

STEM assets in the West Midlands innovation landscape: Warwick Manufacturing Group



With special thanks to Professor David Greenwood (WMG).

The West Midlands Regional Economic Development Institute (WMREDI) is a consortium of organisations led by City-REDI at the University of Birmingham and includes the West Midlands Combined Authority (WMCA), the three Local Enterprise Partnerships, the GB Chamber of Commerce, the WM Growth Company, Birmingham City Council and the seven metropolitan Local Authorities. Our collective research agenda is to understand the relative impact of various interventions and investments for regional economic growth, sustainability and the reduction of social inequality in the West Midlands and the UK. This underpins policies to attract more public R&D investment in the region and apply this and other inputs to guide better growth in the region.

This policy briefing outlines findings from one of our WMREDI projects, focused on examining regional innovation ecosystems and the relationships between universities, local firms, entrepreneurship, innovation, technology transfer and knowledge exchange as contributors to different kinds of growth. We know that strong regional innovation systems underpin stronger economic growth pathways, tend to be more competitive and resilient, and tend to benefit both firms and local communities.

Introduction

The purpose of this briefing is to outline the existing knowledge in the public domain regarding Warwick Manufacturing Group (WMG), at the University of Warwick. The information cited here was collected via a search of the internet – specifically pertaining to WMG’s website, regional audits, impact studies and news articles – as well as an interview with WMG’s Director for Industrial Engagement, Professor David Greenwood. WMG is one of four case studies our empirical research will focus on, aimed at building an understanding of the specific regional contribution the fixed asset makes and the factors that constrain its innovation/productivity growth.

Overview

WMG was formed in 1980 by Professor Lord Bhattacharyya and has since become one of the international leaders in manufacturing research, education and business. Structured as a department at the University of Warwick but run as a hybrid organisation mixing expertise from academia and industry, over the past 40 years it has been driving innovation in STEM through its unique approach to tackling the problem of the ‘valley of death’, a term describing the lack of successful collaboration and knowledge transfer between the two cultures. This fusion of skill sets is maintained by employing 50% of its staff from academia and 50% from industrial backgrounds. Employment figures stood at over 600 employees in 2021¹, but over the last 20 years WMG has saved and created a total of 11,500 jobs².

WMG is also one of the seven High Value Manufacturing (HVM) Catapult Centres, which work with industry to transfer knowledge to, add value to, and thus increase the competitiveness of, private and public sector organisations. It has a specific focus on the areas of Lightweight Technologies and Energy Storage Management which are encompassed under the global challenge of achieving Low Carbon Mobility. It is also HVM Catapult’s lead centre for two of its strategic objectives: Vehicle Electrification and Connected and Autonomous Vehicles³. Due to its expertise in this area, WMG has been selected by the public sector as one of four national Driving the Electric Revolution Industrialisation Centres, enhancing and coordinating

the country’s power electronics capability to achieve sustainable growth and the goal of net zero⁴. But although considered to be the top automotive R&D centre in the country, its manufacturing roots have since vastly expanded to include collaborative R&D and skills development across other sectors, now possessing strengths in aerospace, energy, pharmaceuticals, IT, cyber security and construction.

Within the catapult programme, WMG undertakes six activities: capability building, forming and maintaining strategic industrial relationships, supporting SMEs, providing industrial skills, collaborative R&D, and direct contract research. On top of this, WMG also carries out a further activity: fundamental research supported by Research England. Its research is encompassed under five directives: energy (the largest), materials and manufacturing, digital manufacturing, intelligent vehicles, and organisation and societal transformation (the smallest). Each of these directorates set their research agenda in accordance with WMG’s overall strategy which is decided by senior management. This goes a significant way at explaining the organisation’s success: it enables the group to be mission-led, focusing on bigger societal and industrial issues that require a mix of skill sets and multi-disciplinary capabilities, rather than being problem-led and solving smaller, more specific issues.

¹ Source: Warwick Manufacturing Group

² Source: [Warwick Manufacturing Group](#)

³ Source: [HVM Catapult](#)

⁴ Source: [HVM Catapult](#), 2021, p. 32

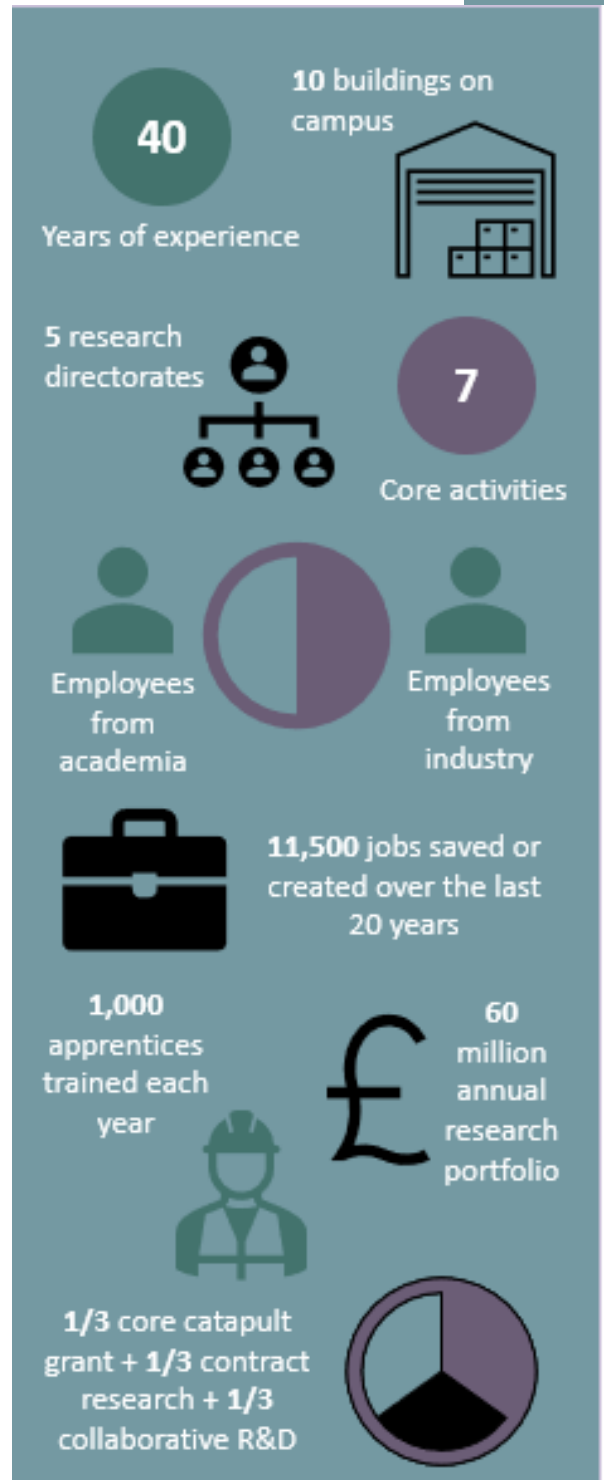
Overview (continued)

Alongside its research, WMG also delivers education and training as part of its role within the university. Whilst not providing many undergraduate courses as university departments traditionally do – the only three being part-time advanced engineering undergraduate programmes for those already in industry – it does run large, industrially-based group projects which have the result of producing high-quality graduates with industry experience. It also provides several courses at master's level, as well as many industrially focused PhDs. In addition, WMG launched two Academies for 14- to 19-year-old students who are exposed to industry from a young age before going on to apprenticeships and degree courses, as well as having over 800 learners studying against a degree apprenticeship standard, including a bespoke programme for JLR.

As part of its SME support mechanism within the catapult programme, WMG engages businesses via a number of methods – networking, diagnosis, workshops and masterclasses – with projects lasting for varying durations, from first step assessments to feasibility studies to full studies.

Research activities amount to an annual portfolio of over £60 million, of which £21 million is provided as a core grant from HVM Catapult. WMG operates a thirds-based funding model, each year trying to match every pound received in core grant with a further pound in commercial income (from contract research) as well as a pound in income from collaborative R&D. Whilst the EPSRC is the biggest funder of WMG's fundamental research activities, Innovate UK, the APC, and the Aerospace Tech Institute provide the largest amount of income for collaborative R&D. In 2017, WMG was involved in 14 successful Innovate UK bids, receiving a total of £76.2m¹. Whilst the core grant provided by HVM Catapult has clear objectives, it has a very strong level of overlap – and thus a large amount of funding flexibility – with the scope of university research.

¹ Source: [HVM Catapult](#)



Facilities – development and functionality

1986 – International Automotive Research Centre

Dedicated to professional education, the building comprises a range of facilities including lecture and syndicate rooms, a fully equipped PC suite, and comfortable communal areas. It is situated adjacent to the university conference centres, the first of which opened in 1982 and is part of the University of Warwick's network of award-winning conference and training facilities.

2002 – International Manufacturing Centre

The IDL is the first digital research centre of its kind, housing state-of-the-art presentation facilities including a 100-seater auditorium. The centre is aimed at inspiring innovation in digital technologies that serve business, healthcare and educational needs.

2012 – International Institute for Product and Service Innovation

WMG's first purpose-built facility, opened by Prime Minister, Margaret Thatcher. It was established by Professor Lord Bhattacharyya as a dedicated facility to work alongside industry. It is now also home to the Energy Innovation Centre which opened in 2014 to develop battery technology and whose scale-up facility is one of its kind in the UK.

1992 – Engineering Management Building

Occupying 7,000m², the IMC contains a mixture of lecture and teaching facilities, research and demonstration areas, and offices. It is the home of the Premium Vehicle Customer Interface Technologies Centre of Excellence, Centre for Imaging, Metrology and Additive Technologies, Cyber Security Centre, and Forensic Centre for Digital Scanning and 3D printing.

2008 – International Digital Library

The IIPSI gives West Midlands SMEs access to world-leading technology to enable development of innovative products and services, focusing on the future digital and connected economy. There are a range of demonstrators within the building that highlight innovative tools, applications, methods and equipment, some of which can be utilized by businesses as part of customised projects.

Facilities – development and functionality (continued)

2014 – International Institute for Nanocomposites Manufacturing

This facility provides a place for researchers to test manufacturing and assembly processes in realistic conditions. It houses both an Applications Facility and the Advanced Steel Research Centre.

The IINM represents a first of its kind in the world, housing state-of-the-art facilities including: characterisation laboratories, a wet chemistry laboratory, processing hall, as well as research space. The building was designed by Cullinan Studio as a highly sustainable facility and consequently possesses several environmental features.

2017 – Advanced Materials Manufacturing Centre

The MEC houses both the National Polymer Processing Centre, and Automotive Composites Research Centre (ACRC). The facility enables applied research at industrial scale, providing partners with industrial scale composite processing equipment to carry out process development and demonstrations.

2018 – Materials Engineering Centre

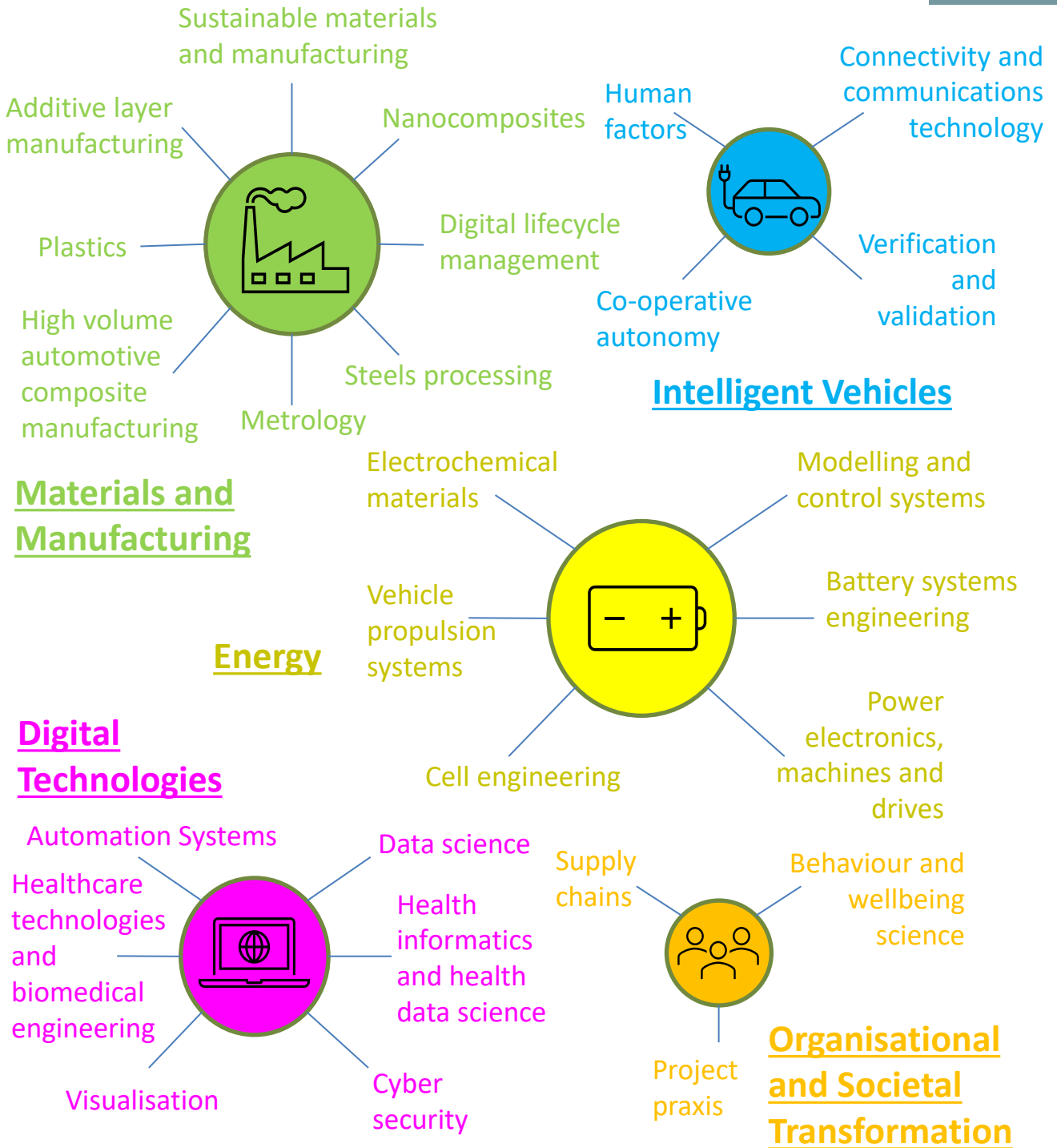
NAIC is focused on the long-term challenges outlined by the UK Automotive Council, including electric vehicles, carbon reduction and smart and connected cars. A partnership between WMG, JLR and Tata Motors UK, it is the largest research centre of its kind in Europe, with 33,000m² dedicated to automotive innovation.

2019 – National Automotive Innovation Centre

This building provides the capacity for training up to 1,000 degree apprentices at a time, possessing open spaces for collaborative work, technology-enabled seminar rooms and a purpose-built, multifunctional, laboratory for activity-based teaching and learning.

2019 – Degree Apprenticeship Centre

Capabilities – research directorates

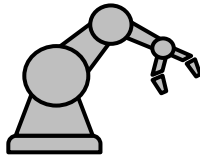


Source: [Warwick Manufacturing Group](#)

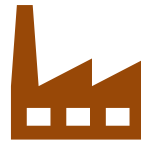
Capabilities – technical capacities and competencies



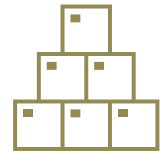
Advanced Assembly



Automation



Casting



Composites



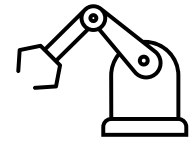
Design



Digital manufacturing



Electronics



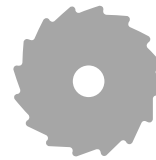
Flexible Manufacturing



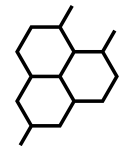
Formulation



Joining



Machining



Materials Characterisation



Metal forming and forging



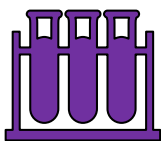
Metrology



Modelling and Simulation



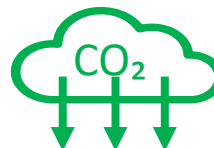
Netshape and Additive Manufacturing



Powder Technology



Power and Energy Storage



Sustainable Manufacturing



Tooling and Fixtures

Source: [HVM Catapult](#)

Capabilities – product offerings for businesses

Resource	What	Who	How	Output
Market insight	Overview and understanding of those areas of UK activity that are growing and making money – enables better decisions about potential market size, competition and pricing	Those who are new to an area, or those who want a fresh look at their existing area	Discussion of WMG knowledge in an area – with experts in the field	A more effective approach to making money from technology
Access to people	Various length programmes to transfer academic knowledge into a business	Companies who want to explore a new technology or market, as well as companies who want to develop their own new technologies and generate IP.	Depending on timescale required, level of knowledge and urgency, agreement on specific tool to use	Specific knowledge transfer and people development
Access to equipment	Latest manufacturing equipment, fully maintained and calibrated with full technician support	Companies looking to explore the use of new equipment and needing business case, or those with short production runs	Agreed programme to use equipment with tailored amount of support from WMG	Case for acquisition or validation that equipment is needed for expansion

Source: [Warwick Manufacturing Group](#)

Impact

There have been few publicly available independent impact assessments of WMG conducted since its inception. The most recent was published in 2017 as a small part of the regional science and audit¹. Nevertheless, the reach of its impact is clearly international, having worked with over 1,100 global companies over the past 20 years² as well as undertaking education programmes in much of Asia.

Regarding the impact of WMG's research beyond academia, together with University of Warwick's School of Engineering 96% of their submissions to the 2014 Research Excellence Framework achieved a score of either 3 or 4, representing the highest two standards of quality awardable.³ What does this impact look like in practice? A 2021 independent assessment by BWI on the SME Group's Digital Manufacturing programme identified that over the last 26 months WMG has helped Midlands SMEs to achieve:

- Additional Employment of 464
- Safeguarded Employment of 1,629
- GVA of £143.4m

By understanding industrial challenges and working with companies to help them utilise research to their advantage, it successfully leads to increased productivity and growth on an individual basis, which when aggregated have a positive effect on the macro level. Moreover, unlike most university departments, WMG grants IP and patents to industrial partners during collaborative research, generating impact by allowing research innovations to reach the market as a viable commercial product. Such products add economic value as well as bringing positive developments for society and the environment.

Prior to 2009, WMG had provided skills training to over 25,000 people, for which is received the Queen's Anniversary Prize for Higher and Further Education⁴. Thus, WMG delivers on all three of the University of Warwick's mission activities (education, research, and societal contribution).

WMG has an evidence base of 90 case studies outlining some of the things that have been achieved on individual projects. Each of the success stories document the respective challenge, its solution, as well as the subsequent impact. The selection can be found [here](#).

In action: WMG helps Ramfoam deliver during the pandemic

During the height of the COVID-19 when PPE was in strong demand, Ramfoam – a small business based in the Black Country which makes normally produces foam products for the military among other organisations – secured a UK Government contract to supply the public sector with 3.5 million face visors per week. They faced the challenge of scaling their output by 300 times in a short space of time and during a time in which there was widespread supply chain disruption.

WMG proved critical in helping Ramfoam to hit their target within the space of five weeks through the use of digital manufacturing and supply chain support and expertise. Within this time, the small business became the largest UK supplier of PPE to the NHS, and has since gone on to produce over 55 million visors for the organisation. The upscaling created 550 new jobs in the local economy as well as 750 in the broader supply chain. RamfoamCare+ now supplies their visors in the global market and is working with WMG to make their manufacturing process more sustainable⁵.



¹ [A Science & Innovation Audit for the West Midlands, 2017](#)

² [Warwick Manufacturing Group](#)

³ [Research Excellence Framework](#)

⁴ [University of Warwick](#)

⁵ [HMV Catapult, 2021, p.](#)

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Next Step: Measuring impact

Impact addresses the ultimate significance and potentially transformative effects of an intervention. It seeks to identify social, environmental and economic effects of the intervention that are longer term. Beyond the immediate results, this criterion seeks to capture the indirect, secondary and potential consequences of the intervention.

Next Steps for our research on WMG:

This policy briefing, alongside a systematic review of the literature, provides a strong foundation for the next phase of our research.

This will involve a 'deep dive' case study on WMG, aimed at building an understanding of the specific regional contribution the fixed asset makes and the factors that constrain its innovation/productivity growth.

Our project will work to identify the size, scale, employment, turnover, and growth of WMG, in direct and indirect terms using proxy measures and multipliers.

We will then compare the commercial and non-commercial impacts of WMG, identifying any social/ environmental/ economic trade-offs. This impact analysis will help identify different forms of regional economic growth that can be attributed to university-related investments.

This will be achieved through interviews with key stakeholders, which will focus on:

- 'How' and 'in what way' WMG generates impact: exposing the relationship between inputs, activities, output, and outcomes, and considering their relative contribution alongside other factors and 'third mission' activities.
- The impact of WMG, beyond commercial / economic impacts: focusing on understanding the complete picture of value created by STEM assets, which can help inform funding strategies.
- The factors that constrain the innovation/productivity growth of these STEM assets and to what extent they are region or university specific. The impact of STEM assets will be dependent on their ability to overcome different local challenges in relation to the availability of specific kinds of skills, R&D assets, and infrastructure.