Future Mobility Grand Challenge
Evidence Review

This report was produced by Daniel Marlowe, with support from the University of Nottingham Business and Local Partnerships, Postgraduate Placements team, and D2N2 LEP.
Future Mobility Grand Challenge Evidence Review

1 Executive Summary

2 Introduction

3 Key Stakeholders

3.1 Infrastructure Providers and the Public

3.2 OEMs and Innovators

Figure 1: Benchmarked annual bus usage per capita by region (excluding London)

Figure 2: Average distance (km) travelled to place of work

Figure 3: Future Mobility Zone implementation region

Figure 4: Regional ULEV uptake

Figure 5: Regional EV uptake

Figure 6: D2N2 rankings in motor vehicles

Figure 7: D2N2 rankings in manufacture of other transport equipment

Figure 8: D2N2 rankings in repair and installation of machinery and equipment

Figure 9: D2N2 IUK Grant Harnessing by Sector

Figure 10: D2N2 IUK Future Mobility Grant Allocation by Specialism

Figure 11: D2N2 IUK Future Mobility Projects by Specialism

Figure 12: IUK grant by enterprise size

Figure 13: IUK future mobility grant use distribution

Figure 14: Manufacturing, Materials & Mobility IUK grants by LEP (excluding London and the South East)

Figure 15: D2N2 graduate employment

Table 1: Automotive manufacturing

Table 2: Other transport equipment manufacturing

Table 3: Repair, installation, and maintenance of machinery and equipment

Table 4: University of Nottingham corporate co-authorship
1 Executive Summary

1.1.1 This report presents a condensed and evidenced review of future mobility competencies and opportunities in the Derby, Derbyshire, Nottingham, and Nottinghamshire (D2N2) Local Enterprise Partnership (LEP) area, assessing data from available sources to support D2N2’s forthcoming Local Industrial Strategy (LIS).

1.1.2 Further to the key enabling competency of next generation transport identified in SQW’s Science and Innovation Audit\(^1\) of the D2N2 LEP area, we identify here key research excellence and a robust industrial landscape in advanced manufacturing across the automotive, rail, and aerospace industries. This, coupled with forward-thinking policy and competitive exploitation of central government funding for future mobility urban development by local authorities, puts D2N2 in a competitive position as a potential frontrunner in the United Kingdom’s bid to access this growing international market.

1.1.3 Threats to this picture emerge in the form of the potential rigidity of the manufacturing ecosystem and its embedded supply chain infrastructure in light of changing supply chains (many of these operating on a just-in-time basis), a rapidly changing market, and increasingly strict environmental policy, with insufficient exploitation of HEI expertise by local businesses, and the automotive industry in particular suffering from a lack of local R&D expertise. These, alongside competition for funding from other regions, D2N2 will need to strategically address if it is to capitalise upon its research and manufacturing assets.

\(^1\) D2N2 SIA, January 2018
2 Introduction

2.1.1 Future mobility encompasses a swathe of technological, infrastructural, and societal changes to how we approach the transportation of people and goods; these changes promise to increase the efficiency, reliability, economy, and sustainability of travel by harnessing developments in electrification, connectivity, and autonomy across multiple industries. This emerging market presents a growing opportunity to access what is forecast to be a £1.4 trillion industry by 2030\(^2\) in harnessing our internationally leading research excellence and position as a centre of manufacturing in the UK.

2.1.2 In this report we make the case for D2N2’s standing in the future mobility market, identifying strengths and opportunities and assessing the threats to these. Data has been analysed from various open sources alongside qualitative insights from consultations with industry leaders and academics, with supporting use of the Beauhurst database of high-growth UK companies.

2.1.3 The structured approach we follow here is predicated upon the identification of key stakeholders in the future mobility market: Infrastructure Providers and the Public (§3.1), encompassing local and central government spending and policy, and the uptake of these by the public; and OEMs and Innovators (§3.2), comprising the industrial and R&D landscape in the automotive, rail, and aerospace advanced manufacturing industries and the enterprises that support this.

3 Key Stakeholders

3.1 Infrastructure Providers and the Public

3.1.1 D2N2 enjoys a largely integrated and connected public transport, fuelled by healthy competition between a number of bus companies, with 24-hour access between the two largest D2N2 conurbations, Derby and Nottingham, strong connections between each city and outlying towns, and frequent services to and from the East Midlands Airport\(^3\).

3.1.2 Of note is the success of the Nottingham Robin Hood Network, offering accessible travel across a network of bus, tram, and rail operators in greater Nottingham. The uptake of integrated travel has been aided here by the Robin Hood smartcard, allowing discounted, contactless ticketing; 100,000\(^4\) have been registered in greater Nottingham.

---

\(^2\) Transport Systems Catapult Intelligent Mobility brief

\(^3\) The Economic Case for the Derby-Nottingham Metro, 2017

\(^4\) Midlands Connect, Our Routes to Growth, 2018
3.1.3 The largest bus operator in Nottingham, Nottingham City Transport, runs 330 routes, with 100% of services offering free-wifi, and 97% audio announcements; despite privatisation, Nottingham City Council have 82% equity in the company, permitting the piloting of policy-driven schemes such as the Robin Hood smartcard and a fleet of electric buses financed principally by the DfT’s Green Bus Round and NCC’s Workplace Parking Levy.

3.1.4 The Workplace Parking Levy has been key to the city council’s efforts to mitigate congestion and encourage sustainable travel, introduced in 2012 and having generated £53m in funds used in the NET Phase 2 tram line extension, and the redevelopment of Nottingham station.

3.1.5 The uptake of public transport is demonstrated in car ownership figures for Derby and Nottingham: 1.02 and 0.76 cars per inhabitant, relative to East Midlands average of 1.33 in 2017, and competitive bus provision and usage across the two conurbations of Derby and Nottingham, as visualised in Figure 1.

3.1.6 This connectivity is seen to fuel greater access to places of work and key resources in these conurbations; improved transport links between the two cities and outlying areas are a significant driver of equality of opportunity, as addressed in the joint bid made by Derby and Nottingham City Councils for the Transforming Cities fund (see below).

---

5 Nottingham City Transport

6 My Nottingham News: New electric buses power Nottingham’s clean air ambitions

7 Statista
3.1.7 Access to key resources, barriers to opportunity, and quality of living environment are the central metrics of the Office for National Statistics’ *English Indices of Deprivation*\(^8\) analysis. With reference to 39 LEP areas, D2N2 scores relatively high in the indices of multiple deprivation (ranked 13\(^{th}\) most deprived by average score) and is notably ranked 9\(^{th}\) and 11\(^{th}\) most deprived with respect to performance in employment and education, respectively.

3.1.8 Visualised in Figure 2\(^9\) is an apparent disparity between employment connectivity between the four largest conurbations (Mansfield, Chesterfield, Derby, Nottingham) and more rural outliers; showing the average distance travelled to the workplace for inhabitants of each local authority (with reference to the East Midlands average of 12.8km), the map seems to indicate a net flows of workers into each of the conurbations; note that the outlying value in High Peak is presumably to be attributed to a flow of workers into the Greater Manchester district.

3.1.9 Accessibility, connectivity, and opportunity are key themes addressed in the Derby and Nottingham City Council Future Mobility Zone bids for the Transforming Cities (Phase I) and Future Mobility Zone (Phase II) bids, one of seven combined authority shortlisted projects encompassing central government’s financing of pilot schemes and testbeds for the future of urban mobility.\(^{10}\)

---

8. *English indices of deprivation, 2015*

9. *2011 Census data*

10. *FMZ phase II guidance*
3.1.10 Nottingham City Council and Derby City Council’s joint Transforming Cities bid, awarded £7.2m Tranche 1 funding\textsuperscript{11} constituted an ambition and structured effort to increase connectivity and transport integration in conurbations, whilst addressing transport deprivation and strengthening the infrastructure for sustainable travel (walking and cycling) in the region. The bid consists of two strands, \textbf{Active Travel} and \textbf{Public Transport}. The first consists of four components\textsuperscript{12}.

3.1.11 Key points: a structured scheme setting out to upgrade and increase the existing cycle connectivity infrastructure; encourage sustainable transport intermodal shift as a means of tackling the air pollution, congestion, and productivity restrictions of the 425,000 daily commutes in the region.

3.1.12 \textbf{Component 1 - Nottingham to East Midlands Airport via Clifton Growth area route improvements}

Improvements in connectivity between Nottingham Rail Station and the Clifton Growth Area on a route out towards the East Midlands Gateway development and East Midlands Airport, comprising improved access to Nottingham Rail Station, upgrading of 1.2k of road cycle facilities, and up to 2.1k of foot- and cycle-paths along the A453/B679, in liaison with Highways England.

\textsuperscript{11}\textit{Transforming cities: shortlisted cities}

\textsuperscript{12}Data from joint NCC and DCC TC proposal.
3.1.13 **Component 2: Nottingham to Derby via Nottingham Enterprise Zone route improvements**
Upgrading of sections of off-road routes between Nottingham and Derby, including improved connections to the Nottingham Enterprise Zone, comprising improvements in cycling infrastructure, integration of new cycle routes and footpaths into and through the Nottingham Enterprise Zone, extending the work of the Cycle City Ambition Programme funded by D2N2 LEP between 2015 and 2018.

3.1.14 **Component 3: Derby to Nottingham route improvements (Spondon area)**
Improvement of cycling facilities between Derby and Nottingham, comprising improved cycle access to existing routes, and two new routes, prioritising cyclist and pedestrian access and visibility.

3.1.15 **Component 4: Cycle hire/e-Bike scheme expansion**
Upgrading of the recently installed Derby e-Bike scheme and work towards an extended replacement cycle hire scheme in Nottingham, with an e-Bike component. This will comprise additional docking and charging stations, purchase of electric vehicles for redistribution of bikes, and more bikes. This will be seen to encourage growing private interest in the installation of docking stations at or near workplace premises.

**Public Transport**

3.1.16 **Key points: use of telematics and real-time data collection to optimise and regulate traffic movement in key locations, including the A52 corridor; improvement of existing integrated public transport systems and move towards smart ticketing to improve public uptake, with 38% of public respondents to a 2018 Bus/ Tram survey citing ‘Ease of Access’ as the primary reason for bus/ tram usage; provision of EV charging points is key to EV usage and mitigating trip anxiety.**

3.1.17 **The Public Transport agenda suggests upgrades in telematics, smart cameras, and electric charging, with four components.**

3.1.18 **Component 1: Bus priority through key junctions and smart camera trial**
Upgrading of the existing Derby and Nottingham Traffic Centre Control (TCC) systems to allow traffic light priority for buses along the A52 corridor between the two cities, substantiate by trials of smart camera traffic management system in the Nottingham Enterprise Zone and UoN SCOOT region. These will provide vehicle movement data with the objective of improving bus reliability, integrating with the existing real-time bus time feeds at bus stations, and improving traffic flow and reducing congestion for all vehicles.
3.1.19 **Component 2: Public transport information system upgrades**
Introduction of 250 colour LCD real-time update screens along Derby-Nottingham bus corridors, increasing the ease of transport integration and provide more consistent disruption information for travellers. Addition of screens at key employment, development, and interchange locations.

3.1.20 **Component 3: Smart public transport payments**
Improvements into Nottingham’s existing investments into integrated ticketing, including the enabling of the Robin Hood intermodal pass for smartphones, and updates across the tram system to permit contactless payments throughout.

3.1.21 **Component 4: Electric charging at interchange hubs**
Improvement and provision of electric charging infrastructure at the East Midlands Gateway, and electric car charging hub expansion across the D2N2 charging point network and at key bus and tram park-and-rides.

3.1.22 **Key points:** the introduction of innovative new technologies building existing infrastructure in carefully chosen testbed locations to make the social and economic case for MaaS, enhanced data sharing, sustainable, connected, and autonomous transportation. Packages A and B promise to offer invaluable perspectives on societal barriers to modal shift and MaaS uptake, helping guide policy; Package C serves as a series of proofs-of-concept via the introduction of mobility pilots in key areas.

3.1.23 Subsequent to this successful bid for a tranche of Phase I Future Mobility Zone fund was Nottingham and Derby’s joint bid for the implementation of future mobility zones in Phase II of the trial; prior to feedback from central government on the outlined plans, the region’s proposals comprised three packages, focusing on open access mobility-as-a-service (MaaS), an enhanced mobility data platform, and the implementation of e-mobility hubs.

3.1.24 **With reference to Figure 3** Figure 3: Future Mobility Zone implementation region, the testbed zone comprises the interface of the two conurbations, and aims to support growth and productivity through innovation and connectivity; improve air quality and congestion; and promote social inclusion. In addition to the TC proposal, the Phase II bid seeks to build upon and unify existing funds and pilots in the D2N2 area, including Nottingham’s Go Ultra Low City status, the National Productivity Investment Fund, the NottinghamGets2Work access fund, and the Let’s Keep Nottingham Moving and Derby Connected transport network schemes.

3.1.25 This and the above scheme represents a progressive step in the urban design and operation of the two cities, seeking to address disparities in public transport usage and e-mobility choices between the two cities in line with the unified approach outlined in the *Derby & Nottingham Metropolitan Strategy 2030*. 
3.1.26 **Package A: Open Access MaaS** comprises the implementation of a public-transport-oriented MaaS platform, building upon the success of the Robin Hood pass and centred around a web and mobile app delivered in three stages.

3.1.27 **Stage 1: Trip data linking and recording**
Provision of an integrated data recording and analysis platform, allowing users to aggregate, understand and compartmentalise transport costs associated with anything from petrol stations to e-bike schemes, and providing anonymised data to the city councils for use in predicting travel trends, modal shifts, and gaps in the existing transportation infrastructure.

3.1.28 **Stage 2: Payment, incentives, and mobility credits**
Introduction of app-based and contactless payments for increasingly seamless transportation; this will permit the addressing of area- and demographic-specific objectives, via for instance the use of public transport rewards or discounts for users living in areas with low air quality. A mobility credit scheme targeted at low income groups with low travel horizons promises to link deprived areas to employment and key resources. This is further to the infrastructure provided by Nottingham City Council via the TC and National Productivity Investment funds, comprising plans to install contactless payment in all bus and tram vehicles by March 2020.

3.1.29 **Stage 3: Subscriptions and direct debit**
More refined payment options, including tailored mobility subscriptions, direct debits, and a PAYG scheme, increasing the ease of mobility planning and prediction and accelerating the transition towards cashless, barrier-free, bespoke transportation services.

3.1.30 **Package B: Future Mobility Data Platform** constitutes an extension of the Smart Nottingham Real Time Data Trial, an existing Nottingham City Council in liaison with the University of Nottingham. This will comprise the collection of real-time traffic count and journey time data, integrating this with public transport data to give a dynamic model of a mobility network centred at UoN’s Park campus.

3.1.31 **Package C: e-Mobility Hubs** seeks to broaden travel horizons and encourage modal shift with proof-of-concept trials in *neighbourhood, depot*, and *campus* mobility hubs (with reference to *Figure 3*) comprising the offering of electric mobility hubs that will enable users to exploit a variety of transport choices.

3.1.32 **Neighbourhoods:** this will seek to reduce car dependency via the provision of secure cycle parking, e-bike charging and docking points, electric car club hire, and EV charging, and will be trialled in the anticipated Trent Basin residential development.
3.1.33 **Depots:** located in Nottingham’s Eastcroft depot, this strand will seek to encourage the shift towards electric and hydrogen-fuelled vehicles through the purchase of specialist electric vehicles, implementation of vehicle telematics services, V2G technology contributions, and the embedding of training and skills development in liaison with the Nottingham Electric Vehicle Services Maintenance and Repair Centre.

3.1.34 **Campus:** East Midlands Gateway, Rolls-Royce, Nottingham Enterprise Zone, and the University of Nottingham will see the introduction of a fleet of connected and autonomous shuttles, alongside the provision of e-bike charging, smart bus stops, and EV charging, in line with the *campus of the future* concept.

3.1.35 **Go Ultra Low Nottingham:** £6.12m of funding announced by the Office for Low Emission Vehicles to Nottingham city constituted one of four city regions allocated funding in the Go Ultra Low City Programme nationally. This package aims to deliver a raft of measures to support the uptake of ultra-low emission vehicles (ULEVs) up to 2019/20.

3.1.36 The scheme will see the provision of 200 EV charge points in the Nottingham area; introduce a designated ULEV lane to facilitate and reward the shift towards sustainable transport; and offer try-before-you-buy schemes for the purchase of electric taxis. To support the uptake of these technologies the city council anticipates working with local businesses and the community, offering consultancy advice on sustainable transport choices, hosting events in partnerships with local dealerships, and offering advice from industry experts.
3.1.37 Despite these progressive policy measures, the benchmarked registration (vehicles per capita) of ultra-low emission and electric vehicles (ULEVs and EVs) shown in Figure 4 and Figure 5 indicate a need for greater incentivisation amongst the D2N2 populace towards the uptake of more sustainable transport options. Falling behind both the East Midlands and national average of 1.95 and 1.29 EVs (resp.) and 2.00 and 1.47 ULEVs (resp.) per 1000 inhabitants\textsuperscript{13}, this disparity is perhaps mitigated by a greater reliance upon public transport than the national average.

\textsuperscript{13} DfT vehicle licensing statistics, VEH 0131/2, 2018
3.2 OEMs and Innovators

3.2.1 The latest ONS data show a competitive industrial composition, with Manufacturing, Transportation, and Scientific and Technical services industries comprising 27% of the value added. These industries, jointly key to Intelligent Mobility development, are projected to grow by 12% over the next decade\textsuperscript{14}.

\textsuperscript{14} Cambridge Econometrics estimates for the Midlands Engine Independent Economic Review. 2019-2030 time frame
3.2.2 This competitive footprint in Advanced Manufacturing and multiple R&D projects and feasibility studies with local HEIs put D2N2 in a strong position to pursue developments in vehicle design and engineering in the Electric and Hybrid Vehicles (EHV) and Rail sectors. More on this in breakdown of Innovate UK Grants, see below.

3.2.3 Our competitive footprints in automotive, rail and locomotive, and aerospace manufacturing are led by several multinational firms and a number of high-growth SMEs in various affiliated industries, and comprises innovation in lightweighting, electric vehicles and power electronics, advanced materials, and logistics and vehicle telematics.

3.2.4 These industrial strengths are demonstrated in Figure 6, Figure 7, and Figure 8 exhibiting the centrality of the motor vehicle (SIC 29), transport equipment (SIC 30), and general repair, installation, and maintenance of machinery and equipment (SIC 33) to D2N2 employment and productivity. For a more granular analysis of LQs with reference to local business counts, consult Table 1: Automotive manufacturing, Table 2: Other transport equipment manufacturing, and Table 3: Repair, installation, and maintenance.

3.2.5 D2N2 boasts a robust automotive manufacturing ecosystem with a resilient and agile supply chain, supporting the presence of a high concentration of automotive OEMs and multinational Toyota, reflected by a regional GVA LQ of 1.7.

3.2.6 The Toyota manufacturing plant in Burnaston, one of two such in the UK, is the centre of production of the Auris Hybrid and anticipated to host production of Suzuki hybrid models by end of 2020. The plant is situated in the midst of a complex parts and services supply chain extending nationally and within the EU, with many major suppliers within a 10 mile radius operating on a just-in-time basis.

3.2.7 Innovation in light-weighting and power electronics for electric and hybrid vehicles is supported by a flourishing R&D ecosystem in advanced materials, academic alliances with the University of Nottingham, and local SMEs in composites, including EPM Composites, Cytec, FAR-UK.

3.2.8 The D2N2 LEP area comprises 29% of jobs in Manufacture of Railway Locomotives and Rolling Stock nationally, with an employment LQ of 9.2\textsuperscript{15}, evidencing a competitive footprint in rail and locomotive and reflecting the presence of the Bombardier manufacturing plant in Derby, centre of manufacturing, diagnostic and fleet control, and vehicle refurbishment, and recipient of £113k in IUK grants for innovation in locomotive performance and efficiency.

\textsuperscript{15} D2N2 Science and Innovation Audit (SQW)
3.2.9 The significance of the D2N2 rail and locomotive industry base is exhibited by the presence of all five members of the Midlands Rail Forum, comprising industries from rolling stock and equipment leasing to data science and cloud consultancy: SNC-Lavalin, Porterbrook, Bombardier, Resonate, and Elastacloud.

3.2.10 D2N2 is home to an aerospace R&D and manufacturing hub, supported by the headquarters of multinational engineering firm Rolls-Royce in Derby accounting for 14,000 jobs in the region, and partner in the Rolls-Royce University Technology Centre in Manufacturing Technology multidisciplinary research group at University of Nottingham, exploring all aspects of aerospace manufacture, part of the Rolls-Royce UTC group.

3.2.11 Innovation in light-weighting and electrification is exemplified by Rolls-Royce’s participation in the E-Fan X project alongside partners Airbus and Siemens, and £35m IUK funding in aerospace 2004-2019, in line with the European Commission’s Flightpath 2050 Vision for Aviation.

3.2.12 Innovation in light-weighting and power electronics for electric and hybrid vehicles is supported by a flourishing R&D ecosystem in advanced materials, academic alliances with the University of Nottingham and local SMEs in composites, including FAR-UK, collaborator in international projects in lightweight (Esprit, Light-Join) and sustainable (RE Cotrans) automotive technology; Cytec advanced materials and EPM, high-end composites manufacturing, recipients of IUK grants in lightweight vehicle design.

3.2.13 This innovation in composites is supported by the University of Nottingham’s Composites Innovation Cluster in liaison with the National Composites Centre and endorsed by the National Skills Academy. This strategic scheme was established to support the delivery of a nationally connected network of composite knowledge and technology providers to address the market failures facing composites for high value manufacturing applications in the UK.

3.2.14 Key to the future success of the D2N2 advanced manufacturing landscape will be a strategic and fluid response to competition and external threats; in line with the UK government’s pledge to reduce greenhouse gases to net zero by 2050\(^\text{16}\), energy-intensive industries such as automotive manufacturing and the steel production upon which they rely will be exerted to increasing policy pressures towards decarbonisation. In view of this the process innovation seen in Toyota’s Burnaston production plant is a progressive step towards sustainability; as part of Toyota’s ‘Sustainable Plant’ initiative, the site aims to generate 4.3GWh of energy per annum through a solar photovoltaic array\(^\text{17}\), the largest of its kind connected to an industrial site in the UK.

\(\text{16 UK becomes first major economy to pass net zero emissions law}\)

\(\text{17 Toyota UK Renewable energy}\)
Figure 6: D2N2 rankings in motor vehicles

- Employment (FTE): 4,430
- Productivity: £162,980
- Growth (2012-17): 48.9%
- GVA: £0.7bn

£722.0M
GVA
1.6%
Share of D2N2 economy

4.4K
Employment (FTE)

Figure 7: D2N2 rankings in manufacture of other transport equipment

- Employment (FTE): 20,513
- Productivity: £46,996
- Growth (2012-17): -14.0%
- GVA: £1.0bn

£964.0M
GVA
2.1%
Share of D2N2 economy

20.5K
Employment (FTE)

Figure 8: D2N2 rankings in repair and installation of machinery and equipment

- Employment (FTE): 5,215
- Productivity: £60,403
- Growth (2012-17): 86.4%
- GVA: £0.3bn

£315.0M
GVA
0.7%
Share of D2N2 economy

5.2K
Employment (FTE)
Table 1: Automotive manufacturing

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LQ</td>
<td>1.37</td>
<td>1.28</td>
<td>1.68</td>
<td>0.93</td>
</tr>
<tr>
<td>Count</td>
<td>140</td>
<td>40</td>
<td>45</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 2: Other transport equipment manufacturing

<table>
<thead>
<tr>
<th>SIC</th>
<th>30: Manufacture of other transport equipment</th>
<th>3020: Manufacture of railway locomotives and rolling stock</th>
<th>3030: Manufacture of air and spacecraft and related machinery</th>
<th>3099: Manufacture of other transport equipment n.e.c.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LQ</td>
<td>1.21</td>
<td>3.47</td>
<td>1.12</td>
<td>1.60</td>
</tr>
<tr>
<td>Count</td>
<td>85</td>
<td>15</td>
<td>30</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 3: Repair, installation, and maintenance of machinery and equipment

<table>
<thead>
<tr>
<th>SIC</th>
<th>33: Repair and installation of machinery and equipment</th>
<th>3315: Repair and maintenance of ships and boats</th>
<th>3316: Repair and maintenance of aircraft and spacecraft</th>
<th>3317: Repair and maintenance of transport equipment n.e.c.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LQ</td>
<td>1.42</td>
<td>0.29</td>
<td>0.90</td>
<td>2.88</td>
</tr>
<tr>
<td>Count</td>
<td>565</td>
<td>5</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

3.2.15 A metric for D2N2 enterprise innovation is presented in an analysis of Innovate UK (IUK) grant recipients in the LEP area (2004-2019)\textsuperscript{18}. Grants are allocated to both private enterprise and public research institutions comprising HEIs, Derby and Nottingham City Councils, and the Nottinghamshire-based Health & Safety Executive, and comprise product and service R&D, testbeds and proof-of-concept, technology accelerators, and upscaling grants. Categorisation of successful IUK project proposals by research/industry specialism reveals a growing D2N2 R&D, innovation, and manufacturing hub in future mobility, with 52% of the D2N2 grant total allocated for projects in Manufacturing, Materials, and Mobility, as visualised in Figure 9.

\textsuperscript{18} IUK funded projects since 2004
3.2.16 Notable here (with reference to Figure 10 and Figure 11, detailing grant allocation and number of funded projects by specialism, respectively, in future mobility related developments) is the diversity of the D2N2 innovation landscape, with R&D in advanced materials and lightweighting, drivetrain and power electronics, electric batteries and vehicle-to-grid technology, and logistics and telematics in each of the automotive, rail, and aerospace industries supported by a basis of research advanced manufacturing techniques, production processes, and feasibility studies. The capital-intensive projects evident in the aerospace sector here are accounted for by research into aircraft design and electrification primarily by the University of Nottingham and Rolls-Royce Plc, receiving 41% and 48% of the grant total in this sector, respectively.

3.2.17 Promising here is the presence of micro, small and medium enterprises (MSMEs) in the D2N2 innovation environment, as indicated in Figure 12; 43% of IUK funded projects in developments relating to future mobility were led by MSMEs, including a number of disruptive high-growth enterprises (Nexor, cybersecurity; Romax, gearbox, drivetrain, and bearing technology; Microlise, fleet telematics), with large manufacturing enterprises such as Ford Motor Company Ltd., GE Aviation, Rolls-Royce, and global consultancy firm AT Kearney often participating in research partnerships with local HEIs.

3.2.18 The LEP comparison offered in Figure 14 demonstrates D2N2’s competitive footprint in Materials, Manufacturing & Mobility; the LEP area sits comfortably within the top 10 LEPs (excluding London and the South East) rated by IUK grants awarded in this sector, and occupies a corresponding place of fifth in the Midlands. Key to the development of the future mobility innovation environment in D2N2 will be a continued exploitation of such funding opportunities if it is to maintain its place as a leading centre of manufacturing in the UK.

3.2.19 Key in assessing the robustness of the D2N2 innovation landscape is the translation between allocated grants and project expenditure to date; as visualised in Figure 9, 62% of the estimated £104m grant total in Manufacturing, Materials, and Mobility (of which around £78m comprises projects in future mobility developments) awarded between 2004 and 2019 has been utilised, with 77% of projects having spent more than 50% of the grant allocated, 73% more than 70%, and 53% more than 90% (see Figure 13 for a visualisation of this distribution). This competitive project implementation ratio points to an intensive and agile future mobility innovation landscape in D2N2.
Figure 9: D2N2 IUK Grant Harnessing by Sector

Figure 10: D2N2 IUK Future Mobility Grant Allocation by Specialism

Figure 11: D2N2 IUK Future Mobility Projects by Specialism
Figure 12: IUK grant by enterprise size

Figure 13: IUK future mobility grant use distribution

Figure 14: Manufacturing, Materials & Mobility IUK grants by LEP (excluding London and the South East)
Case study: Microlise

A high-growth fleet management enterprise base in Nottingham, Microlise work with a varied portfolio of clients and research partners to deliver services in Fleet Management and Telematics; Safety, Heath and Compliance; Journey Management; and Delivery Management. These combined services account for a 472k metric tonne reduction in CO₂ output and a £210m saving in fuel costs amongst its customers annually. The recipient of £1.56m in grants and £243k in fundraising, Microlise has benefited from Innovate UK funding between 2013 and 2019, in projects comprising EHV and low-emission vehicle trials, predictive modelling and vehicle maintenance, and a research partnership with the University of Nottingham in transport logistics and optimisation. Notable also is work with the Smart Systems and Operations team of the University of Nottingham’s Transport, Mobility and Cities portfolio in vehicle telematics and optimisation, aimed at reducing the costs associated with empty freight runs.

3.2.20 The R&D and innovation landscape enjoyed by the D2N2 LEP area is supported by its three higher education institutes and comprises a number of academic alliances, knowledge transfer partnerships and corporate collaborations.

---

19 https://www.microlise.com/

20 Beauhurst database profile.
3.2.21 The University of Nottingham is a key player in producing internationally recognised research in STEM and is a participant in a number of academic alliances and knowledge transfer partnerships, including a Deep Academic Alliance (previously the IMPETUS project) with Transport Systems Catapult alongside the University of Leicester; the i-Motors consortium (smart technologies for data transfer and storage in CAVs); and the CAPRI consortium, funded by IUK and the Centre for Connected & Autonomous Vehicles for research in CAVs.

3.2.22 The Transport Systems Catapult-UoN Deep Academic Alliance will bring together academia, research councils and key industry players to provide evidence and policy advice to underpin, plan and regulate new transport systems; over the next five years it will seek to increase the budgetary focus of local and national government upon transport innovation, leveraging the UK’s industrial and research potential in accessing the emerging future mobility market.

3.2.23 The UoN Transport, Mobility, and Cities research portfolio in urban mobility and smart cities comprises projects in advanced and precision engineering, composites, telematics, logistics, and human factors, and is the integrated output of multidisciplinary research groups throughout the university.

3.2.24 Illustrative of this rich research environment is the university’s receipt of both domestic and EU funding: 94 Horizon 2020 projects with a total value of €381.4m, and in excess of £8m Innovate UK (IUK) funding for future mobility projects in data analysis, telematics, remote sensing, power electronics and drivetrain, vehicle-to-grid tech., electric batteries, and advanced materials science.

3.2.25 Key to this research excellence is the university’s precedent in corporate collaboration; Table 4: University of Nottingham corporate co-authorship exhibits the extent of this in automotive, rail and locomotive, and aerospace R&D.

3.2.26 The University of Derby Institute for Innovation in Sustainable Engineering is the focal point of academic alliances with Rolls-Royce, Toyota, Bombardier, delivering expertise in additive manufacturing, manufacture software, product development and materials testing offered to facilitate innovative solutions in SMEs.

3.2.27 Nottingham Trent University’s collaboration with Transport Systems Catapult via the IMPART project alongside Coventry, de Montfort, and Loughborough universities, is key in assessing intelligent transportation and transport infrastructure solutions. Indicative of the university’s research strengths are its 27% of IUK grants (2015-18) awarded for projects in advanced materials, high-value manufacturing, transport, and urban living; and 62% in energy.
Table 4: University of Nottingham corporate co-authorship

<table>
<thead>
<tr>
<th>Institution</th>
<th>Co-authored Publications</th>
<th>Institution</th>
<th>Co-authored Publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>JLR</td>
<td>20</td>
<td>Airbus Group</td>
<td>3</td>
</tr>
<tr>
<td>Rolls-Royce</td>
<td>18</td>
<td>Ford Motor</td>
<td>3</td>
</tr>
<tr>
<td>Network Rail</td>
<td>14</td>
<td>General Motors</td>
<td>3</td>
</tr>
<tr>
<td>General Electric</td>
<td>9</td>
<td>BMW Group</td>
<td>2</td>
</tr>
<tr>
<td>Alstom</td>
<td>6</td>
<td>Transport Systems Catapult</td>
<td>1</td>
</tr>
<tr>
<td>Arup Group</td>
<td>4</td>
<td>Transport Research Laboratory Limited</td>
<td>1</td>
</tr>
</tbody>
</table>

3.2.28 Smart Specialisation Hub (SSH) data\(^{21}\) points towards the strengths of D2N2 academic alliances; the region score 21% higher than the average LEP on interactions between HEIs and businesses in consultancy and 185% higher in contract research (2015-'16), yielding a benchmark score of 2.24 for combined interaction. As indicated in the UK Government’s *Future of Mobility: Urban Strategy*\(^{22}\), our national assets in mobility comprise the international research excellence of HEIs, and a strong pedigree in the aerospace and automotive industries; this puts D2N2 in good stead to exercise these strengths in competitively accessing the emerging future mobility market.

3.2.29 Further SSH analysis (2015-16) of graduate employment points to a high persistence of graduate enterprises in D2N2, ranking the region with a benchmark score of 1.74 for graduate start-ups persisting three years or longer. With reference to

3.2.30 Figure 15: D2N2 graduate employment, we see a strong precedent for technical innovation, with 7.4% of 1st degree graduates working in Transport, Storage, and Communication, 7.9% in Mining and Manufacturing, and 9.8% in Professional, Scientific and Technical activities.

3.2.31 Necessary for D2N2 to capitalise upon this technical skills base is the mitigation of an emerging graduate ‘brain drain’ amongst its HEIs; data from the Higher Education Statistics Agency\(^{23}\) points to graduate retention rates of 29% and 22% for the University of Nottingham and Derby (resp.), with displacement of a valuable skills base occurring as graduates choose to relocate (often back home) to London and the South East.

---

\(^{21}\) SSH LEP profile

\(^{22}\) UK Gov. FoM Urban Strategy

\(^{23}\) HESA, 2016/17