial opportunities. Hewlett-Packard typically reaches out to other organisations, such as the United Nations Industrial Development Organization, to partner.

Coventry and Warwickshire already offers many similar resources for entrepreneurs via its universities, particularly Coventry University and the Warwick School of Business. But there is a role for the LEP in ensuring that there is steady funding for local entrepreneurship competitions (typically raised through donations from large local firms), representation of the entrepreneurship need for space in key development decisions, and engagement of the region's larger firms in support entrepreneurship training.

Tapping into different forms of finance

Start-ups and scale-ups typically struggle to obtain financing and the challenges are multiplied for the digital creative sector. Not only is the sector fragmented, with many small firms in different market niches, but also the traditional sources of funding (like the ERDF) most readily support capital investments more appropriate for larger, goods-producing firms.

The LEP would benefit from adding a representative from finance to its Board. Ideally this representative could bring expertise in SME finance, to help address the gaps experienced by SMEs in advanced manufacturing. But to help meet the financing needs of the digital creative and cultural industries, the LEP will need to engage in more targeted efforts.

For the start-ups in the digital creative sector, crowdfunding – an open appeal directly to the public – is particularly relevant for early stage funding. Via a crowdfunder like Kickstarter, funders provide cash either as a donation or for a non-financial reward. Kickstarter, which has raised over two billion dollars for over a hundred thousand projects in the USA, tends to draw one-time donations from members of the entrepreneur's social circle, with funding increasing as the project nears its goal (giving more confidence to potential investors) (Kuppuswamy & Bayus 2018). Kickstarter UK currently has 157 projects in Coventry alone. Crowdfunding is not a long-term solution for the sector, but could provide some cash inflow as the concentration of firms increases.

Unfortunately, there are few sources of funding for arts and culture. Creative United, which is funded in part by the Arts Council, is in the process of creating a comprehensive business support programme for the arts, museums and libraries, called Prosper. The first phase of the initiative focuses on capacity building and education, with workshops and webinars for representatives of cultural organizations. Prosper's Phase 2 will help support access to finance from a group of affiliated lenders. The LEP should reach out to Creative United at this early stage of development to partner in financing programmes for its local cultural and arts organisations.

Embracing the City of Culture designation

The City of Culture designation provides a timely opportunity to strengthen industrial diversification in Coventry and Warwickshire. The importance of a creative milieu in supporting entrepreneurship is well established, and growing evidence suggests that alternative subcultures, or the "avant-garde," support visionary entrepreneurs and innovation better than large-scale or mainstream amenities do (Audretsch and Belitski, 2017). The City of Culture approach, with its focus on co-producing art with local communities, educating the area's young artists, and creating more of a public realm, will help support an innovative milieu.

One much-cited example of how culture can contribute to innovation is the city of Austin, Texas. Austin has long embraced a "live and let live" approach, exemplified by its motto, "Keep Austin Weird," which has supported a lively local music scene. This was fortified by the arrival in the mid-1970s of the Austin City Limits TV series and music festival, followed by two film festivals by the 1990s – an example of local distinctiveness leading to national prominence (Markusen 2012). At the same time, a collaboration of actors across government, business, academia, and civic sectors has attracted significant R&D and venture capital investment, fuelling the development of an entrepreneurial ecosystem and a high-technology cluster (Gibson and Butler 2015). The combination of cultural and entrepreneurship initiatives has arguably created an open environment for innovation, attracted new talent, and fostered cross-sectoral collaboration. Stakeholders credit the interaction between the cultural and high-technology sectors with fostering a new digital media and gaming cluster that is the third largest in the USA.

Another key aspect of this transformation is visioning. The City of Culture designation provides an opportunity to conduct a regional visioning exercise, which in turn may help to align and mobilise diverse constituencies in support of industrial diversification (Grillitsch 2018). Numerous stakeholders mentioned the need to develop more of a regional

brand to enhance tourism, but it could also serve to fortify connections across sectors and between large firms and SMEs. As Coventry prepares for 2021, the LEP could play a role in launching a broader conversation about the identity of the region, in the process strengthening connections across sectors as in Austin.

Connecting the region's assets

Although the UK eliminated its Regional Spatial Strategies in 2010, many other countries around the world have strengthened regional planning governance, following the call of the United Nations for regional sustainability planning in the 2012 Rio+20 (Chapple 2015). In most of these cases, regional planning stems from a combination of factors: increased decentralisation by central government, the rise of new collaborative and cross-sectoral forms of governance, and the realisation that mitigating climate change will require coordinating resource consumption across diverse jurisdictions in a region.

In regions that lack a strong public sector role in regionalism, the private sector has stepped in to lead regional visioning around spatial planning. One famous example is Joint Venture, Silicon Valley, which convenes business leaders to discuss issues related not just to regional competitiveness but also issues like jobs-housing imbalance and traffic congestion. In one interesting twist, Facebook is now leading the planning effort for a regional rail spur to connect its office campus with housing opportunities across the bay.

Another noted example is Chicago, a highly fragmented metropolitan region in which local governments have long collaborated from the bottom up in the Metropolitan Mayors Caucus. As the mayors have advocated an agenda around transport and competitiveness, they have gained policy support from business organisations like the Metropolitan Planning Council. One such effort was Chicago Metropolis 2020, a report on spatial planning produced in 1999 by the Commercial Club of Chicago. Even without significant implementation authority, Metropolis 2020 quickly became a formidable business pressure group for infrastructure investment, and its ideas continue to influence decisions (Hamilton 2002).

As these examples suggest, Coventry and Warwickshire LEP could play a role in regional spatial planning even without significant implementation authority. To help shape regional infrastructure planning, the LEP might conduct a regional visioning process, convening actors across sectors or even simply local governments. Publishing a vision should help create momentum and a framework to address regional connectivity problems as investment opportunities arise in coming decades.

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4. Knowledge exchange and the automotive cluster

Introduction

This chapter will briefly analyse the evolution of the automotive industry, the main driving cluster in the area, focusing on issues of industry diversification and knowledge exchange. It will be clear that there are not one but several types of possible diversification. For example, diversification can exist within the sector or outside it in other economic activities with potential to either complement or substitute the presently dominant economic activity. There can be multiple paths to recovery, but all of them are highly dependent on the range of stakeholders willing and able to cooperate and to contribute to the process of diversification. In this context, institutions and policies need to be able to find the right balance between the reinforcement of existing competencies and the creation of future ones.

Technological trends and policy options in the automotive cluster

Technological trends in the car industry

During the period 1950-1990 the number of product models offered by most car manufacturers increased from a few tens to several hundred, while product quality, as represented by performance characteristics, increased. Furthermore, although the innovations introduced into cars after the assembly line have been mostly incremental, some of them, such as front wheel drive, automatic transmission and disk brakes, were more radical.

In spite of this increase in variety, the development of the car industry up to the 2000s can be reasonably well described by the concept of a 'dominant design' (Abernathy and Utterback, 1975). This predicts that a given technology emerges with a variety of possible designs but that after a while it converges on a dominant design, defined by strong scale economies and a mainly incremental pattern of innovation shared by most firms. A further distinction became relevant as the range of product models widened between generalists and specialist producers, where the former produced the full range of models and the latter only a limited subset. Typically, specialist producers concentrated on high-quality high-price models while emerging countries entered focusing on low-quality low-price models.

Another concept that applies quite well to the car industry is that of industry life cycle (Klepper, 1996,1997; Jovanovic and MacDonald, 1994), according to which the number of firms in the industry is expected to increase rapidly in the early phases, to reach a maximum and then to decline, finally tending towards an oligopoly. Such a pattern of development was typically followed in the countries which that pioneered the production and use of the automobile. At the global scale, the car industry is now evolving from a series of national oligopolies to a world oligopoly. Generally, in less developed countries car production starts under some forms of import substitution and

later begins to export by concentrating initially on cheap models. The most successful producers eventually move upmarket to higher-performance and higher-price models. This has given rise to an international division of labour in which car producers are multinational firms assembling parts made by suppliers organised in different tiers and participating in international value chains (Gereffi et al, 2005).

Such a relatively predictable pattern of development is now threatened by a series of constraints and opportunities linked to the impact of the technology on the environment and to the concurrent emergence of technologies which can substitute for or complement the ones currently used in the car industry. In particular:

1. The likely exhaustion of fossil fuels is inducing the search for alternative forms of energy, amongst which electric cars seems to be the most prominent with a possible contribution from fuel cells;
2. The recent progress of artificial intelligence (AI) considerably shortened the expected timeline towards the availability of autonomous vehicles (AV).
3. The use of cars could be potentially revolutionised by the emergence of socio-technical technologies such as car sharing and by the availability of in-car services (McKinsey, 2016; TAB 2012).

These are the main technological developments that in the foreseeable future could revolutionise the motor car industry.

The precise timing of these changes is difficult to predict because it depends on a number of factors with a highly uncertain evolution. For example, in 2030, the share of electrified vehicles could range from 10 to 50 percent of new vehicle sales. Furthermore, any aggregate trends will hide wide differences between economic environments. Adoption rates are likely to be highest in developed, dense cities with strict emission regulations and consumer incentives (tax breaks, special parking and driving privileges, discounted electricity pricing, etc.). On the other hand, sales penetration will be slower in small towns and rural areas with lower levels of charging infrastructure and higher dependency on driving range. Likewise, subject to progress on the technical, infrastructure, and regulatory challenges, up to 15% of all new vehicles sold in 2030 could be fully autonomous (McKinsey 2016)

Probably the previous changes can be summarised as a paradigm shift from car ownership to mobility as a service. This will change both the structure of the industry and that of the corresponding demand. Thus, traditional car manufacturers will have to compete on multiple fronts with new entrants (Tesla), with mobility providers (e.g. Didi Kuaidi, Uber, Zipcar) and with tech giants (e.g. Apple, Google). On the other hand, consumers are likely to choose different types of mobility depending on the trip and on where they live (dense city or countryside; level of development of the country).

The previous trends entail both opportunities and dangers. According to McKinsey (2016) the world car market is likely to keep growing until about 2050 although more slowly than in the recent past. However, the nature of the cars produced and of the services supplied is likely to undergo drastic changes. For example, a considerably larger share of total value is expected to come from the connectivity of cars and from the data they can generate.

These changes imply that firms in the car industry will have to modify substantially their knowledge bases by incorporating technologies that they were not previously using. Such a learning process is not completely new because since the 1980s car firms had to

acquire new types of knowledge in electronics and new materials (Patrucco, 2014). However, the expected changes in the economic and technological environment of the industry are far more radical and could easily lead to the failure of some incumbent firms and to the emergence of new ones.

The importance of knowledge exchange

The knowledge intensity of all industrial processes has considerably increased since the beginning of the 20th century and particularly since the 1950s. The most visible expression of this trend has been the emergence of R&D as a separate function of the economic system (Freeman and Soete, 1997). However, R&D is not the only manifestation of this growing knowledge intensity. Other activities, such as consulting are heavily knowledge intensive. The role of physical capital in development is gradually complemented by that of human capital, which increases with the level of skills, competencies and knowledge of the labour force (OECD 1996; Cooke and Leydesdorff 2006; Godin, 2006).

Firms have a knowledge base which can be defined as the level of the collective knowledge that firms can use for their productive purposes. The knowledge base of a firm can be mapped based on its patents and publications and some relevant properties of its knowledge base can be defined and measured (Krafft et al, 2014):

- *Cognitive distance* is the property of the knowledge which measures the dissimilarity of a firm's knowledge base at a given time with respect to either that of another firm at the same time or the same firm at a previous time (Nooteboom et al, 2007). Typically, learning by a firm of a type of knowledge very dissimilar to the one the firm was previously using entails a large cognitive distance and a long learning period.
- *Coherenc*e of a firm's knowledge base measures the capacity of a firm to use components of its knowledge base together. Thus, the coherence of a firm's knowledge base tends to fall when a very new and very different type of knowledge needs to be learned and to rise during periods in which there are only incremental changes in the type of knowledge used. In the course of time, knowledge diversifies by disciplines and technology fields and by internal diversification of existing fields.

Incumbent large diversified firms tend to have relatively stable knowledge bases over relatively long periods of time and to experience difficulties when learning new and very different types of knowledge.

The pharmaceutical industry is typical example of a sector that experienced difficulties in learning a new field of knowledge, genetic engineering, which replaced a large part of its pre-existent knowledge base and subsequently became one of its most important components (Nesta and Saviotti, 2005, 2006). In these situations, start-ups play the role of explorers of the new knowledge for large diversified firms and help them to move it towards industrial applications (Powell et al, 1996; Zucker and Darby 1996). These start-ups are very different from the SMEs which have traditionally been common in the automotive industry as suppliers. They have knowledge bases very close to the frontier of some new technologies and play an essentially the role of knowledge explorers bringing disruptive innovation.

In the past one could have expected exploration to take place in research institutions and exploitation in firms. The recent emergence of start-ups corresponds to an increasingly

fine division of labour in the process of knowledge generation and utilisation. Entrepreneurial knowledge is likely to occupy a growing share of overall knowledge generation the higher the knowledge intensity of the economic system.

In its present state the automotive industry is moving from a relatively stable and well-known knowledge base to one which will need to incorporate knowledge with a high cognitive distance with respect to the one used in the past at the risk of reducing knowledge coherence (Nesta et al, 2005, 2006; Krafft et al, 2014).

Large diversified firms and start-ups tend to have different capabilities. The former are better capable of integrating many different types of knowledge, competencies and functions they have been using for a long time and the latter are better at developing ideas generated in scientific institutions and moving them towards market exploitability. In other words, large diversified firms are better suited for exploitation of knowledge while start-ups are relatively better for exploration, creating new fields of technology and industrial sectors which will then follow a life cycle with declining uncertainty and growing firm size (March, 1991).

In these conditions, incumbent firms need to collaborate more intensely with start-ups and research institutions that have strong knowledge bases in emerging science and technology fields.

Local policy options for knowledge exchange

Starting from the 1990s there has been a considerable shift of innovation policies from the national to the regional level (OECD 2009, Bathelt, Malmberg and Maskell, 2004). This not only refocused policies on the regional level but led to a new paradigm in regional development policy in which identifying sources of growth specific to each region became more important than resource transfers to lagging regions from wealthier ones (OECD 2011 p. 32).

Since the 2010s, there has been a particular emphasis on regional innovation strategies and smart specialisation strategies. This approach emphasises the need to prioritise investments within strong areas of regional specialisation with high growth and differentiation potential, making use of an entrepreneurial discovery process involving research, business and government stakeholders.

As a consequence, given their past experience and present capabilities OECD regions have available three main types of strategies for innovation:

- building on current advantages (science push, technology-led, or a mix);
- supporting socio-economic transformation (reconversion or identification of a new frontier)
- catching up: towards the creation of knowledge-based capabilities (OECD 2011 p. 79).

Of course, these strategies are not mutually exclusive: the first and the second can be used together. Coventry and Warwickshire can build on current advantages and at the same time support major transformations in the existing automobile industry.

In this context, two key policy tools that could be introduced or strengthened in Coventry and Warwickshire to strengthen knowledge exchange in its automotive cluster can be suggested:

Innovative start-ups

JLR is already cooperating with knowledge-intensive start-ups situated in different parts of the world. Public policy to sponsor similar start-ups at the local level could be a useful complement of its internationalisation strategy. Incubators would be appropriate for the creation of innovative start-ups.

Innovation capability of existing SMEs

For what concerns existing SMEs, competence centres could be useful in Coventry and Warwickshire. Competence centres are typically constituted by a combination of different organisations, including firms in related technologies, research centres and government departments (OECD, 2011). The core objective is not just to develop innovations and technologies but to favour the interactivity and synergies of participating organisations.

It should be recognised that (i) the creation of a competitiveness centre is generally a medium or long term project, and that (ii) it may support both competencies that improve parts of the existing knowledge base and other competencies that aim for the extension of the knowledge base to new and not closely related fields. This emphasis reflects the recent trend towards an increasingly systemic character of innovation policies.

The LEP can seek to promote these types of measures.

The automotive cluster in Coventry and Warwickshire

Historical evolution of the cluster

The origins of the UK automotive industry date back to the final years of the 19th century. From very early on Coventry played a very important role in the development of this industry. Three facts about the origin of the car industry in Coventry are worth noticing:

i. the birth of the car industry in Coventry coincided with that of bicycle making;

ii. some of the initial car producers had been or still were also bicycle producers;

iii. the emergence of the car industry led to a recovery of the city's economy from a recession due the decline of the activities which were previously at the core of the local economy, one of which was watch making (Thoms and Donnelly, 2017).

Coventry entered a period of prosperity after the Second World War that was to last until the 1970s. By the 1950s the UK had the world's second largest car-making industry and was the world's leading car exporter. Coventry became known as the UK's 'Motor City', and more migrants flocked to the city for work. In 1950 there were 12 manufacturers - Alvis, Armstrong Siddeley, Daimler, Hillman, Humber, Jaguar, Lanchester, Lea-Francis, Singer, Standard, Sunbeam-Talbot and Triumph. Between 1959 and 1963 weekly earnings in the car industry in Coventry were 24% higher than the national industrial average. Women formed 37.9% of the workforce compared to 30.8% in the rest of the UK.

But the boom was not to last. One of the main factors leading to this decline has been identified as the insufficient innovativeness of the local car industry in the face of increasing international competition. A rise in European and American manufacturing

meant that by 1974 Britain had slipped from second to fifth place in the list of the world's biggest car-making countries. As a result, Coventry's car output went into decline, and the city's iconic factories began to close. From the 1980s mergers and failures drastically reduced the number of firms and the local production capacity. Meanwhile the car industry in the UK moved to other places, but the new plants were essentially assembly operations managed by multinational firms such as Nissan, Toyota and PSA.

By the mid-80s the two surviving plants were Browns Lane and Ryton, producing Jaguar, Daimler and Peugeot products. Unemployment had risen to 17% and Coventry band The Specials released Ghost Town. *(Sources: Coventry Motorcar Heritage by Damien Kimberley and the Coventry Transport Museum)*

An impressive recovery of the industry in the region started in the early 2000s. The most important event in this recovery was the purchase by the Tata Group of Jaguar and Rover to create JLR. This involved a considerable investment by Tata but also the location of JLR's R&D activities in the region. The decision by Tata to invest in JLR was an event that cannot be replicated in other regions. This was not the result of a systematic search for investors but the outcome of unique connections existing in the region in the person of Lord Bhattacharyya. As such it is an example of the specificity of regional contexts and of the need for long term investment to accompany the recovery process. Elsewhere the same need could have been satisfied by different institutional means and channels. A further component of this recovery consisted of the purchase by BMW of the Mini brand.

The interpretation of this recovery needs to take into account some specificities of the industry:

- It is dominated by a small number of multinational firms acting essentially as assemblers of parts and components produced by suppliers, mostly SMEs, organised in increasingly internationalised supply chains.
- Since the Second World War innovation in the industry has been mostly incremental, but giving rise to a huge diversification in terms of the range of models produced and of the knowledge base used.
- The industry is now facing the emergence of some radical innovations, such as electric cars, self-driving cars, AI, car sharing, environmental requirements, etc., which are likely to increase the uncertainty in the industry's future development and possibly revolutionise it.

JLR as a cluster anchor

Particular attention should be paid to the role of the Jaguar Land Rover Group (JLR) as one of the key anchors in the Coventry and Warwickshire automotive cluster, and a key player in UK automotive manufacturing generally. It originated from the combination of Rover and Jaguar. Both businesses had previously been part of British Leyland. Jaguar Cars and Land Rover were eventually reunited as a single entity by the Ford Motor Company in 2002. In 2008, the Jaguar Land Rover company was established when Tata Motors acquired the Jaguar and Land Rover businesses from Ford.[11] This

[11] Tata Sons "Jaguar Land Rover",http://www.tata.com/company/profile.aspx?sectid=ZhDd6fXWtEY=. Retrieved 30 July 2008.

was the beginning of a successful recovery in which JLR very quickly invested in new plants, hired new personnel and signed over GBP 2 billion of supply contracts with UK-based companies.[12] Furthermore, manufacturing plants have been set up in China and Brazil, and new plants are being built in Slovakia and Austria.

In 2013, JLR increased its investment in R&D significantly by investing GBP 3 billion in "product creation" and now claims to be the "biggest R&D investor in the UK in the automotive business" (Ingenia, 2015). Furthermore, in September 2013 JLR announced plans to establish a new R&D centre called the National Automotive Innovation Campus, based at the University of Warwick in Coventry. JLR will invest GBP 50 million in the facility with additional funding from Tata Motors, the University and the UK government (BBC, 2013).

Since 2013 the JLR group achieved a remarkable market success as sales increased from 374 636 units [of which 316 043 were Land Rovers and 58 593 were Jaguars] (Jaguar Land rover, 2013) to 489 923 cars, thus overtaking Nissan, the previous leader (Guardian, 2016). In that period 21.6% of sales were in Europe (excluding the United Kingdom and Russia), 20.6% in China, 19.3%in the United Kingdom, 16.8% in the United States, 4.8% in Asia Pacific (excluding China) and 16.9% in the rest of the world (Jaguar Land Rover, 2013).

The recovery brought about by JLR is interesting not only in quantitative terms but also because the firm is not just another assembly plant by a multinational firm carrying out a limited number of functions but a truly integrated manufacturer with a full range of activities locally going from R&D to design, production, strategy, marketing and sales. The Jaguar and Rover brands were in themselves an asset but they would not have led to success unless they were accompanied by an adequate strategy, a good knowledge base and an improved group organisation. Clearly, JLR is not generalist producer but has wisely chosen to concentrate on the segment of luxury and sports cars. The construction of an adequate knowledge base for this has built not only on the R&D and training it carries out internally but also on the collaboration with outside research and training organisations locally. Key among them are Coventry University and the University of Warwick, for example through the National Automotive Innovation Campus and Warwick Manufacturing Group (WMG) at the University of Warwick,.

JLR seems to be fully aware of the ongoing trends in technology and of their disruptive potential for the established producers in the industry. They have divisions such as 'InMotion Ventures', which invests in and invents businesses in the mobility, transportation and travel sector, and has a wide interpretation of what the transport and mobility sector includes. Some of the areas JLR is most interested in include:

- Mobility as a Service (MaaS)
- Travel, navigation and data

[12] The *Guardian*. London. 21 March 2012."Jaguar Land Rover and Chery Automobile agree deal to sell vehicles in China" (https://www.theguardian.com/business/2012/mar/21/jaguar-land-rover-chery-automobile-china); *The Indian Express*. 29 June 2012."JaguarLR to generate 4,500 jobs in UK" (http://www.indianexpress.com/news/jaguarrl-to-generate-4-500-jobs-in-uk/968286/); *Solihull Observer*. 10 September 2013."Jaguar Land Rover announce 1,700 jobs" (http://www.solihullobserver.co.uk/2013/09/21/news-Jaguar-Land-Rover-announce-1,700-jobs-83540.html).

- Last mile services (delivery, parking)
- Car and ride sharing
- Autonomous vehicle fleets and services
- Financial services (leasing, insurance).

Furthermore, JLR realised that today no firm can keep up with all the knowledge developments alone, especially the most disruptive ones. In response, it has a number of collaborative 'open innovation' initiatives:

- The Strategic Business Unit collaborates with the parent company Jaguar Land Rover and with other partners to develop new products and services.
- The Jaguar Land Rover Tech Incubator programme supports start-ups currently positioned to disrupt, advance, and define the future of automotive technology.
- JLR Venture Capital team invests in start-ups across the globe, funding companies at all stages from Seed to Series B.[13] These start-ups are very different from the typical suppliers of the automobile industry and much better adapted to explore new emerging technology fields which could disrupt the knowledge base and business environment of automotive firms.

The activities that JLR is pursuing are playing an important role in the upgrading and diversification of the automotive cluster in Coventry and Warwickshire. It has upgraded Coventry and Warwickshire's automotive cluster by concentrating on the high value, top of the range models which are less price sensitive, subject to less intense competition and capable of providing higher profit rates. At the same time, it is driving a diversification within the cluster with a widening of the range of products produced. These products may potentially extend to related areas such as mobility services. Continuing this evolution puts a premium on JLR building and diversifying its knowledge base and integrating disruptive as well as incremental innovation.

Skills bottlenecks

In spite of the undoubted recent success of the automotive cluster in Coventry and Warwickshire, there are also some bottlenecks for policy to address. One of the major issues lies in the area of access to workforce skills for the local large firms and SMEs in the supply chain.

The level of workforce skills is a general British weakness (OECD, 2017) and Coventry and Warwickshire appears not to be worse than the UK average and possibly better. However, there may be local solutions that can help address the problems. While low to moderate skills are generally sourced locally, the high competencies of the scientific, technological or managerial type are often in short supply at the global scale and need to be sourced internationally. As a consequence, a different approach needs to be adopted in each of the two cases.

For low to moderate skills, one of the interesting local initiatives involves an educational experiment consisting of a curriculum in which students are taught manufacturing from a relatively early age. This initiative is a step in the right direction, but it is not of sufficient scale to provide a general solution for the lack of skills and cannot give results

[13] http://www.jaguarlandrover.com/2016/technology-innovation-1

in the short term. SME competence centres could be another part of the solution, as could be a wider take up of apprenticeships by SMEs.

With respect to international competition for the highest skills, the quality of the local environment, especially in its physical and cultural aspects, is important. Coventry's successful bid for the UK City of Culture 2021 could be a catalyst for improvements in this area.

Responding to potential lock-in

Coventry and Warwickshire has been highly specialised in the automotive industry at least since the end of World War 2, and went through a serious crisis in the 1980s partly reflecting the changing nature of competition in that same industry globally. This was a typical example of lock-in. Although Coventry and Warwickshire now seems to have recovered from the crisis and has transformed its automotive industry, it still needs to create structures and routines that avoid new lock-ins in the future. Box 4.1briefly examines the cases of another automotive region that transformed itself after a period of crisis. Box 4.2 examines the case of an innovation cluster initiative that also helped to diversify a regional economy.

Box 4.1. Recovery from a local automotive industry crisis, Turin, Italy

Approach

The case of the Turin Piedmont region bears a considerable resemblance to that of Coventry and Warwickshire for its specialisation in the automotive industry and for having gone through a similar crisis at a slightly different period. The economy of the region had relied heavily on the automotive sector and had been quite prosperous until the 1970s.

However, a crisis started in the 1970s and gave rise to a series of initiatives involving different stakeholders in the city and region, which by the 2010s had considerably and successfully transformed the local economy. The crisis was so serious that it led to the shedding of more than 100 000 jobs over the period 1970-2000 (Ciravegna, 2012; Colantonio et al, 2014; Power, 2016). By the 1980s, the city of Turin had been placed under controlled administration.

While Fiat's crisis continued until the early 2000s and culminated with the near failure of the firm, initiatives aiming at diversifying the city's industrial base had been in operation for more than twenty years. Amongst the most important stakeholders there were the Politecnico (a highly reputed engineering university), the local chamber of commerce, banks and bank foundations. A very significant step in the recovery process was constituted by the appointment of the first elected mayor in 1993. The recovery strategy included the creation of financial institutions (e.g. Finpiemonte) that cooperated with other stakeholders to create the first incubator (IC3P), followed by others. There was an explicit effort to aid firms to diversify away from the automotive industry and from an exclusive reliance on Fiat. In the early 2000s, Turin drafted a development plan. The city economy diversified towards design, aerospace, culture, high quality food and wine (ibid). An important component of the overall recovery strategy was an urban development plan, including the redevelopment of the industrial areas previously occupied by Fiat and renovating Turin's centre. The Winter Olympics in 2006 contributed to this process.

Success factors

Amongst the most relevant policies adopted in the region there were:

- Labour market policies aimed at improving training and skills.
- The establishment of four technology platforms in automotive, ICT, aeronautics and transportation.

An important example of training and skills initiatives consisted of an effort to enable SMEs previously supplying the automotive industry to reconfigure their competencies and to enter new and more technology intensive sectors.

Of the four technology platforms, automotive, aeronautics and transportation were based on upgrading of pre-existing industries while ICT was more of an emerging specialisation.

Fiat's crisis continued to foster until the appointment of a new CEO in 2004, which led to a decisive improvement (Economist, 2008).

In summary, Turin's recovery has been spread over a period of about thirty years and in the end it has been quite successful. As compared to Coventry and Warwickshire, the Turin case is much more focused on diversification external to the automotive industry, and by the intense involvement of many different types of stakeholders. Furthermore, the diversification process also relied heavily on the promotion of culture and tourism.

Relevance for Coventry and Warwickshire

The case of Turin shows that it is possible for a region narrowly specialised in the automotive industry to survive a serious crisis. Efforts to diversify the technological capability and the knowledge base of the region, if well conceived, provide a very effective recovery strategy. Among the most noticeable factors that can affect the chances of recovery are the importance of skills and the efforts made to diversify. The lack of adequate skills was addressed by labour market policies in Turin. Attempts to diversify involved the collaboration of higher education institutions, banks and financial institutions, and public and private organizations in creating an effective development plan generating new production and cultural activities.

Box 4.2. Brainport Innovation Cluster, Netherlands

Approach

Brainport is an innovation cluster in North Brabant, one of the most innovative regions in Europe, which can offer insights about the diversification of the local knowledge base (OECD, 2007, p. 211). The main objective of Brainport is 'Creating the industries of the future'. The most important influence on the creation of this cluster has been Philips. Between 1999 and 2007 the company recentralised most its R&D near Eindhoven and created the High Tech Campus Eindhoven. This includes Mi-plaza, an open facilities centre with state of the art facilities (labs, clean rooms). It is fully owned by Philips but open to other companies.

Success factors

Several firms participate. Effectively Brainport is a cluster of clusters, including components such as high tech software, smart energy regions, biotech systems, lifetec zone, automotiveNL, DITSS Technology safety and security. Brainport combines regional, national and international objectives. At the regional level its ambition is to enable clusters that solve common company- problems that are relevant to the Brainport region. In addition it aims to integrate its clusters in national policy and instruments, by:

- positioning its clusters and building a cluster network;
- fulfilling knowledge-hub function;
- recognising potential new clusters;
- positioning in EU and international cluster networks.

The case of Brainport is obviously based on a different starting technology, but shares the objective with Coventry and Warwickshire of creating a diversification of the local economy towards the industries of the future while reinforcing the previously dominant technology. Here a crucial actor (Philips) was the catalyst for an initiative involving several existing companies and a growing number of start-ups.

Conclusions and policy recommendations

In the past, the automotive industry has been the main industry in the Coventry and Warwickshire economy and, after a crisis, it has been the main contributor to its recovery. The most important event in the recovery has been the investment by Tata in the JLR Group which acquired and rejuvenated Jaguar and Land Rover. The strategy so far adopted by JLR consisted of selecting a narrow but high-value subset of an expanding range of outputs, carrying out a full range of activities going from design to manufacturing to marketing and R&D and diversifying its knowledge base. Thus, it is a specialisation within an increasingly diversified range of outputs provided by industry amounting to an intra-industry diversification and upgrading.

The development of the knowledge base of the cluster has been critical to achieving this upgrading and diversification. The R&D collaborations between JLR and the University of Warwick in various fields of technology that are likely to affect the industry in the near future is a strong example of how the players in the cluster are generating and diffusing the knowledge required to adapt to the evolution of the industry. This enhances both the competitiveness of the key anchor firms in the cluster and creates the possibility to generate start-ups and scale-ups sharing the same or a similar knowledge base but applying it to the production of different types of goods or services.

The strategy of JLR includes the internationalisation of a number of activities ranging from manufacturing to advanced R&D in collaboration with start-ups working at the frontier of knowledge in the fields where disruptive developments are expected to occur. In the absence of major perturbations, we can expect the present performance of the industry to last for a period of about ten years. However, major perturbations are on the horizon. Google, not a car producer but a company whose main strengths lie in big data and artificial intelligence (AI), has the largest fleet of self-driving cars in the world. Tesla, a company that did not exist ten years ago, produces and sells 400 000 cars per year, although without making a profit. Furthermore, the speed at which these innovations are arriving is highly uncertain. In the early 2000s self-driving vehicles were considered to be very far away in the future. The observed progress has been faster than expected due to advances in AI, a field whose promises in the past had often turned out to be excessively optimistic.

Possible scenarios include the substitution of incumbent car manufacturers by technology companies, such as Google, Apple, Tesla, or the survival of only those car producers that will be able to develop the required knowledge base. Such a knowledge base will include fields which until recently were not central in the industry, such as AI, electric motors, energy, big data etc.

The challenge for Coventry and Warwickshire will therefore be to continue to create the conditions for diversified knowledge generation and diffusion that are currently successfully driving cluster upgrading and diversification.

Favour the interactivity of key research and training organisations for knowledge exchange

In this respect, the LEP should seek to favour the interactivity of the organisations that are likely to contribute the most to the recovery and resilience of the region's economy, including encouraging the area’s two HEIs to continue to educate scientists and technologists and undertake research in the fields in which automotive technology is likely to diversify.

Support cross-sector fertilisation of knowledge

In addition, because of the possibility of a disruptive scenario and its high inherent uncertainty, it is also worth encouraging some other activities that could be future sources of local growth. The positive aspect of this diversification is that the technologies driving this diversification are generally applicable to many sectors and activities. As a consequence, even if the present focus is mostly centred on the transformations of the automotive industry, knowledge in this area is likely to have the potential to diversify outside it. To keep in mind and nurture this possibility could contribute to reinforce the resilience of the local economic system.

Stimulate innovative start-ups and scale-ups and SME innovation

The key local policy tools in this respect should include actions for innovative start-ups and scale-ups and SME innovation, including business incubators and SME competence centre, in order to support the extension of the cluster to include both more exploratory activities.

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5. Institutions and policy governance arrangements

Introduction

This chapter analyses the role of institutions and policy governance arrangements in enabling entrepreneurship and local emerging industries in Coventry and Warwickshire. It focuses on the degree to which current regulations, organisations and institutions are conducive to entrepreneurship and new industry path formation, and the extent to which policy in the region is adapted to overcoming the bottlenecks it experiences. Institutions are the stable patterns of interactions based on mutual social expectations, which arise from formal regulations and informal norms and conventions (Hodgson 2006; Bathelt and Glückler 2014).

The chapter proceeds as follows: The first section presents an analytical framework with which to assess regulation and regional governance, organisations and institutions in Coventry and Warwickshire. The second section assesses how institutions and policy governance arrangements contribute to economic diversification and structural change in Coventry and Warwickshire. The final section concludes with tentative recommendations for how to improve or refine existing institutions and governance arrangements in support of entrepreneurship and industrial diversification.

Analytical framework

Entrepreneurship and local industry emergence are strongly influenced by local institutions (Boschma 2017). Local industrial diversification requires skills, innovation, and entrepreneurship that bridge existing activities and connect with new ones. An assessment of local institutions and policy governance arrangements in this context therefore has to focus on those institutions and governance arrangements that are conducive for training and education, research and development, knowledge exchange within and between firms and universities, and enabling business start-ups, scale-ups and SME innovation.

In particular, empirically, case studies on the rise of the San Francisco Bay Area vis-à-vis the relative stagnation of Los Angeles (Storper et al. 2015), or the continuous reinvention of the Boston economy (Glaeser 2005), suggest that the quality and inclusiveness of social networks, i.e. the relational infrastructure (Storper 2018), is key in facilitating breakthrough innovations, technological transitions and industrial diversification.

The analytical framework for examining the institutional context[14] in this chapter rests on three pillars (Table 5.1): regulations and policies (formal rules); people and

[14] The notion of the institutional concept resonates with the notion of an institutional architecture (Gertler 2010) or institutional regime (Martin 2000), which is made up of an institutional

organisations (institutional actors); and the institutions through which these organisations come to play together (Glückler and Bathelt 2017).

Table 5.1. Elements of the institutional context to analyse

Elements	Description	Example
Regulation (sometimes called formal institutions)	The set of legally actionable rules and regulations, which affect the modus operandi of economic development in a geographical setting.	Legislation on regional governance structure, e.g. level of decentralisation of power and resources; regulations on land use and regional and urban planning; policy programmes
Organisations (Institutional actors)	Individuals and organisations that affect the economy in a geographical setting.	Local and regional authorities, LEPs, business firms and associations, unions, NGOs, universities, colleges, trusts, charities etc.
Institutions (sometimes called informal)	Interaction orders based on legitimate mutual expectations, which arise either from formal rules or informal norms and conventions.	Stable forms of interactions, e.g. cooperation, collaboration, competition or coordination among and between actors and organisations

Source: Author's elaboration

The analysis looks at each of the three elements in Table 5.1 as well as the linkages within and between them.

The concept of 'relational infrastructure' is a useful tool to characterise the quality and linkages of the local institutions. A relational infrastructure includes four institutional dimensions (Storper 2018):

- *Across-network connections* serve to bridge the boundaries between co-existing technologies and sectors. In the case of Coventry and Warwickshire, for example, the creation of productive connections between the established automotive sector and the emergent digital sectors could be a source of successful diversification.
- *Organisational sites* serve as interfaces that facilitate the mixing of networks. In the context of the recent reforms of regional governance in England, Local Enterprise Partnerships (LEPs) promise to be key organisational vehicles at the local level to support the coupling and rewiring of diverse networks between industries, technologies and different stakeholders.
- *Informal* networks serve as 'invisible colleges' and are important to bring different stakeholders together early on to enable timely cross-fertilisation between technologists, researchers, entrepreneurs, and investors.
- The strength and structure of *elite leadership networks* is key in bridging divides between leaders in private business sectors, public authorities and civil society. The more inclusive are the leadership networks, e.g. the more interconnected are the corporate, public, and civic boards of directors, the better can new visions on technological and economic development be shared and the necessary support and resources found.

environment that includes all formal and informal institutions, and the institutional arrangements that describe the types and forms of organisations that emerge in this environment to pursue certain ends.

Regulation of economic development

Recent reforms in local economic policy governance

The assessment of regulation as the first pillar of the institutional context focuses on the changes that have occurred in the devolution of powers and resources to the regional and local levels in England, and the linkages between the new national Industrial Strategy and place-based support for entrepreneurship and emerging industries in Coventry and Warwickshire.

The United Kingdom has a long tradition of centralised governance in a context of important inter-regional economic disparities (OECD, 2017). Arrangements for decentralisation economic development responsibilities to local and regional levels in England has been relatively discontinuous, involving frequent reforms of governance structures (Bentley et al. 2010; Jones 2010; Peck et al. 2013, Pike et al. 2015).

For over a decade, between 1998 and 2012, Regional Development Agencies (RDAs) were responsible for regional economic development in England at the geographical scale of nine administrative regions (NUTS level 1) in England. The territorial definition of those nine regions had been in place only since 1994. RDAs were mandated to follow a business-led approach to regional development and work with industry, universities and colleges, and local authorities to support innovation and manage cluster policy (Borowik 2014). Coventry and Warwickshire fell into the jurisdiction of the RDA Advantage West Midlands, which invested a total of about GBP 3 billion in the period between 1999 and 2012.

In 2010, the new Conservative/Liberal Democrat Coalition Government announced a fundamental reform of regional economic development policy in the UK. RDAs were to be abolished and replaced by LEPs, in order to move to smaller and more natural economic regions, increase value for money, better realise local and regional development potential and improve local discretion, initiative and innovation (Pike et al. 2015). In 2010 and 2011, the UK government approved LEPs for 39 functional economic regions. The central government gave local authorities the flexibility to devise their own approaches to constitute LEPs in different ways in a bottom-up approach. As a consequence different LEPs took different organisational forms, pursued different strategies and took on rather distinct roles in their regions (Pike et al. 2015). In this process, the local authorities of the City of Coventry and County of Warwickshire joined together with business leaders to establish the Coventry and Warwickshire LEP in 2012.

More recently, a further governance reform has taken place with the creation of Combined Authorities. Through this initiative, the government has enabled local authorities, particularly in densely populated urban regions, to voluntarily pool responsibilities and receive certain delegated functions from central government to deliver transport and economic policy more effectively over a wider area. A Combined Authority forms a legal body with powers of decision-making granted by parliament. Nine Combined Authorities have so far been established in England.

One of these Combined Authorities operates in the Coventry and Warwickshire territory – the West Midlands Combined Authority (WMCA), established in 2016. WMCA includes the jurisdictions of seven constituent and ten non-constituent authorities and expands over three LEP regions: Black Country LEP, Greater Birmingham and Solihull LEP, and Coventry and Warwickshire LEP. Thanks to two Devolution Deals with the

central government, the WMCA has received targeted funding and additional powers to take on additional responsibilities from the government.

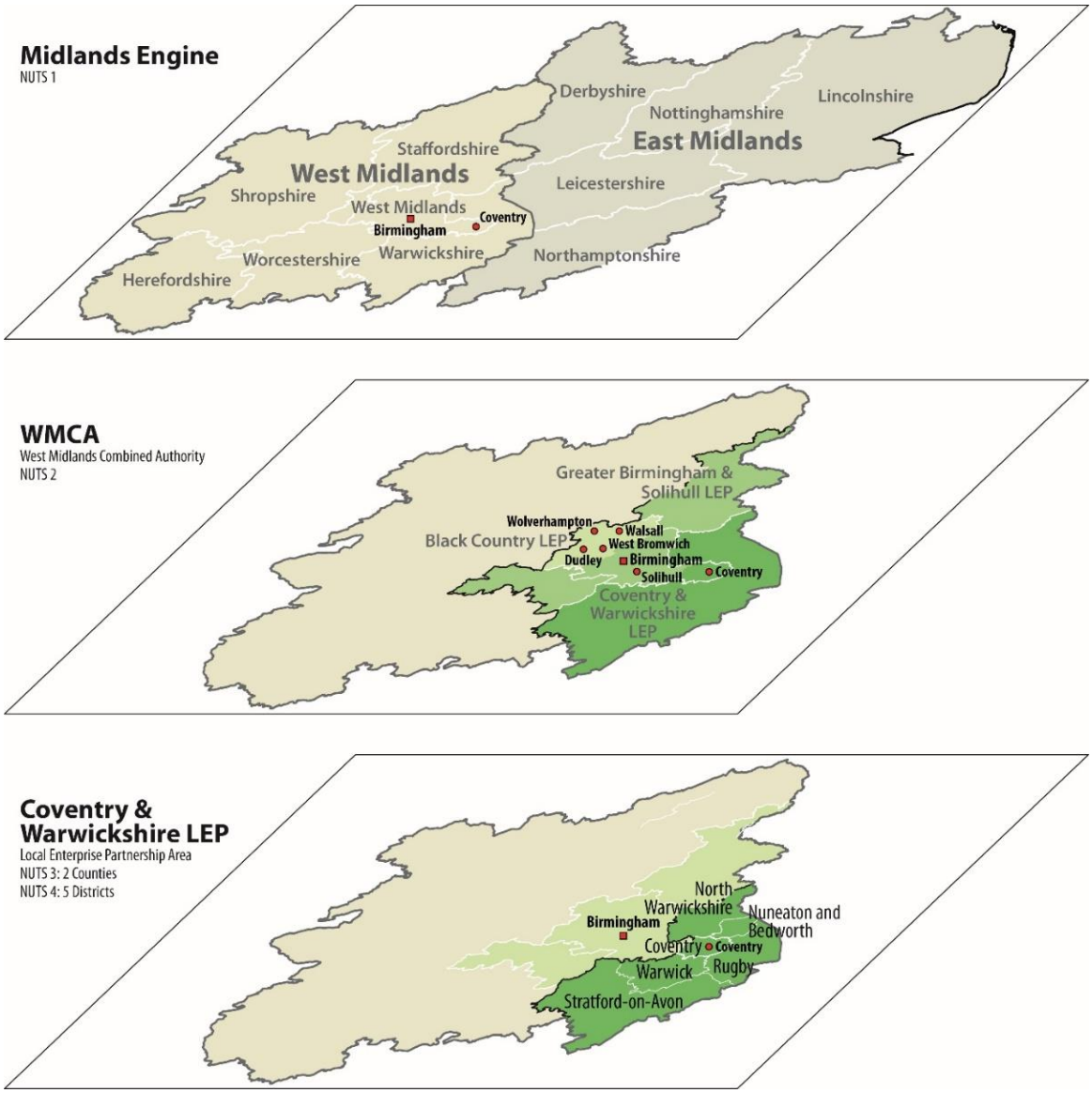
In broad terms, the regulatory framework could be seen as having replaced the RDA as a vehicle for organising economic development at NUTS 1 level, with new devolved arrangements, at smaller scales. In the West Midlands, this corresponds to the WMCA at NUTS 2 level and the LEPs at a scale below this.

Central government has implemented this rescaling to lower spatial levels to increase devolution and to support regional communities to grow local leadership and drive local development. However, the reforms have also to an extent re-centralised some economic development responsibilities that the RDAs formerly had to the national government in London (Bentley et al. 2010).

In addition, the central government has given a particular priority to the economic development of the wider Midlands region (as well as the north of England) by creating the Midlands Engine in 2015 to help the Midlands become a growth engine for the whole UK (CLG 2017). The Midlands Engine covers the two NUTS level 1 regions of the West Midlands and East Midlands. Its organisational unit is the Midlands Engine Partnership consisting of local and combined authorities, eleven LEPs, universities and businesses.

Overall, the new cascading economic development policy governance arrangements are described in Figure 5.1.

Figure 5.1. Geographical scales of sub-national economic development governance arrangements for Coventry and Warwickshire



Source: Author's elaboration.

The fact that the Combined Authorities, LEPs and Midlands Engine have been created de novo, requires new organisations to formalise new patterns of partnership between private and public sectors. However, the historical legacy of constant reforms could pose a risk to the commitment of actors to the new governance structures, if they believe that further reform is likely in the short or medium term.

The Industrial Strategy at local level

The UK government has developed a comprehensive national Industrial Strategy to define priorities for economic policy. It was published as a White Paper in late 2017, building on nearly 2 000 formal responses to the public consultation on a previous Green

Paper. The strategy follows a vision for the UK to become "the world's most innovative economy" (HM Government 2017) and is part of the framework to be referred to in awarding public funding for investments and policy initiatives across the country. The Industrial Strategy centres around five foundations of productivity – ideas, people, infrastructure, business environment, and places –to enhance innovation, employment and skills, entrepreneurship and the flourishing of SMEs and world-leading industries.

The explicit acknowledgement of 'place' as one of the foundations of productivity helps to respond to the regional productivity disparities in the UK and the importance of adapted local policy packages to respond to the problems (OECD, 2017). The key means of translating the Industrial Strategy into reinforcing local strategies is the agreement of Local Industrial Strategies between central government and local governance organisations (particularly LEPS and Combined Authorities) that "will be long-term, based on clear evidence, and aligned to the national Industrial Strategy" (HM Government 2017: 220). These Local Industrial Strategies will be used as a basis to award funding to corresponding programmes and projects. In addition, the Prime Minister organises a 'Council of Local Enterprise Partnership Chairs' to enable LEP leaders to inform national policy decisions upward.

In each local area, the responsible partnerships formalise detailed Strategic Economic Plans (SEPs), which together enable a vertical cascade of translations from the national industrial policy through the various scales of regional governance structure down to the local level. SEPs include policy priorities and concrete propositions for projects, programmes and activities that need to be aligned with the national strategy in order to be approved and found eligible for funding by the central government. In the case of Coventry and Warwickshire, three cascading subnational levels of strategy formulation are involved (Table 5.2):

- *Midlands Engine*. This initiative has elaborated a Midlands Engine Strategy that is tightly aligned with the national Industrial Strategy and puts emphasis on large investments in connectivity, infrastructure and attraction of international investments and trade (Midlands Engine 2017).
- *West Midlands Combined Authority*. On a lower scale, the WMCA set up a SEP in 2017 that focuses on eight priority activities and aims to facilitate investments in housing, digital and mobility infrastructures, skills and employment as well key industries such as advanced manufacturing and engineering, digital and creative, and medical and life sciences (WMCA 2017). Due to the additional responsibilities assumed by the Combined Authority, it has also attracted a regional GBP 250 million share in the national GBP 1.7 billion Transforming Cities Fund to improve connectivity and reduce congestion.
- *Coventry and Warwickshire LEP*. At the local level, Coventry and Warwickshire LEP established a SEP in 2016. This is a revision of a first version established in 2014 and defines five pillars of a Local Industrial Strategy. Two pillars focus on the key economic sectors of advanced manufacturing and engineering, and on culture and tourism, whereas three pillars support necessary improvements in skills, innovation and productivity of the long tail of low productivity SMEs in the region. To address the perceived deficits in productivity, skills, innovation, and agglomeration economies, Coventry and Warwickshire LEP has used the SEP to find government approval and funding for targeted strategic programmes. These include investments in physical, mobility and digital infrastructure to increase the connectivity between people,

workplaces and enterprises to increase agglomeration benefits. Interventions also include the development of employment land in Coventry and Nuneaton (e.g. the Urban Core Strategic Programme that is detailed in the SEP). In addition, the strategic programme of the Growth Hub implies the provision of business services and consultancy to SMEs and entrepreneurs. Other strategic programmes focus on the improvement of skills in key sectors; investing in capital infrastructure to promote innovation in technologies of the future, such as low carbon economy, intelligent mobility and digital technologies; and key industries such as advanced manufacturing, digital industries, and culture and tourism (CWLEP 2016).

Table 5.2. Industrial Strategy: national, regional and local strategic economic plans

Spatial scale	Strategy	Policies and funding schemes regarding 'place' (selected)
HM Government (2017): National Industrial Strategy White Paper, NUTS 0	Five foundations of productivity: Ideas: the world's most innovative economy People: good jobs and greater earning power for all Infrastructure: a major upgrade to the UK's infrastructure Business Environment: the best place to start and grow a business Places: prosperous communities	Sector Deals, i.e. government-industry partnerships, in aerospace, life sciences, construction, artificial intelligence, automotive, (more under negotiation) City Deals, i.e. agreement between the government and English cities, giving cities greater authority for decisions in their area to create economic growth and decide how to spend public money Devolution Deals and Mayoral Combined Authorities Fund (GBP 12 million) Growth Deals for Local Enterprise Partnerships Regional Growth Fund (RGF) to lever private sector investment to create economic growth and employment
Midlands Engine (CLG 2017) NUTS 1	Five priorities Connect the Midlands Invest in strategic infrastructure Grow international trade Increase innovation and enterprise Shape great places	GBP 4 million operating budget for the Midlands Engine Partnership Subvention fund to attract events and support international trade Support the Coventry UK City of Culture bid
WMCA (2017), NUTS 2	Eight priority actions: New manufacturing economy Creative and digital Environmental technologies Medical and life sciences HS2 (high speed rail) growth Skills for growth and employment Housing Exploiting the economic geography	1st Devolution Deal (2016), GBP 1 billion for WMCA 2nd Devolution Deal (2017): additional funding from the one-off Mayoral Capacity Fund Transforming Cities Fund (WMCA: GBP 250 million) Delivery Team to drive an ambitious house-building program, and investment in high-tech economic sectors
CWLEP (2016), NUTS 3	Five strategic pillars: Unlocking growth potential Advanced Manufacturing and Engineering Growing the SMEs Growing the talent Culture and tourism	Aggregate awards of GBP 454.4 million, including GBP 122.3 million by the UK Government in three Growth Deals (2012-2017) to support 16 projects within the five pillars Establishment of a Growth Hub and a strong business support system (2014)

Source: Author's elaboration

Challenges for local economic development regulation arrangements

The regulatory arrangements for local economic development in Coventry and Warwickshire have seen a number of significant changes in the last decade. They involve the rescaling of regional governance, the introduction of additional layers at local and regional levels, the formulation of a national Industrial Strategy, and a cascade of SEPs through which the government assesses the coherence of Local Industrial

Strategies with the national strategy. In the case of Coventry and Warwickshire, there are three relevant SEPs, the Midlands Engine strategy, the WMCA strategy and the LEP strategy. Although the three subnational strategies are well aligned, both together and with the national strategy, the new governance structures pose three main challenges for using local policy to address local entrepreneurship ecosystem bottlenecks and promote emerging industries, as discussed below.

Complexity of governance structures

First, the rescaling of devolution has required the creation of new types of organisations on new spatial scales with multilateral partnerships between public, private and civic sectors. The lack of pre-established structures on which to build, and the multi-level architecture of four nested spatial scales make it rather complex for stakeholders, especially for businesses, to decide where and with whom to commit. This is also complicated by the heterogeneous legal and organisational forms, different roles and different strategies pursued by different LEPs (Pike et al. 2015). Although SEPs are an important tool for achieving coherence in strategies across scales, and so far appear to be working well, they have been set up only very recently.

In addition, elements of the geographies of local policy organisations are not fully aligned. Coventry and Warwickshire LEP combines a major urban area that is part of the WMCA area (Coventry) and a more rural area (Warwickshire) that is a non-constituent part of the WMCA area. While the strategies and policies of the LEP and the WMCA have so far been consistent, there may be gains of coherence to be had by reviewing again these geographies. For example, a realignment of local organisational boundaries or additional methods of co-ordination could help ensure that the policies of the LEP and the WMCA remain aligned and mutually reinforcing going forward.

Lack of continuity in governance structures

Second, the historical legacy of repeated reforms in regional governance structures generates a sense of uncertainty with many local actors (Jones 2010). Business understands that the role of the local and regional level in economic development ultimately depends on the central government. Hence, there is a fear that strong and enduring commitment to LEPs might not pay off, if regional governance continues to be reformed. Moreover, the lack of continuity potentially encourages tactical and short-sighted investments while deterring more strategic, long-sighted and probably more risk-averse investments.

A short-term policy practice runs the risk of prioritising ever-new ideas over the continuous evolution of a longer-term and ambitious objective. It spurs a search for immediate results and incentivises a proliferation of disjointed patchwork interventions rather than ensuring coherence and complementarity between individual initiatives. Short-termism is also likely to prioritise the exploitation of existing assets and skills over the exploration of new knowledge, which is important for stimulating positive local industrial transitions.

It is important therefore to ensure continuity and increase the credibility of the current system of regional economic policy. In this regard, the national Industrial Strategy promises to be an important step in building coherence and continuity in strategies for entrepreneurship and industrial development at different spatial scales.

Limited dedicated resources at local level

Third, although the central government has devolved responsibilities to regional and local levels, LEPs enjoy only limited autonomy in terms of resources. Financial resources and control over the use of these resources remain largely centralised. Combined Authorities and LEPs can only access most central resources upon approval of competitive bids for short periods of a few years, which tends to facilitate fixed-term rather than long-term activities. Furthermore, business leaders are less willing to engage locally if important decisions affecting the quality of the business environment are only made centrally (Porter and Ketels 2003). The tension between the devolution of responsibility and the centralisation of power and resources also becomes visible in the reform of skills policies. Although the government has moved from a centrally-driven policy system to one of greater local business involvement in areas such as skills and innovation, national regulations and funding policies are still a constraint to local policy flexibility and effectiveness. For example, a recent OECD assessment in the area of skills policies found that "the ability to build local strategies is constrained by a lack of clear strategic lead on employment and skills locally, and a lack of autonomy to influence policy at this level" (OECD 2015: 11). The temporary character of funding projects and a lack of truly devolved resources and autonomy leave local economic policy more operational than strategic.

Key organisations of economic development

A place-based strategy of economic development requires a local fabric of organisations, inter-organisational cooperation and collaborative governance. In Coventry and Warwickshire, key roles are played by the LEP and the two Universities, as discussed below.

The LEP and the Growth Hub: linking organisations

Although established only in 2011, Coventry and Warwickshire LEP has managed to adopt a key role as a 'linking organisation' (Heinze et al. 2016) in its region reflecting the benefits of 'public entrepreneurship' (Rossiter and Smith 2017). It has been responsible for preparing the SEP for the LEP area. The SEP identifies a number of key challenges in terms of a need to increase growth in knowledge-intensive sectors and in SMEs, invest in skills in the local population, increase agglomeration effects within the local economy, and extract increased value added from economic activities (CWLEP 2016).

In order to deliver on the SEP, the LEP has created eight business groups and they have been able to raise a total of GBP 454.4 million in funding, of which the UK government contributed GBP 122.3 million through three Growth Deals (Table 5.3. Funding awarded to Coventry and Warwickshire LEP since inception, 2011-2017

The funding is used for various projects and activities, including physical and digital infrastructure investments, training centres and apprenticeship academies, seed capital for entrepreneurs, etc. Moreover, in 2014, the LEP established a Growth Hub to fulfil a central business support coordination function for local SMEs.

Table 5.3. Funding awarded to Coventry and Warwickshire LEP since inception, 2011-2017

Funds	Awarded projects	Grant sums (GBP million)			
		UK Gov.	European Union	Other Public	Private Sector
Growth Deal Rounds 1 and 2	New transport infrastructure New R&D and business support facilities in AME Provision of business advice and support services Investment in Further Education Colleges	89	0	37.1	28.6
EU Funds	ERDF: R&D Development, ICT infrastructure, business start-ups, addressing barriers to growth faced by SMEs, low carbon economy ESF: access to employment and training, social inclusion and poverty, education, skills, lifelong learning EAFRD: rural micro and SMEs, diversification of farming businesses, tourism and broadband infrastructure	0	110	100	15
Regional Growth Fund	Supports projects and programs raising private sector investment to create economic growth and employment In CWLEP: provision of infrastructure for private investors to commit to key employment sites in C&W	30.9	0	0	37.6
Rural Growth Fund	Funding used to help businesses to grow and to support start-ups (with a focus on women-led enterprises)	2.4	0	0.9	2.9
	Total amount of funding: £454.4m	122.3	110	138	84.1

Source: Author's elaboration from CWLEP (2018)

Without doubt, the LEP has evolved as the key linking organisation for most stakeholders. Local authorities admit that some of the key challenges, such as the lack of employment land, need to be solved in cooperation across authorities and businesses and the LEP is an important tool for this. Furthermore, the LEP has helped colleges and other providers of vocational training and apprenticeships get together with employers in order to improve skill formation and the absorption of skills in the labour market. Finally, business voices appreciate that Coventry and Warwickshire LEP has a good business understanding.

The LEP serves as a showcase of a linking organisation that has taken a truly central position in the region and offers inclusive participation by many stakeholders and organisations. CWLEP and the Growth Hub are the kind of 'organisational sites' (Storper 2018) that are so important to bridge the gaps between industries, societal sectors and local authorities to create fertile cross-network connections.

Universities as institutional entrepreneurs

The two universities in Coventry and Warwickshire are both successful institutional entrepreneurs. While the University of Warwick is an excellent public research university, Coventry University has its roots originally in a school of design and, then, a polytechnic before it became an award winning and fast growing public research university. Both universities belong to the top universities in Britain, while locally being complementary in their strengths and specialisations.

Through their affiliate organisations, the universities provide a lively "triple helix" case (Etzkowitz 2008, 2018) of multifaceted and productive collaboration with private businesses and public authorities in education, R&D, and entrepreneurship.

Examples of the tight university-industry collaboration are abundant. The Warwick Manufacturing Group (WMG, established in 1980) is an academic department at the

University of Warwick. It is part of a national Catapult Centre providing research, education and knowledge transfer in engineering, manufacturing and technology. It operates a Lifelong Learning Academy in partnership with JLR. In addition, in late 2017, a partnership between WMG, the LEP and Coventry City Council was awarded GBP 80 million to establish the new UK Battery Industrialisation Centre (UKBIC). Similarly, Coventry University has a key collaboration with Unipart Manufacturing Group to bring together education, industry and R&D in a manufacturing environment in the Institute for Advanced Manufacturing, "the UK's first Faculty on the Factory Floor" (AME 2018).

Both universities offer services to innovative start-ups and SMEs through science and technology parks. The University of Warwick Science Park was one of the first university based science parks in the United Kingdom when it was opened in 1984. It was established as a joint venture between the University of Warwick, Coventry City Council, Warwickshire County Council and Barclays, before the University of Warwick became sole shareholder in 2012. Similarly, Coventry University runs the Coventry University Technology Park, among other services to support SMEs.

Challenges for local organisations

Although the LEP has established itself as key linking organisation in the organisational landscape of public, business and civic partners, the multitude of actors and stakeholders is vastly disperse. Such organisational fragmentation makes it difficult to rewire networks across technologies and industries and between large and small enterprises. Four key challenges are discussed below.

LEP funding

Although the LEP plays a key role as a local linking organisation, limited funding and human resources are severe bottlenecks, as is the fixed-term duration of the majority of the funding obtained for projects. Most of the work of the LEP is undertaken by LEP Board members and business group leaders on an honorary basis.

University linkages with SMEs

Although the Universities are already represented on the LEP Board and have strong connections with local large firms, there is further potential for collaboration between the Universities and existing SMEs. Smaller firms are often less visible as employers to students and less experienced in joint R&D with academia. By aiding the creation of industry-SME connections, the LEP and the Growth Hub could leverage access to talent and human resources as well as to collaborative R&D for a vast base of small enterprises in the region.

Limited local engagement of national business associations

There are several national business associations that could form a focus for co-operation and networking among members and for determining and supporting local economic development actions as partners to Coventry and Warwickshire LEP. To take a few examples: the Confederation of British Industry (CBI) is an umbrella of 140 trade associations and speaks for 1 500 direct and 188 500 indirect members. Together, CBI members employ 7 million people, about one third of the UK private sector-employed workforce. With its focus on SMEs, the Federation of Small Businesses (FSB) represents SMEs and the self-employed. The FSB has 184 branches around the UK, each with its own committee. The Engineering Employers Federation (EEF) has 2 000

direct members and speaks for 5 000 businesses in British manufacturing. However, the main focus of these organisations is directed to London in order to lobby for their interests rather than on local economic development activities.

Fragmentation of stakeholders

The regional organisation of business interests is loose and dispersed. Although there are some networks that aim to connect certain businesses locally, e.g. the Coventry and Warwickshire First forum for knowledge intensive business services, there is no single organisation through which all or the vast majority of private sector companies could be reached. The most important local business organisation is the Coventry and Warwickshire Chamber of Commerce. It is the 6th largest Chamber in the UK, works with 6 500 businesses and delivers over 800 apprentices every year. However, since membership is voluntary, it has only partial coverage of local businesses. The same is true for the field of vocational training and apprenticeship. There are nearly 200 different organisations delivering apprenticeships in Coventry and Warwickshire, and no encompassing regional organisation to coordinate interests and changes in skills policies among all the providers.

In German and Austrian Chambers of Commerce, for instance, membership and fees are mandatory for local businesses. Apart from other important privileges, e.g. a monopoly on certification of apprentices, the Chambers of Commerce serve as powerful gatekeepers to reach out to all regional industry and at the same time represent all industry inclusively (Maennig et al. 2015; Vossiek 2017). The German region Heilbronn-Franconia may serve as an illustration of how a powerful linking organisation contributes to successful local economic policy and the creation of inclusive and productive leadership networks and cross-network connections (Box 5.1).

Box 5.1. Regional collective governance arrangements in Heilbronn-Franconia, Germany

Description of the approach

Heilbronn-Franconia in north eastern Baden-Württemberg is located in between the metropolitan regions of Stuttgart, Nuremberg and Frankfurt. It is one of the fastest growing sub-regions in Germany, with high levels of income per capita, value-added, productivity, and technological innovation. The sub-region has been very successful in diversifying from traditional engineering specialisations to new specialisations in medical, environmental and information technologies and to industry 4.0. It also has one of the highest concentrations of 'hidden champions' in Germany; less well known, leading technology-driven companies in premium segments of international market niches.

Business and local government actors have developed a dense network of regional collective governance arrangements. There are some 35 business development related formal or informal networks running across the sub-region involving co-operation across different local government and business actors. These arrangements are supporting local entrepreneurship, innovation and industrial diversification by mobilising diverse stakeholders and collaborating across the borders of districts and counties.

One of the key networks is a co-operation among the five local authorities in the sub-region (the city of Heilbronn and the counties of Heilbronn, Schwäbisch-Hall, Hohenlohe, and Main-Tauber), which have pooled part of their economic development resources in an umbrella organisation *Wirtschaftsregion Heilbronn-Franken GmbH.* They are using this organisation as a tool for joint marketing and investment promotion. Leading local businesses and family firms in the region, together with local government, have also created a regional network of business angels, *Venture Forum Neckar,* and an independent venture capital fund of EUR 200 million, the *Zukunftsfonds Heilbronn*. Several formal cluster initiatives have also been established in the sub-region, including for packaging and medical technologies.

The local Chamber of Industry and Commerce (CoIC) plays a critical role as a linking organisation across businesses, public authorities, universities, and civic organisations and as an initiator of common projects. The CoIC benefits in this effort from its compulsory membership, which enables it to reach out to the whole community of private businesses, and an annual budget of nearly EUR 20 million (including from membership fees), to offer services.

The multilateral and cross-sectoral collaboration, regional commitment, and an explicitly entrepreneurial orientation among businesses, local governments and other stakeholders that have been favoured by the networks stimulated in part by the CoCI have shaped an institutional context that is highly conducive to entrepreneurship, innovation and diversification.

Success factors and challenges

The collective regional governance arrangements have been supported and complemented by informal institutions of trustful mutual obligation between employers and employees as well as socially imprinted conventions of 'doing' (e.g. problem-solving) and 'tinkering' (e.g. experimenting for innovation), especially within family firms and SMEs. The sub-region benefits from marked civic engagement, illustrated by the so-called "*Heilbronn Declaration*" for corporate social responsibility, and powerful networks of financial philanthropy. These informal institutions have been critical for supporting entrepreneurship, innovation and diversification across industries, occupations and technologies.

However, Heilbronn-Franconia also faces a number of challenges for entrepreneurship and innovation. With almost full employment, the region lacks skilled workers and professionals to sustain further expansion, diversification and growth. In addition, there is a substantial deficit in knowledge-intensive business services and highly-qualified professionals. The rural location and the lack of a university have limited the ability to attract talent to the region.

The region has tackled the bottleneck of attraction of talent, by building a new university focal point in the area through an endowment in 2018 to the Technical University of Munich School of Management by the Heilbronn-based charitable foundation *Dieter Schwarz Stiftung* to establish an affiliate in Heilbronn and promote research and teaching in the areas of digital technologies, entrepreneurship, and family businesses. The university affiliate has joined with the local technical college and business school in a single training campus. This response was enabled by the networks and philanthropic approach that has been developed in the area. In addition, the city of Heilbronn successfully bid for the *Bundesgartenschau* (BUGA) in 2019, a biennial Federal horticulture show in Germany, to facilitate major infrastructure projects, such

as the development of an entire city quarter, to become more attractive to skilled professionals as a family-friendly place to live and work.

Relevance for Coventry and Warwickshire

Heilbronn-Franconia offers potential lessons for organising collaborative business, government, and university networks in a context of lack of a single local authority jurisdiction and an economic concentration on the automotive sector, organised around a major firm (Audi). It has developed collaborative networks that have supported a range of initiatives for entrepreneurship, innovation and industrial diversification, including in education, training, entrepreneurship finance, and investment promotion. Many of the informal institutions behind the success cannot simply be imitated in Coventry and Warwickshire. Furthermore, Coventry and Warwickshire does not have a business organisation equivalent to the CoIC in terms of influence and financial and human resources that can be the key linking organisation. However, there are lessons for Coventry and Warwickshire in how local authorities have joined resources in viable regional organisations and how collaborations have been developed with businesses, and how businesses have engaged financially in many important developments for the region, including the establishment of the university affiliate and the equity funding platforms. In the case of Coventry and Warwickshire, the LEP can act as the linking organisation seeking to develop similar kinds of actions.

Sources:
Glückler et al. (2019); Suarsana and Glückler (2016).

It is therefore recommended that stronger regional business networks are developed for stakeholders to enable effective exchange, cooperation and mitigation between the different interests in skills and innovation projects. Although the LEP might require further resources and/or powers to drive such coordination by itself, it certainly already serves as role model of how inclusive collaboration and collective alignment of interests can be achieved.

Informal institutions of economic development

Informal institutions include interactions in social networks that influence entrepreneurship and emerging industries. Three features of institutional patterns can be observed in Coventry and Warwickshire: an embryonic relational infrastructure, only moderate social capital, and an interaction pattern of short-termism in policy and business behaviour.

Embryonic relational infrastructure

Despite Coventry and Warwickshire LEP acting as a linking organisation, future strategies of industrial diversification will require more productive interlocking between so far loosely or even disconnected industries and technologies. First, there is a certain tension between the large and world-class automotive cluster on the one hand, and the much smaller yet vibrant digital and tourism/culture industries on the other. The ‘Leamington Spa’ gaming cluster shows signs of maturing toward a local ecosystem, in which businesses, colleges, the LEP and the City Council productively collaborate to raise awareness for digital technologies in schools, to improve digital skills in colleges and to provide for highly-qualified human resources, employment land and office space for the rapidly expanding companies in the cluster. However, productive cross-

connections between the automotive and the digital cluster are still underdeveloped, although there are sparks of cross-network fertilisation and productive collaboration, such Serious Games International, a digital firm that spills over to automotive, medical and health and other industries.

A further disconnect is the divide between first-class university-industry R&D on the one hand, and a separate majority of SMEs and family businesses with little or no R&D activity or collaboration. Addressing the challenge of SME innovation requires support for networks for innovation among SMEs. The LEP and the Growth Hub should use their visibility and existing relations with SMEs to open access routes to university partners. Initiatives such as networking events and workshops for talent acquisition and fields of collaborative knowledge exploration would help bridge this gap in the relational infrastructure.

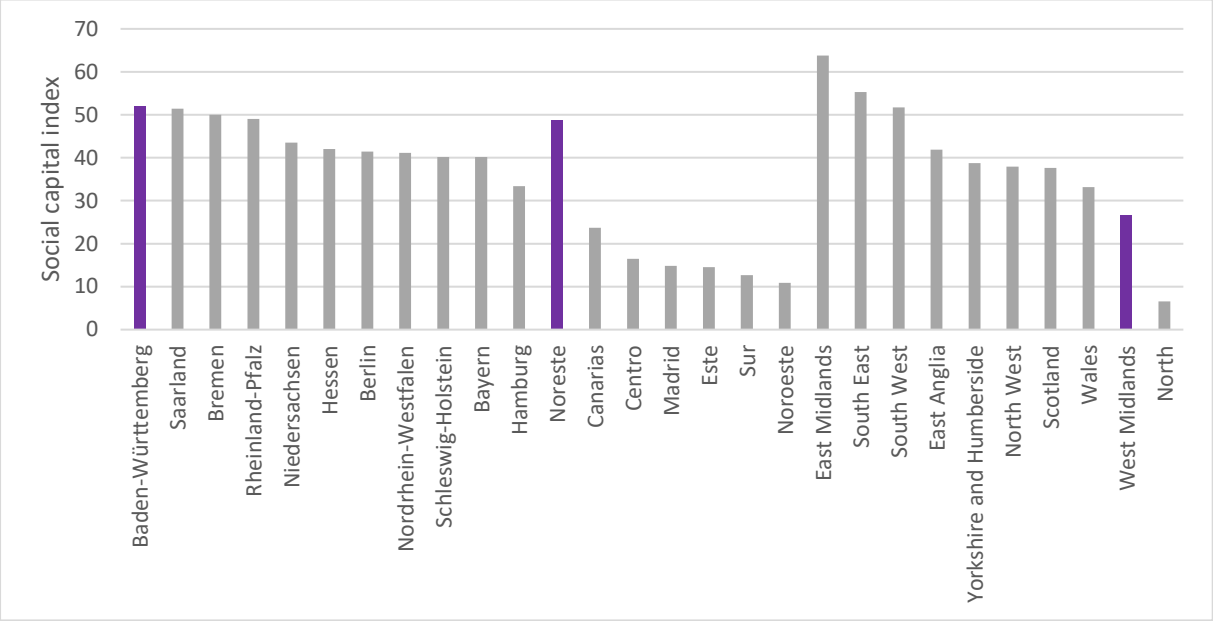
Further, in the field of skills and vocational training, new networks are needed to bridge the divide between supply and demand, for instance through a governance of skill ecosystems (Buchanan et al. 2017).

Finally, leadership networks seem to have become more inclusive and coordinated through the work of Coventry and Warwickshire LEP and the WMCA. To further the opportunities of diversification, business leaders from emergent industries such as digital and creative, medical technologies and health etc. should be included in forums and discussion about how to drive the future of the local industrial strategy.

Moderate level of social capital and civic engagement

Comparative empirical research on the level of social capital across European regions suggests that generally, social capital is positively associated with the level and rate of regional economic growth (Beugelsdijk and van Schaik 2005). Regions leading the ranks in their respective countries in terms of GDP per capita, such as Baden-Württemberg in Germany or the Northeastern region in Spain including the Basque Country, were found to score high on social capital. In the Basque Country, for example, a heritage of associationalism and collective organisation in cooperatives has made the region more prone than other regions to the successful introduction of cluster policies, and to smart specialisation strategies (OECD 2007; Aranguren et al. 2016). Within the UK, however, the West Midlands has the second lowest score on the social capital index among all British regions (Figure 5.2), mainly because of the low civic engagement and lack of associationalism, i.e. the number of civic associations as well as the level of membership and active engagement in these associations (Beugelsdijk and van Schaik 2005). Various local stakeholders also identify low levels of trust between central and local governments, and between public and private actors at the local level.

Figure 5.2. Social capital in the regions of Germany, Spain and the UK



Source: Beugelsdijk and van Schaik (2005: 1059)

A lack of social capital and limited civic engagement is a bottleneck for working together across local stakeholders and for bridging divides between existing and emergent sectors, skills and technologies. In the face of this legacy, the linking activities of the LEP and the institutional entrepreneurship of the universities provide promising examples of how different stakeholders can be animated to join collective planning, decision-making and collaboration.

Conclusions and policy recommendations

Recommendations for national government stakeholders

Ensure continuity and stability in new governance structures

After a significant shift in regional governance structures, with the ending of the Regional Development Agencies and creation of the LEPs (Peck et al. 2013), it will be important to carefully evolve the new localism agenda in incremental ways to improve its workings and to better support the creation and implementation of Local Industrial Strategies. In order to maintain and further incentivise the commitment of local private, public and civic sectors to take leadership for and commit to local economic development, it will be indispensable to refrain from any further radical reforms in the mid-term. Government, therefore, should ensure continuity and stability in its commitment to devolve responsibilities to the local levels.

Devolve more resources to regional and local organisations

A key problem of centralised governance of economic development policy is that programmes and projects, howsoever conceived, are often insufficiently embedded in local economic and institutional contexts to unleash the full potential of regional economies. The UK government has promoted a number of local initiatives to help design and deliver policies that meet local problems but they often lack the financial

autonomy to fully meet their goals (Hildreth and Bailey 2014; MacKinnon 2017). The current funding schemes, e.g. Growth Deals and Devolution Deals, are all well-aligned with the economic strategies at the four relevant levels of governance affecting the Coventry and Warwickshire economy – Whitehall, the Midlands Engine, the WMCA and Coventry and Warwickshire LEP. However, it is important that initiatives do not become 'one-hits' in a policy environment of competitive bidding for relatively short funding periods. Instead, the successful translation of a national industrial strategy into local industrial development requires policy levers that can be used more flexibly at the local level. Therefore, it is recommended to consider the devolution of less conditional and permanent financial resources to allow for long-sighted interventions in the pursuit of enduring Local Industrial Strategies. Such considerations may also address the regulation of local business rates, for example in granting more local decision-making authority in assessing multipliers[15]. A unified business tax limits the incentives of local authorities to engage with private business (Jones 2010).

Recommendations for Coventry and Warwickshire stakeholders

The institutional and policy governance environment in which the local stakeholders operate in Coventry and Warwickshire can be characterised by vertically-aligned local industrial strategies, recently established institutions, moderate social capital, and short-termism. In this context, the LEPs should seek to consolidate the local organisational and governance structures, and help surmount institutional bottlenecks of low social capital and short-termism by nudging inter-sectoral exchange and collaboration. This will be favoured by aligning stakeholders for long-sighted commitments, and by supporting the formation of inclusive networks. Three overall recommendations for this agenda are offered:

Complement 'nodal policies' by devising 'linking policies' in support of industry evolution

Supporting the upgrading, diversification and emergence of local industry specialisations through entrepreneurship, knowledge exchange and skills development requires actions that cut across existing industry boundaries. A general recommendation is therefore to move from an approach of 'nodal policy', i.e. support of individual sectors and themes, toward a dynamic 'linking policy' that creates linkages, spillovers and synergies between strong industries and technologies on the one hand, and emerging industries on the other.

For example, the emergent strength of the heterogeneous digital industries can develop fertile connections with the established automotive cluster (e.g. autonomous driving, connected vehicles), and the culture and tourism cluster (digital solutions) as well as in

[15] Council tax and business rates together make up local authorities' largest source of income. Council tax is a tax on domestic property which was introduced in 1993. It is set by each individual authority and authorities are able to retain all of the funding raised from council tax in their area to support their budget. In 2014-15 the tax raised enough money to cover 24.3% of council expenditure (CLG 2015). A second source of local income are business rates, which are charged on most non-domestic (commercial) properties. Business rates are set by central government, which sets the multiplier, and which is then applied to the ratable value, an estimate of the open market rental value a property could achieve on a specified date. Currently, local government, collectively retains half of the income from business rates, the other half is paid by councils to central government, which uses the income to fund grants to local authorities (Local Government Association 2018).

other local strengths such as health (e.g. medical technologies, serious gaming, cybersecurity) and design-intensive industries (e.g. furniture and other consumer products).

Such cross-sector linkages offer an array of opportunities for industrial diversification, which can be supported by inclusive and bridging local leadership networks within and across public, private and civic sectors. These networks should not be limited to the horizontal linkages within the region, but extend vertically from the level of the LEP, to the WMCA, the Midlands Engine and the departments and agencies of central government.

The 'Council of Local Enterprise Partnership Chairs' organised by the Prime Minister is a first step toward more fluid exchange and coordination. The LEP should also encourage the creation of platforms, events and network activities and actively involve business leaders in higher-level governance processes at WMCA and Midlands Engine levels to raise awareness of technological and business opportunities and to expand inclusive networks beyond the scale of Coventry and Warwickshire.

Incentivise stakeholders to congregate in regional organisations

Coventry and Warwickshire LEP is a key linking organisation, yet its assets and resources are limited, which constrains its abilities to coordinate exchange, negotiation, decision-making and collaboration among all the many regional stakeholders on its own. In addition, local actors in different sectors or policy areas should be incentivised to organise into more visible regional bodies to effectively represent their interests, assets and readiness for collaborating on skills development, entrepreneurship and innovation projects.

For example, about 200 training organisations, academies and colleges offer vocational training and apprenticeships in Coventry and Warwickshire, yet there is no single organisation to reach out to all of them and to effectively facilitate their coordination and exchange with local authorities and businesses. Similarly, no single business association has sufficient membership coverage to speak for and reach out to all regional businesses.

Long-term coherence and effective coordination of policies and initiatives to promote skill formation, collaborative R&D, informal network across sectors and business functions etc., will benefit from more transparency and better representation of regional business interests.

Furthermore, local authorities already demonstrate how the demand for more employment land, office space and housing can be better satisfied by collaborating among each other, and considerations are under way for centralising spatial planning in a single geography.

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6. Productivity upgrading in the automotive cluster

Introduction

This chapter focuses on three particular challenges facing the automotive and related advanced manufacturing cluster in Coventry and Warwickshire, given the importance of the cluster as a key strategic pillar of the local economy. These are skills development, supply chain innovation and knowledge exchange. The chapter identifies the nature and causes of the challenges, where policy has been successful in addressing them, what more policy needs to do, and lessons for how local action can further strengthen a key UK sector. The context is a hierarchy of policy-making bodies from national government, the Midlands Engine, the WMCA and the Coventry and Warwickshire LEP that are providing support for the automotive sector. Alongside these are a number of private sector organisations that are also engaged in productivity upgrading activities for the cluster.

Skills development

Assessment of the situation in the supply and demand for skills

In spite of a wealth of expertise and activity, four areas of concern have been identified by various stakeholders at the regional and at the local level. These are the under-provision of technical skills, particularly apprentices; competition for high-level digital skills; changes in the demography of the skills base particularly an ageing profile of engineers; and a lack of clear labour market information identifying current and future skills demands (see also WMCA 2017a, 2017b and 2017c). While there is clear evidence of high levels of demand from the major employers, less obvious but also important are the weaknesses in the demand side for higher level skills from SMEs (Keep 2016, Green and Martinez-Solano 2011). While the expanding range of highly-skilled jobs in Coventry and Warwickshire means that increasing numbers of people from outside the region are recruited, increasing the supply of local STEM graduates does not directly lead to local employment when there is a lack of local demand.

Demand side – skill shortages

Skills shortages are not just a local problem. A significant factor in the relatively poor productivity performance of the UK overall is the low level of skills in the workforce. The UK ranks in the bottom four OECD countries for the literacy and numeracy skills of 16-24 year olds (OECD, 2018). The country also performs poorly on intermediate professional and technical skills and is forecast to fall to the bottom five OECD countries for intermediate skills by 2020[16]. However, there appear to be significant specific problems in the Coventry and Warwickshire area and in the West Midlands regions as a whole.

[16] HM Government, English Apprenticeships: Our 2020 Vision, 2015.

A report by the Centre for Progressive Capitalism in 2017 drawing on raw data from UKCES' 2015 Employer Skills Survey, which surveyed 5 117 employer establishments across the WMCA area reported that in 2015 technical roles suffered from skills shortages more than any other occupation group in 2015. Nearly half (43%) of all technical vacancies were classified as skills shortage vacancies. This figure is significantly higher than the average across the UK for technical roles (33%). The manufacturing sector accounted for the highest number of technical skills shortage vacancies. Overall this sector made up a greater proportion of employer demand in the WMCA area than the UK average in 2016. A consequence of these shortages is that they act as a constraint on local businesses ability to expand. Moreover, while JLR and other major employers themselves recruit heavily locally, they also increase local competition. A consequence of this is that there are fewer skilled people available in the local supply chain.

Shortages in the area of digital skills, affect the automotive cluster as a consequence of the development of autonomous vehicles. This increases competition for high-level digital skills. The LEP (CWLEP 2016b) points out that the number of digital job vacancies in the Warwick and Stratford-upon-Avon areas tripled in 2014/2015 and estimates that within Warwickshire, jobs requiring the study of Mathematical and Computer Sciences and Technologies are projected to grow by 5% during 2015-22 (equating to an increase of nearly 1 000 jobs).

Changing demographies – an ageing workforce

Amison and Bailey (2014) found that retention of skills within the West Midlands workforce in spite of some of the larger firms e.g. Peugeot, is one of the primary factors for the re-emergence of the automotive cluster as a 'phoenix industry' in the region. However, a potential bottleneck is that as the workforce ages, those skills are gradually lost. Firms find that the younger generation of workers do not have the same practical skills as their older colleagues. New knowledge is also needed to develop and exploit new technologies. Therefore firms in the phoenix industry operate in an environment where skills relating to old and emerging technologies are combined – an ability which has contributed to the success of a number of local firms.

Implementing new national initiatives locally

At the national level, the Apprenticeship Levy is a scheme which is targeted at employers and designed to address shortages in technical skills. It came into effect on April 6 2017. The programme requires that companies with a pay bill of over GBP 3 million set aside funds for on-the-job training. It is intended to raise close to GBP 3 billion a year to fund training.

Under the system, such companies pay a levy to HMRC through the PAYE process amounting to 0.5% of their wage bill which goes into a fund managed by the apprenticeship service. Levy-paying employers are invited to create an account on the apprenticeship service to make use of the fund for apprenticeship training and assessment. To spend the funds in the employer's account it needs to choose a training provider, agree a price and payment schedule, and pay through the account. The money can be spent by the firm on apprenticeship training over the next two years, after which the resources in the account expire. It is also possible to join a group of companies paying the levy together and pool funds. Large firms can also transfer some funds to other employers, such as SMEs in the supply chains, for expenditure on apprenticeships.

Rather than increasing the number of apprenticeships, in practice the number of apprenticeships has reduced. The British Chambers of Commerce Workforce Survey of

2018 reports official figures showing a 24 per cent year-on-year drop in people starting apprenticeships in the six months to January 2018, compared with the same period a year earlier.

Criticisms of the Apprenticeship Levy are that it is inflexible, has not yet achieved its purpose and lacks local control. The Chambers of Commerce report and another by the EEF (2018) (the manufacturers organisation which runs its own apprenticeship scheme), have identified a number of problems. They include: lack of agreement on standards for specific training courses; lack of flexibility in the scheme; a tendency for companies to spend their funding pot on MBA-style masters degree programmes for their senior executives rather than the school leaver apprenticeships for which it was intended; difficulties for the majority of firms to find quality training providers; and complex funding rule requirements. The EEF (2018) find that 95% of manufacturers want the levy rejigged, and revealed that more than half of them think the system was not ready when it was launched.

The WMCA Regional Skills Plan of 2018 recognised that not enough employers were offering apprenticeship opportunities, particularly in the case of SMEs. It argues that the benefits of the apprenticeship reforms have not yet been realised. The regional apprenticeship market was seen to be led by provider behaviour rather than informed by confident employer demand. It finds that the levy is not being spent by the employers that are paying it and that many employers feel that the passporting of funds (to other employers, for example in their supply chains) was restrictive. It argues that WMCA should work with the government to support the use of levy funds within the region, including through more flexible passporting of unspent levy, piloting new approaches to market stimulation, working with higher education providers to increase the range and volume of higher level apprenticeships, and increasing awareness of apprenticeships to employers, young people and employees (WMCA, 2018).

The Employer Ownership Pilot introduced in 2011 is a national competitive fund of GBP 340 million available over four years. It is open to employers to invest in their current and future workforce. Employers can develop proposals to create jobs, raise skills, and drive enterprise and economic growth in England. They are able to look for co-investment from Government to meet the costs. Round 2 (2013/14) of the pilot invites more ambitious bids from employers willing to work together to deliver skills solutions in their industry and locality, aligned to a broader industrial strategy.

Round 2 of the Employer Ownership Pilots is being evaluated by the Institute for Employment Studies (Warwick University) in partnership with Ipsos-MORI. This is a long-term evaluation (2014-2018). There is no evidence that in the Coventry and Warwickshire region anything has been delivered at the local level through the LEP. However, LEP input could help develop and prioritise proposals for Employer Ownership Pilots.

Regional analysis of skills issues

The then WMCA Productivity and Skills Commission (WMCAP&SC) set up in April 2017 was led by Dr Andy Palmer, CEO, Aston Martin Lagonda. It was launched to develop a better understanding of the specifics and extent of the productivity and skills challenge in the West Midlands. Its members included business leaders from the region's three LEPs as well as the universities. Its findings formed the basis for a vision for productivity and skills in the West Midlands underpinning the Regional Skills Plan and Local Industrial Strategy.

In its summary of calls for evidence, the WMCAP&SC (2017) reported a number of findings of particular relevance to the automotive cluster. These include: a mismatch

between employer demand for skills and the skills available within the labour markets; a need to improve technical education/apprenticeships; a need to maximise the role of universities in skills development locally; a need for training needs to be more demand driven, targeted on real issues and specific to business environments; and a need for flexibility in skills provision with unit based and "bite-sized" sector-specific modules compatible to being delivered in the work place. It was also found that skills funding is not flowing at Level 3-7.

The Commission concluded that there are deficiencies within the way that the skills system works, and the complex and confusing array of initiatives available. This has resulted in disconnects between various aspects of the system. There are a great many suppliers of skills in universities, colleges, UTCs and private providers. There is a danger that SMEs' skill needs, management as well as technical, will not always be a priority.

The policy response identified by the Commission is that WMCA has a role in gathering the intelligence, and co-ordinating joined-up, long-term skills development policy which is locally designed. Various stakeholders suggest that avenues for strengthening the skills in the local automotive cluster could include boosting mid-career access to new skills and refresher courses, developing more technically-focussed apprenticeships, or creation of a shared apprenticeship scheme for the cluster, whereby apprentices could be employed by a host employer, whilst carrying out work-placed training in a number of SMEs in the cluster.

To further develop the region's digital economy, the establishment of the WMCA Digital Board was approved in September 2017. The remit of this Board is to develop a region-wide digital strategy. This is to overcome a lack of integration of the efforts of various relevant disparate groups across the West Midlands. The development of the digital strategy and formation of the Digital Board builds on Mayor's digital manifesto and the findings of the Science and Innovation Audit, as well as work undertaken by groups within the region. Furthermore, in December 2018, a new West Midlands Digital Skills Partnership was launched bringing together businesses – including Amazon and Cisco – universities, colleges and training providers to help link local people to training opportunities in the region's digital industry and helping define the region's digital strategy, including a GBP 5 million package for digital training.

The success of the Coventry and Warwickshire LEP and the WMCA plans will depend on the active engagement of partners, some of whom are represented on the LEP Board or its sub groups but many of whom are not. Crucially it will require an increased level of partnership working between the many education and training providers across the area, in neighbouring authorities with collaboration between LEPs and the even larger number of employers to whose needs the skill system has to respond.

Building local level initiatives

Under the City Deal arrangements the government has agreed to delegate to LEPs greater authority over local investments relevant to growth if they can demonstrate high levels of consensus and collaboration.

In the public sector, colleges, universities and other providers share their development plans with the LEP illustrating how they take account of LEP priorities and the evidence base. Local Authorities need to share with the LEP their plans for promoting closer working between schools and the world of employment. In addition the LEP will engage with neighbouring LEPs to agree a joint approach to supporting business clusters that cross LEP boundaries.

Coventry and Warwickshire LEP will also use the City Deal to assume additional powers from government where its skills priorities cannot be met through existing programmes. From 2015/16 a sum of GBP 330 million nationally will be allocated to the Local Growth Fund to support capital investment, for which the development of capital skills facilities is one possible form of intervention that can be funded.

An effective Skills Strategy is a vital component of the LEP's ambitions for the Coventry and Warwickshire region. LEPs have been given a clear role in helping develop and prioritise proposals. Coventry and Warwickshire LEP's Skills Strategy forms an important complementary element of the LEP's proposals in line with its inclusion in Wave 2 of the City Deals initiative. It also provides an overarching basis for the LEP's Apprenticeship Strategy.

The strategy is led by the Jobs and Skills group, which is an advocacy rather than a statutory body. Its members are drawn from universities, schools and colleges. It identifies what future skills are needed. The plan seeks to provide a stable planning framework for skills by setting out agreed priorities for the period 2014-2019 enabling all partners to align their programmes towards shared goals.

An example of where it has been able to target SMEs is the City Deal Skills 4 Growth programme, which started off with European Social Fund (ESF) funding (Box 6.1). It became a City Deal pilot of the growth regional fund during its first two years of operation.

Box 6.1. Skills 4 Growth Programme – Support for SMEs

The Coventry and Warwickshire Skills 4 Growth project is a European Social Fund project managed by Coventry City Council, working in partnership with Warwickshire County Council and the Coventry and Warwickshire LEP and Growth Hub alongside other major stakeholders. It delivers accredited training ranging from leadership and management through to technical and soft skills.

The focus is on the skills needs and gaps of a company, with customised packages developed to address business requirements and support business growth. 50% of the costs of agreed training could be funded. Eligibility criteria apply.

To receive support companies must employ up to 250 people, be operating in a Coventry and Warwickshire postcode and be registered as a company working in a Manufacturing/Engineering sector or Service Sector Industry.

http://www.coventry.gov.uk/skills4growth

Overall, at the LEP level, there are encouraging signs of increasing working across the 3-LEP area (Coventry and Warwickshire, Birmingham and Solihull and the Black Country) as well as with WMCA. However, their ability to deliver skills programmes is constrained by national regulations and funding policies, which are still too rigid to be made locally effective.

Existing local policy initiatives for skills and training

The skills strategy for Coventry and Warwickshire LEP sits within the context of UK national government policies designed to expand private sector training and allow a devolution of the adult education budget from 2018/19. Some skills initiatives, for example apprenticeships and the Employer Ownership of Skills pilot, will remain national

responsibilities. Agencies at different policy levels have an impact on priorities set at the local level and have a differing impact on availability of resources allocated for tackling weaknesses in productivity in the cluster.

Where the Coventry and Warwickshire excels is in the number and variety of public and private sector organisations that deliver training for technical and high level Science, Technology, Engineering and Maths (STEM) skills for the automotive cluster as a whole. These include the two universities, a University Technical College (UTC) based in the WMG and a number of private sector training bodies. There is a strong focus on attracting young people into the sector.

Warwick University

At Warwick University, the WMG supports education and training across the entire skills life cycle – from school age through to executive level education – in the automotive cluster through WMG Education.

Teaching programmes to support the automotive industry include the part-time Applied Engineering Programme, which allows students to study for an undergraduate degree in Engineering while in full-time employment. A portfolio of taught postgraduate courses tailored to the needs of JLR employees working in the fields of future vehicle technologies and virtual engineering has been developed through the Technical Accreditation Scheme of WMG and its partners (the Universities of Cranfield, Loughborough, Coventry, Bradford, Southampton and York). Its Professional and Executive Programmes at the postgraduate level include modules on a variety of technology, business and operations subjects. WMG delivers education programmes to over 1 000 professionals in the UK and abroad.

For younger engineers (14-19 year olds) the WMG Academy for Young Engineers is a UTC initiative in partnership with JLR. It delivers an innovative, high-quality education that combines technical, practical and academic learning which helps train engineers and managers throughout their careers. It is based on two campuses (Coventry and Solihull) catering for the Coventry, Warwickshire, Solihull and Birmingham areas. Students work alongside some larger employers in the region.

Box 6.2. The LEP Skills for Employment initiative

Grant funding from Skills for Employment through the C&WLEP Growth Hub has led to students from the WMG Academy for Young Engineers (Coventry) being invited to Aston Martin in Gaydon, Warwick. The two organisations have created an initiative called Enjoyneering.

The Coventry campus opened in September 2014 specialising in engineering and digital media. It is sponsored by leading employers and the University of Warwick. The most recent assessment by the Office for Standards in Education (Ofsted) in 2017 found the school to be performing well and that ‘Leaders have created a culture where the school’s motto, ‘business like and business led’, is evident in all areas of the school’.

Coventry University

Coventry University offers a number of skills programmes at undergraduate and postgraduate level, many with links to major local employers. For example Coventry University’s Automotive and Transport Design BA (Hons) covers the most broad spectrum

of transport design, examining issues of autonomy, sustainability, ergonomics and the user experience in relation to exterior and interior design, surface and colour applications, lifestyle and future design solutions. Industry links to JLR, Lotus, BMW, Unipart and Morgan Facilities include wind tunnels, clay modelling, CNC machining and shaker rigs. Coventry University offers professional accreditation routes and offers Enterprise and Entrepreneurship BA (Hons) training through its Enterprise Hub.

The Nationwide Apprenticeship University, a part of the wider Coventry University Group, works with employers to provide training and assessment for Higher and Degree Apprenticeships (Level 4 and above). Apprentices gain Higher or Degree level academic qualifications awarded from Coventry University as well as professional qualifications such as Chartered Manager status (for Chartered Manager Degree Apprentices).

Coventry University College (CUC) – part of Coventry University – offers a range of academic qualifications. These include Foundation Years, Access to Higher Education Diplomas, Higher National Certificates, and Higher National Diplomas and Degrees, all of which are awarded by Coventry University.

Coventry University Technology Park encourages and supports the start up and development of innovation-led, high-growth, knowledge-based businesses. It is city centre located and comprises 14 unique dedicated business facilities. Tenants vary from established businesses looking for university links to small start-ups taking advantage of business guidance.

Further Education colleges

Coventry and Warwickshire LEP, through the Growth Deal, is investing in training in order to increase the number of technically trained people able to meet the continuing demands from existing and future local employers in the advanced manufacturing and construction sectors. It provides training for advanced and higher apprentices in the manufacturing, mechanical, electrical, electronic, automotive and product creation sectors, with a view to increasing the supply of skilled engineers to service both short and longer-term growth in the automotive and broader advanced manufacturing sectors. New facilities have been provided at local FE colleges to help in delivering skills for local employers. For example, Trident College is a new build facility funded by the LEP's Growth Deal (Box 6.3).

Box 6.3. The LEP Skills Capital initiative

Warwickshire College has opened its doors to new students and will train advanced and higher apprentices. The Warwick Trident College Centre for Product Creation was partly funded with GBP 1.3 million from the Skills Capital project funded through the Growth Deal. Over 200 apprentices from JLR and SMEs have been recruited to date. (https://www.wcg.ac.uk/page/97/warwick-trident-college, https://www.cwlep.com/project/trident-centre-leamington-spa).

The private sector

A number of organisations are addressing the undersupply of skills in the region. Two significant examples follow.

MIRA Technology Park hosts 35 major automotive companies on site. An 11-point Skills Plan has been developed for the Park focused on building and maintaining the supply of

STEM based skills for the Park. Issues being addressed include poor retention of graduates and problems of recruitment into STEM occupations (Box 6.4).

Box 6.4. HORIBA MIRA Work Experience Network

The Japanese automotive engineering consultancy HORIBA MIRA, a global provider of pioneering engineering, research and test services to the automotive, defence, aerospace and rail sectors, has created a new work experience network for local schools, colleges and other businesses. It was introduced in April 2017 and is able to offer grants between GBP 20 000 and GBP 40 000. The Skills Challenge funding supports projects which directly address a high-priority skills need in a particular occupation, sector or geographic area in Warwickshire. The project is being supported with a Warwickshire County Council Skills Challenge grant worth GBP 36 497.

Work experience placements will not only be offered at HORIBA MIRA, but also at other businesses on the MIRA Technology Park. Firms will work with STEM teachers and careers leads in schools and colleges to provide and market opportunities for students.

The Lloyds Banking Group has committed support for the Advanced Manufacturing Training Centre (MTC) in Coventry, which is part of the High Value Manufacturing Catapult, supported by Innovate UK. It is investing GBP 1 million a year to develop more than 1 000 manufacturing apprentices, graduates, and engineers by 2020. The MTC's areas of expertise are directly relevant to both large and small companies, and are applicable across a wide range of industry sectors. Research partners include the universities of Birmingham, Nottingham, Loughborough and TWI Ltd.

Policy recommendations

A primary goal of the Coventry and Warwickshire LEP Skills Strategy must be to address its agreed priorities for the automotive cluster. The cluster is increasingly competitive and has high-level STEM needs with growth in high-skill and knowledge-based technologies. The Skills Strategy recognises that a strengthening the skilled labour force can stimulate this growth. SMEs need particular support. A particular focus on getting young people into the workforce also needs to be supported more widely.

The focus of the LEP skills strategy embraces school leavers, shop floor, apprenticeships and higher-level skills. Many programmes operate in conjunction with major employers. Green et al. (2017) suggest that the LEP is meant to influence local provision given that it plays an active role in shaping the focus of UK Government (particularly Growth Deal) and European Structural and Investment Fund (ESIF) funding locally. However, it does not have a direct financial say on most activity and so has to rely on a more influencing role for other aspects. This limits its ability to sponsor skills development not targeted by the other bodies. There is also a need to consider which employment and skills issues are more effectively tackled at a LEP level and which ones are more effectively tackled at the WMCA regional level.

Coventry and Warwickshire LEP's Jobs and Skills group needs to work more closely with private sector suppliers of training on this issue as well as with the colleges and universities, over and above the IAG (independent and impartial careers advice information guidance). This requires a stronger training needs and supply assessment and the creation of a road map clarifying the roles of all providers in catering for the training needs of the automotive

cluster, including management training as well as technical skills. This would identify areas of commonality and competition as well as where greater co-ordination and information exchange is needed, and propose a lead organisation responsible for co-ordination. Coventry and Warwickshire LEP should also engage with neighbouring LEPs to agree a joint approach to supporting skills development in the automotive cluster.

There is an ongoing need for further education and training providers to respond effectively to the evolving skills needs of SMEs, both in terms of technical (including sector-specific) and generic skills. In general terms, the need to support the growth and sustainability of the area's SMEs remains a high strategic priority, and the Growth Hub will continue to be integral to co-ordinating publicly-funded business support provision within the area.

A challenge is that capital investment funding streams are constrained for skills. While the national Industrial Strategy sets out objectives, more local action is needed. Decisions are made at the national level, which means a reliance on national competitive funding. The LEP therefore needs to be clear about its priorities in consultation with local and regional stakeholders, and where necessary go for national funding.

Furthermore, the tension between local responsibility for strategy development and central power and resources is visible in the recent reform of skills policies. Although the government has moved from a centrally-driven system to one of employer ownership of the skills agenda, national regulations and funding policies are still too rigid to be made locally effective. In order for there to be more local control, a helpful experiment could allow local employers to pool resources to produce more apprenticeships than needed in house. JLR, Aston Martin Lagonda and others should be incentivised, possibly though the tax system, to over-train apprentices to increase the local supply of trained workers.

Some implications on how local action might strengthen a key UK sector

Coventry and Warwickshire has an outstanding set of skills providers in its universities, UTCs, colleges and private sector suppliers. The LEP has been successful in making better use of these providers by fostering collaboration between local Further Education and Higher Education Institutions and employers to better align the education systems with the needs of employers. For example, it is working with local partners, including employers and education providers, to maximise effective use of the upcoming Apprenticeship Levy, including Higher and Degree Apprenticeships. It has also channelled Growth Deal financing to investment in training facilities and training programmes for technical workers for the automotive cluster in co-ordination involving local employers and education institutions identifying and providing for existing and future skills needs. This is helping expand private sector investment in training as well as steering skills supply.

However, although cooperation has delivered major investment, a lesson for this and other LEPs is that they need to work together more. So far, this largely happens only when forced by the necessity of applying for government funding but a culture change seems to be underway.

Supply chain innovation

Assessment of the situation in the supply chain

A study by the Automotive Council (2017) shows that 44% of parts used to make UK cars came from UK suppliers in 2017, up from 41% in 2015. UK car part makers had boosted turnover by GBP 3.7 billion since 2011. Growing local content is important as a stronger

supply chain serves to increase the attractiveness of the UK as a location for vehicle production as well as R&D.

In 2015, strengthening the supply chain in key sectors was a major focus of the then Coalition Government's Industrial Strategy[17]. It identified six common themes where action would benefit suppliers across a range of sectors. These are innovation, skills, access to finance, building capability in SMEs, strengthening collaboration across supply chains and creating more resilient supply chains.

A key target was strengthening collaboration through the successful delivery of the Advanced Manufacturing Supply Chain Initiative. Other actions included launching the Catapult network to help industry commercialise UK world-class research, reforming apprenticeships, creating the British Business Bank and launching the Business Growth Service to make it easier for manufacturers to get the right help, when they need it most in order to compete internationally.

The West Midlands region has been able to retain and continue to attract suppliers of vehicle design and engineering services, despite the loss of volume vehicle production to the region (Amison and Bailey 2014). JLR has a relatively large supply chain input of around 50 percent, and is an important customer for many local firms, entering into close working relationships with them. Amison and Bailey (2014) point out that these specialisations have created a space for specialist suppliers and technology developers locally that so far has not been attractive for mega supplier firms to fill. Many of the local supply chain firms are working at the leading edge of their particular technological areas, often in areas that fall outside traditional automotive competences. Hence there are more direct interactions between firms at different levels in the supply chain, between small and large firms, and between firms in different specialised areas –and scope for even more. Moreover, these supply chain firms also serve international markets – e.g. Japanese and German automotive firms – as well as local customers, adding to the resilience of the cluster.

Collaboration with government, through the Automotive Council and supported by the work of the Automotive Investment Organisation in the Department for International Trade, has been significant in helping to put the industry back on the global automotive map. From a UK perspective, given the ownership structure of the tier-1 supply base, 50% local content by value is regarded as a plausible target for the overall UK car industry, in contrast with the say 60% claimed in Germany[18]. Amison and Bailey (2014) found that the Automotive Council had been important for long-term direction setting for the industry, through road-mapping work, informing the setting of standards at national and international levels, and work to support the supply chain.

An example of a specialist supplier is Penso which could be presented by the LEP as demonstrating good practice to other firms in the automotive supply chain.

[17] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407071/bis-15-6-strengthening-uk-manufacturing-supply-chains-action-plan.pdf.

[18] https://www.automotivecouncil.co.uk/wp-content/uploads/sites/13/2017/06/Automotive-Council-UK-local-sourcing-content-research-2017-Final-1.pdf

Box 6.5. Penso – an engaged local automotive supply chain SME

Penso employs more than 200 people and has been based at Coventry airport for 12 years. It focuses on design and engineering solutions for the automotive industry. Penso is a world leading manufacturing specialist, providing a turnkey engineering service to global customers. It offers leading edge engineering consultancy, composite technologies and special operations including niche vehicle build. It has an impressive track record of working with some of the biggest names in industry, such as BAE Systems in defence and JLR, Aston Martin, Bentley, Spyker, Ford and Mercedes Benz in the automotive sector. See http://www.penso.co.uk/

However, while there are examples of good practice, there are also many weaker SMEs in the supply chain. The UK is weak in creating new scale-up companies that can make the step up from prototype or demonstrator stage and enter the supply chain. Many existing SMEs also need to grow and innovate more to be effective supply chain partners.

Challenges in the SME supply chain

A report for the UK Government's Department for Business, Innovation and Skills (2015) found that the main bottleneck in the UK SME supply chain is weak management and leadership skills and uneven adoption of management best practices. The report also showed that variations in management and leadership skills are associated with variations in SME performance; both directly and indirectly through their propensity to adopt management best practices. The findings further pointed to the specific dimensions of leadership and management skills and specific elements of management best practice that are most closely associated with improved SME performance outcomes.

The Coventry and Warwickshire LEP Skills Strategy and 2016 European Structural and Investment Funds 2014-2020 Priority Descriptors document identified that many SMEs in the LEP area lack management skills and need more leadership and management training to learn good practice. This also relates to a lack of SME demand for high level skills (see Keep 2016), since work organisation, job design and employee relations matter to the demand for skills and how well skills are used (also Green & Martinez-Solano 2011).

Reports have also found that not enough SMEs invest in R&D and that there are weaknesses in capacity and information failures. For example, SMEs often do not know that they need to engage in innovation collaboration or what is available to them in local science parks and universities.

Problems with access to finance is a further issue. Access to finance should not be confined merely to providing physical availability of finance. It extends to the managerial skills necessary to access finance that supports business growth, alongside the associated red-tape. Research commissioned by the 6 participating LEPs (set out in the West Midland Cross-LEP Access to Finance Sub-Group Report dated November 2013) covered both National and Regional evidence on the ongoing gaps. This report overwhelmingly confirms that gaps persist in a number of areas of the market including the provision of micro-loans (sub GBP 100 000 unsecured loans), loans for business expansion, equity finance for start-ups and early stage expansion, and the provision of development capital (equity/mezzanine) up to GBP 2 million.

Existing local policy initiatives for supply chain development

Funding for developing supply chain SMEs has been available from the EDRF, national government and local government. The current strategy for dealing with problems facing SMEs and the supply chain more generally falls within the remit of the WMCA's Productivity and Skills Commission, as well as Coventry and Warwickshire LEP's Jobs and Skills group.

Management and leadership skills

The WMG High Value Manufacturing Catapultoperates a Catapult Reach programme specifically for SMEs that supports companies to overcome product development challenges across themes such as customer insights, business strategy, manufacturing, materials and design verification and validation with appropriate management training[19]. Accreditation is provided to participants through a degree developed in conjunction with industry firms such as JLR, BMW and Ricardo[20].

Beyond this, the WMCA Productivity and Skills Commission Summary of Responses to the Calls for Evidence stated that Leadership and Management training is a key priority, that greater focus should be placed on degree-level apprenticeships in leadership and management for people currently in work, and that the provision of managerial and leadership skills should be related to other business support. It therefore recommended that a dedicated programme should be created to tackle skills gaps for SMEs in the advanced manufacturing and engineering sector, covering both management and leadership and technical skills.

Business advice

Coventry University offers a wide range of services and bespoke business solutions for SMEs. Services include gaining access to grants and funding, support for companies that are looking to take steps into international markets, innovation management support, providing help developing firms' ideas and taking innovation into new markets. This can be done by for example by delivering tailored workshops.

WMG also offers SME Support Services within the International Institute for Product and Service Innovation (IIPSI). IIPSI has worked closely with a number of SMEs in the automotive sector to support investment and growth of innovation across the supply chain. Between 2011 and 2015 WMG's SME Group delivered an ERDF programme which provided assistance to 1 400 businesses.

Another way of providing advice and consultancy into SMEs is through supporting student internships with guidance from university staff. The two universities in Coventry and Warwickshire have both introduced programmes to support SME development in the automotive sector. For example, the WMG SME Grouphas developed a specialist internship programme for students and graduates to work in SMEs. Themes include new product development, automation, industry 4.0, manufacturing, lightweight materials and design verification. Internships are based primarily within SME organisations in the West Midlands, with supervision provided by WMG.

[19] https://warwick.ac.uk/fac/sci/wmg/careers/apprentice.

However, a problem facing supply chain development in the cluster is the loss of an important national agency, the Business Growth Services (BGS), which closed in 2016. The BGS comprised the Manufacturing Advisory Service (MAS) and the Growth Accelerator programme, which both aimed to help SMEs to grow. This move was set to save the government GBP 84 million. The loss of this national agency is significant at the local level as it provided specialist business advice for SMEs in the automotive cluster in a way that was visible to SMEs, helping to overcome the problem that many do not know where to go to get advice. This type of services remains lacking in the Coventry and Warwickshire LEP area. There is therefore scope for the LEP in conjunction with the WMCA, WMG and Coventry University to provide specialist business advice to automotive supply chain SMEs.

Technical skills

Moving forward there is also an effort to enhance the technical education system. Coventry and Warwickshire LEP in its Industrial Strategy Green Paper response from April 2017 indicated a need for Institutes of Technology (IoTs) in the area. IoTs are institutions that specialise in delivering the higher-level technical skills that employers need, in areas with evidence of a higher-level skills gap and clear learner demand. The allocation of IoTs will be decided at a UK Government level: a Call for Proposals was launched by the Department for Education in December 2017.[21] Warwickshire College submitted an application to host an IoT, which would increase the supply of STEM skills, particularly targeted at the automotive sector, including an emphasis of improving the supply of digital skills. The application was unsuccessful, but the need to develop such skills within the automotive sector still remains.

The private sector in Coventry and Warwickshire also provides training in the supply chain. The Management Group Training Services (MGTS) Coventry has been working in partnership with JLR to develop and deliver training programmes to JLR staff and JLR supply chain companies. More recently, plans have been made to offer the supply chain development programme to the wider automotive SME supply sector.

Access to finance

The LEP has been able to access funding to improve SME access to finance through competitive bids for funding that is allocated for short periods of a few years, for example as is the case with the Midlands Engine Investment Fund. In addition, through other funds, the British Business Bank funds projects of a minimum of GBP 25 000 to GBP 50 000, with more near to the GBP 100 000 to GBP 150 000 mark.

[21] See https://www.gov.uk/government/news/170m-competition-launched-for-new-institutes-of-technology.

Box 6.6. The Midlands Engine Investment Fund

The 10 LEPs in the Midlands Engine for Growth area have agreed to join together to create the Midlands Engine Investment Fund (MEIF) worth at least GBP 250 million, using ERDF, European Investment Bank, and former Regional Development Agency legacy funding. The MEIF will provide a range of equity, loan and proof of concept funds to support growing businesses.

However, the need to increase the supply of micro loan finance (under GBP 50 000 and particularly under GBP 25 000), particularly for early-stage asset-poor SMEs that are not capital intensive (e.g. digital micro businesses) remains an important strategic issue, particularly as this is an area where the banks tend not to intervene, and therefore currently needs public funding.

Policy recommendations

Increase business advice

Tailored and targeted business advice is needed to increase innovation capacities in many local supply chain SMEs. Coventry and Warwickshire Growth Hub has a central 'single gateway' function that points to available business advice. It is also encouraging open innovation in the automotive cluster by helping businesses to identify external partners (including universities, research institutions and other firms), and sources of funds to support innovation collaboration projects. However, it draws on limited funding channels and has not been able to fully replace the previous interventions of the BGS. A financial plan is in place, which focuses on diversifying the Hub's income base to ensure its future sustainability, including securing funding from other public sources (such as ERDF), additional subcontracting opportunities, private sector rental of facilities and conferencing income. However, additional funding is clearly required to provide addition specialist business advice in the region to complement the Growth Hub's 'single gateway' function.

Initiatives are needed to identify proactively SMEs in the automotive supply chain that would be ready to engage with management advice to help them to develop and implement company growth plans. In addition, public support will be needed to finance the provision of specialist advice to these firms. Such initiatives could potentially be organised through the establishment of new SME competence centres, which could be joint HE and FE organisations.

SME management and workforce skills development

The LEP could consider ring fencing funding for investment in human capital innovation in SMEs. This could include enhancing performance and job design (Green et al. 2017). Among other providers, the universities could have a greater role in supporting SME training in the automotive cluster in conjunction with the LEP.

An example of where a LEP in the West Midlands region has used information from its skills audit to support skills development in SMEs is the Black Country Skills Factory Leadership and Management Programme (Box 6.7). A similar programme would be developed by the CWLEP.

Box 6.7. Black Country Skills Factory Leadership and Management Programme

The Black Country Skills Factory launched a programme of 12 bespoke bite-sized and accredited leadership and management courses, which aim to up-skill the operational leaders of manufacturing supply chain companies (i.e. supervisors and managers).

Half of the courses focused on 'hard (practical management) skills', where there is currently no provision of this type in the Black Country. The other courses focused on 'soft (leadership) skills' with individual coaching running alongside these modules. The courses were delivered on-site, in host manufacturing companies, enabling delegates to benchmark and learn from the host company. The 12 courses ran between April and December 2015.

The course programme was developed in response to a Black Country LEP skills audit in 2013 which identified management and leadership skills shortages across the manufacturing sector. The project was funded by the UK Commission for Employment and Skills (UKCES) through their UK Futures Programme 'Management and Leadership in Supply Chains and Networked Organisations'. It addressed the lack of operational management and leadership skills in Black Country manufacturing SMEs and helped to improve their overall productivity.

The Skills Factory has coordinated this project together with a consortium of employers and employer representative groups including: Huf UK Ltd; ZF Lemforder Ltd; UTC Aerospace Systems; Thomas Dudley Ltd; Lift and Engineering Services Ltd; the EEF Ltd; the Confederation of British Metalforming (CBM); and the Cast Metals Federation (CMF).

The Skills Factory is an example of an initiative that has drawn out employer demand and reshaped some supply to better meet needs in high value manufacturing. Through detailed analysis it identified gaps in local provision where (usually) smaller employers had not used existing provision because it required larger class sizes or trained people in more modern equipment than that used by the employers. The Skills Factory has therefore worked as a broker in identifying where provision and facilities could be made available and linking firms to this.

https://www.blackcountrylep.co.uk/news/black-country-skills-factory-launches-leadership-and-management-programme/

Access to finance

The gap in small amounts of finance to SMEs should be addressed with a specific public funding stream for small loans.

Some implications on how local action might strengthen a key UK sector

Coventry and Warwickshire LEP has been successful in working with universities in providing management development and business advice to SMEs in dedicated initiatives such as leadership development courses and student internships in SMEs. It has also been successful in increasing the financing opportunities for SMEs by developing access to finance initiatives with neighbouring LEPs.

Knowledge generation and exchange

Assessment of the situation in knowledge exchange

Coventry and Warwickshire benefits from substantial local public sector automotive R&D expenditure, driven by various EU, national and local government funding sources. This has created strong activity but in a patchwork that needs stronger co-ordination to avoid either duplication of effort or missing key research initiatives or organisations that could be important potential drivers of diversification and upgrading in the automotive cluster. Furthermore, much of the investment concerns longer-term R&D projects involving the science base and the larger OEMs that are still far from commercialisation and have limited direct connection with SMEs.

The two universities in the area are key players in channelling public funding to R&D and innovation together with their own resources and funding from the private sector. They are developing strategies to work in a collaborative manner rather than a competitive way, including through joining university consortia. Coventry University is involved with Birmingham City University and Wolverhampton University in the West Midlands Combined Universities consortium. The University of Warwick is involved with the universities of Aston, Birmingham, Cranfield, Keele, Leicester, Loughborough and Nottingham in the Midlands Innovation consortium of universities.

There is also very strong R&D and innovation activity in the private sector, concentrated in the large automotive firms.

The private sector has invested heavily in research in the region with knowledge exchange with other companies and often with the universities. Some examples of these initiatives are outlined in Box 6.8 below.

Box 6.8. Examples of private sector knowledge exchange initiatives

The Advanced Propulsion Centre (APC), is a private limited company created in 2013 from a commitment between the government and the automotive industry (through the Automotive Council) to position the UK as a global centre of excellence for low carbon powertrain development and production. It functions as an industry-wide collaboration of innovators and producers of low carbon propulsion systems, linking people with ideas to those who can bring them to market. The APC has partnered with other manufacturers, including AMG Batteries Ltd, and WMG, to develop the next generation of battery packs for high performance low carbon vehicles.

TMETC, based in Coventry, is a wholly-owned subsidiary of Tata Motors. It was created in 2005 as a UK-based centre of excellence for automotive design and engineering. It employs 250 people and provides R&D principally for Tata Motors but also for selected partners in the automotive industry. Facilities in the West Midlands include an engineering centre, design studios, and a vehicle test and development workshop. The company has been an active partner in a number of collaborative projects in low carbon vehicle technology since 2009, notably the government-supported CABLED programme (supported by the Technology Strategy Board) and the ERDF supported Low Carbon Vehicle Technology Project (LCVTP).

The London Electric Vehicle Company (LEVC) (formerly London Taxi Company) established its Ansty Park plant as the UK's first dedicated electric vehicle manufacturing

facility in 2017. LEVC is leading a consortium to research zero-emissions hybrid propulsion technology in Coventry. In January 2016 the LEVC, Morgan Motor Company, AMG Batteries Ltd, JLR and Parker Hannifin alongside other consortia partners, were awarded GBP 31 million of government investment to deliver innovation in areas including lightweight advanced diesel engines and high energy density batteries.

While there is so much R&D being undertaken in the CWLEP region, a major challenge facing the Coventry & Warwickshire economy is to support the diffusion of innovation throughout the local business base, particularly its SME base, and address the tail of less innovative firms that is currently limiting the growth of the local economy.

The Coventry and Warwickshire LEP area is above the LEP average on the proportion of firms undertaking product or service innovation, introducing new business practices, introducing new methods of work organisation, undertaking marketing innovation, or undertaking design investment for innovation (CWLEP, 2016a), although more needs to be done to support them to participate in a world-class cluster. On the other hand, Coventry and Warwickshire's performance is below average for SME collaboration with other firms for innovation. This suggests a need to build more networks involving SMEs in the cluster, including supporting local SMEs to collaborate with the knowledge base in developing innovations, and strengthening local supply chains for the major OEMs.

Furthermore, not enough innovative new, scalable firms are being formed in the automotive cluster in Coventry and Warwickshire.

Existing local policy initiatives for knowledge exchange

Strengthening innovation is one of the major priorities of the WMCA, as witnessed for example by the clear emphasis given to innovation in the WMCA SEP and the WMCA Productivity and Skills Commission.

The WMCA produced its own Science and Innovation Audit (SIA) in June 2017, commissioned and funded by the three LEPs associated with the WMCA. This built on the Midlands Engine SIA but was designed to be more granular. The SIA concluded that the way forward to address low productivity is to leverage the region's science and innovation excellence to lead to investment in new products and processes and in turn drive-up productivity in the innovation ecosystem.

In addition, WMCA approved the creation of a West Midlands Innovation Board (WMIB) in March 2018 to provide strategic leadership in ensuring that innovation both drives economic growth and public service reform and is embedded across the activities of the WMCA. WMIB includes senior representatives from the region's six leading universities, the LEPs and innovation experts from the private sector. It recognises that there is also a strong and complementary focus on innovation at the level of the three constituent LEPs.

The SEP for Coventry and Warwickshire LEP also recognises that a key enabler of economic development will be supporting a greater number of businesses (particularly SMEs) to work with the area's innovation assets to foster innovation and facilitate their growth. Marketing these innovation assets will also play an important role in attracting further investment from knowledge-intensive sectors to Coventry and Warwickshire.

The LEP has made a significant contribution to the region's science and innovation excellence. In collaboration with other public sector stakeholders, universities and the

private sector it has been successful in winning funding for nationally and internationally important R&D centres to be hosted in Coventry and Warwickshire, including the National Automotive Innovation Centre (NAIC) and the National Battery Manufacturing Development Facility (NBMDF). These are providing key enablers of technology-led economic development including diversification into new technological fields (see Box 6.9 and Box 6.10).

Box 6.9. The National Automotive Innovation Centre

The National Automotive Innovation Centre (NAIC) is a new campus initiative at the University of Warwick supported by JLR, Tata Motors, WMG and the University of Warwick, along with an expanding network of supplier companies. The project cost GBP 150 million, with GBP 15 million of capital funding from central government through the Higher Education Funding Council England.

It will focus on the long-term multi-disciplinary R&D challenges of smarter, lighter, greener cars. The building opened in 2018 is the largest automotive R&D facility in the UK and Europe, providing innovative design studios, collaborative working space and state-of-the-art research facilities. It has the capacity for approximately 1 000 scientists, engineers, academics, technicians, designers and support staff who work on carbon reduction, smart vehicles and electric cars.

Box 6.10. UK Battery Industrialisation Centre

Announced in November 2017, the UK Battery Industrialisation Centre (UKBIC) will bring together academics and businesses to work on new forms and designs of batteries, and provide open access R&D facilities to scale up and commercialise advanced technologies central to the development and manufacture of batteries. The partnership between WMG, Coventry and Warwickshire LEP and Coventry City Council was awarded GBP 80 million to establish the UKBIC.

The announcement of UKBIC was in parallel with GBP 40 million of government funding for 27 individual battery research projects. The money is part of the GBP 246 million earmarked for research in the sector under the Faraday Challenge as the Government begins to articulate how its Industrial Strategy will be implemented.

UKBIC aims to enable UK-based companies and researchers to come together to build and maintain a world leading position in manufacturing technologies for batteries and their components in vehicles and transportation, and enhance the UK's position as a global leader in the development of low emission vehicles. It will provide a strategic link between R&D and full-scale industrialisation for battery technologies across the UK and enable effective partnerships between manufacturers, researchers, and economic development leaders. It will also significantly scale up UK skills capacity in this area and through the UKBIC a learning facility will be created to train the future skills base.

Many government investments have been made in R&D and innovation initiatives in the two Coventry and Warwickshire universities that strengthen the knowledge base and knowledge exchange in the automotive cluster (see Box 6.11and Box 6.12).

Box 6.11. Examples of automotive knowledge exchange initiatives at the University of Warwick

High Value Manufacturing (HVM) Catapult. WMG operates one of seven facilities nationally in the HVM Catapult undertaking a range of research and testing projects with university and industry. The particular focus of the WMG centre is on the global challenge of low carbon mobility. It includes the Energy Innovation Centre, which comprises a battery materials pilot line together with battery characterisation laboratory plus abuse testing chambers and an electric / hybrid powertrain testing facility. It also includes the Vehicle Energy Facility launched in 2011. The combined facilities provide a one-stop-shop for the development of new battery chemistries from concept through to fully proven traction batteries within vehicle systems.

Automotive Composite Research Centre. This opened in 2014 and provides local industry with hands-on technical expertise and equipment to develop its manufacturing capability for polymeric composites. It is located within WMG's International Manufacturing Centre. The Centre focuses on the development of carbon fibre reinforced composite manufacturing technologies for high volume automotive applications.

International Institute for Nanocomposites Manufacturing (IINM). This also opened in 2014, and aims to produce polymer nanocomposites (manmade materials) for the automotive industry that are lightweight, strong and durable. It exploits polymer processing techniques which will enable industry to innovate their manufacturing technologies to produce polymer nanocomposites. The Nanocomposites Research Group within the Institute focuses on the manufacture of Nanocomposites.

International Institute for Product and Service Innovation (IIPSI). This opened in 2012 as a hub for business to access insight into world-leading technologies to develop competitive, innovative products and services. The focus in IIPSI is on developments associated with the future digital and connected economy.

International Digital Laboratory (IDL). This opened in 2008, creating a platform for new collaboration to solve real world challenges and to provide knowledge transfer, education and training. In 2011, the laboratory became a high value manufacturing centre which aims to speed up the commercialisation of new and emerging technologies.

Materials Engineering Centre. This is a new planned centre which will accommodate further research space for applications-driven 'engineering scale' research on metallic, non-metallic and polymeric materials; their composites and hybrid structures. Funding of GBP 10 million has been secured from the Engineering and Physical Sciences Research Council (EPSRC).

Wellesbourne Campus Bleasdale Building. This will be a new facility for vehicle build and test with two state of the art workshops for build/test and styling area. There will also be a purpose-built fitting/modification space, and an onsite office with access to CAD. It will accommodate WMG’s Special Vehicle Projects Team.

Box 6.12. Examples of automotive knowledge exchange initiatives at Coventry University

Institute for Future Transport and Cities. This Institute has the mission of creating safe and sustainable transport solutions fit for the cities of the future. Work covers automotive, aerospace, maritime and rail transport modes. Over 140 research staff and 120 PhD research students are based at the Institute. The Institute capitalises on links with Coventry City and its status as a European Living Lab for transport and close collaboration and joint initiatives with major stakeholders such as Unipart, FEV and Horiba MIRA. In 2017, the National Transport Design Centre was opened within the Institute.

Institute for Advanced Manufacturing and Engineering (AME). Established in 2013, this is otherwise known as the "Faculty on the Faculty Floor". AME is supported by the Higher Education Funding Council for England's Catalyst Fund. It is a collaboration between Coventry University and Unipart Manufacturing Group. It has a track record of 100% employment for its industry-ready manufacturing graduates, and commercialisation of several new technologies for lightweight and low/zero carbon powertrain applications.

Centre for Connected & Autonomous Automotive Research (C-CAAR). This was opened in 2017 following investment of GBP 26 million in partnership with Horiba MIRA. It aims to pioneer and test new developments within the global intelligent mobility sector. Academic staff members and doctoral research students from Coventry University work alongside HORIBA MIRA's engineering and test teams on projects at the Centre. It builds on existing collaborative activity between the two partners, including work with other leading industry players to test connected vehicle technology in real-world conditions; a project exploring how connectivity will help drivers reach their destinations more efficiently and conveniently; and wide-ranging doctoral research activity exploring, amongst other things, technologies that make journeys safer, cleaner and smarter, as well as the development of more resilient cyber security systems within modern vehicles.

Centre for Applied Low Carbon Propulsion Systems (C-ALPS). This is a joint venture between Coventry University and FEV (a German based international engineering service provider). A new Centre for automotive engine testing will be built within the Technology Park.

Policy recommendations

Funding long-term automotive R&D projects

It is essential to continue a concerted effort at the regional and local level to win further funding for high-level innovation centres and projects for the automotive cluster.

Supporting innovative start-ups

At the same time, a shorter-term, coordinated approach is needed involving the CWLEP and the public and private science base to foster innovation-led start-ups

Supporting SME innovation networks

There is a need to build more innovation networks involving SMEs in the automotive cluster. This will require supporting local SMEs to collaborate with the knowledge base in developing innovations, including support for skills upgrading in local automotive SMEs and targeted funding programmes for SME innovation collaboration with the universities.

Some implications on how local actions can strengthen a key UK sector

The key role that Coventry and Warwickshire LEP and WMCA are playing in supporting knowledge generation and exchange in the region demonstrates the importance of local policy of keeping a watching brief on new technologies affecting their key local clusters. To do this local policy players need to have available advice on emerging and early stage research areas. They need to continue to support innovation in these areas and need to address the training needs of new technologies and markets.

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