BRADFORD DISTRICT

DIGITAL STRATEGY 2022-2027

LAYING THE FOUNDATIONS

City of **BRADFORD** METROPOLITAN DISTRICT COUNCIL

CONTENTS

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FOREWORD

Advances in technology and its increasing integration into every aspect of society is transforming the way we work, travel, power our homes and access health care, education and local services. Whilst this transformation has been significant in recent years, it is small in comparison to how technology will transform our lives in the years to come. Added to this is the need to respond to the climate emergency, the continuing challenges of the pandemic, the need to nurture growth in the local economy and ensure our local communities and businesses are not excluded by the opportunities digital technologies will bring.

We need to ensure that Bradford District continues to thrive and develop the right skills, infrastructure and businesses that will empower people to self-serve, encourage social innovation and build a prosperous and connected district.

It is against this backdrop that this Digital Strategy for Bradford District is designed, to transition Bradford as a community and place into the future where it has integrated the best of digital and smart technologies to improve the lives of the citizens of Bradford District and support the district's priorities for Clean Growth.

This Strategy encompasses initiatives already underway, investments we are making now to take us forward, and areas to be considered to help us identify opportunities into the future. The focus is on getting the foundations right, building capability in emerging technologies and lifting our ambition through digital growth priorities.

This is just the beginning, it is a living strategy. It is an opportunity to reshape the future of the district to ensure all our communities can thrive. We will continue to develop the strategy together with our partners and adjust course as we need to, to ensure we are successful in reaching our ambitions.

As the district makes the changes necessary to keep pace with a digitally transforming world, it's important we bring all our communities along with us. We need to make sure our citizens see and experience the benefits of digital and smart technologies and that we are able to meet the technological expectations of our community. This cannot happen if sections of our communities feel left behind – we need to work with all our communities to ensure a digital future is for everyone.

We will achieve this together, relying on partnerships with all communities, industry and government. We will work in unison with the Mayor of West Yorkshire and the West Yorkshire Combined Authority to achieve these goals. Digital technology provides an opportunity for a brighter future for Bradford District to become an innovative and resilient world class leader. It is hoped this strategy provides a coherent framework and a "call to arms" to focus our collective efforts to achieve that aim.

Kersten England
Chief Executive
City of Bradford Metropolitan District Council

BRADFORD DISTRICT SHARED VALUES

WE PROTECT each other and the world we share so that everybody can be happy, healthy and safe

WE SHARE ideas, resources, knowledge and skills as well as our challenges and opportunities

WE RESPECT ourselves, each other and our communities

WE CARE for each other and treat each other with kindness

DIGITAL STRATEGY-ON-A-PAGE

AIM: **To support Bradford District's social and economic development in a sustainable way**

SUB GOALS:

Laying the Foundation for Success	Building our capabilities in new technologies	Lifting our ambition on Digital Growth

We are supporting the achievement of our goals by delivering this initial set of capabilities in four critical areas:

Connected District

100% Gigabit Capable Connectivity: A programme to deliver 100% Full Fibre gigabit capable connectivity across the whole district including a barrier-busting programme with mobile operators to accelerate 5G rollout.

Fixed Wireless Access Rural Programme (FWA): providing gigabit coverage to poorly served rural district communities and businesses.

Smart Place Infrastructure: Build on our LoRaWAN and 34 Gateway network across the district providing the foundation for smart city application growth. Use cases will be developed in conjunction with citizens to deliver value to our citizen's priorities.

Digital Work Plan to support UK City of Culture (CoC) 2025. A digital plan to support CoC and the increased requirement for connectivity for the cultural celebration of Bradford.

Data-Driven Decision Making

Data Analytics Platform: Building on investments already made to create an analytics platform to drive "whole-systems" approach to services.

Digital Twin Modelling – Virtual Bradford – a 3D model of the city centre already established with further investment in its development across the city to support the planning of Bradford's new development frameworks and its clean growth objectives.

Globally recognised as a Centre for Citizen & Data Science: A plan to build on our world class programmes such as Born in Bradford, and to optimise the opportunities for growth from Data Science, skills development and innovation.

Digital Economy

Entrepreneurship Ecosystem Support: Enhanced programmes of support for innovative start-ups and scale-ups.

Targeted Investment – creating better intelligence and marketing collateral to promote Bradford's strengths as a hub for Data Science, Skills & AI Innovation. Look to secure inward investment and target foreign direct investment (FDI) opportunities. Looking to secure investment.

Regional Digital Skills Plan: in place including Digital Skills Partnership Programme, CTE Partnership Boards, Digital Makers initiative, and working with industry and academia to identify and close gaps in digital skills.

Circular / Green Economy – Targeted support to this sector including supply chains; Complete Green Economy audit as part of our Clean Growth Strategy.

Digital Inclusion

Framework for Delivery – a comprehensive approach with a new local stakeholder governance framework & investment in dedicated resources.

Champions Network & Community Programmes – a digital champions community network established. Baseline of current activity documented and now creating a prioritised Community Programme to address where need is most urgent.

Subsidy Schemes for Connectivity & Skills – a programme of support to access various schemes and benefit from the social value obtained from our network procurement.

AI for Bradford – AI Innovation Partnership – working together in a public-private-academic partnership across Bradford District to drive economic growth and improve competitiveness and innovation of Bradford businesses

MEASURES OF SUCCESS BY 2027

- Whole district coverage of affordable gigabit capable connectivity
- All our citizens have the essential skills to succeed
- Economy growth faster than UK average
- Established at least 10 start-ups or scale-ups through the Innovation Partnership
- Moved from promising IoT Tech pilots to delivering real world citizen value at scale in at least 10 key use cases
- Bradford recognised as a global centre for researching attracting significant inward investment

Key Budget Highlights (Initial)

- £100m+ investment in digital connectivity
- £2.5m investment in smart city platform capability
- £5m 5-year capital programme

Relevant Strategies & Plans

- District Plan
- Council Plan
- Economic Strategy and Economic Recovery Plan
- Clean Growth Strategy
- Local Plan
- Joint Health and Wellbeing Strategy

INTRODUCTION

This Digital Strategy is just the start of a strategic map for the digital transformation of Bradford. Much of that map has yet to be decided and will require a robust stakeholder collaboration and engagement framework to develop. Some of it will be driven by the West Yorkshire Combined Authority Strategy, which we are very much a part of. However, there is also a need for Bradford to develop its own strategy to build our digital and smart capabilities as a district particularly for our clean growth aspirations.

To develop such a strategy and roadmap to its fullest is a significant task with many complexities requiring significant stakeholder engagement. One could also argue that the continued pace of technology change, and the increasingly social-economic and environmental challenges means the strategy will constantly evolve as a living entity. How far do we look into the future? How aspirational should we be whilst being pragmatic on successful delivery with the constraints we face? What should the vision for Bradford be as a Smart Place? How can we move forward with confidence in an ever changing environment and the economic challenges we face?

As we faced the pandemic, and with too many variables and constraints, we took the view that the development of a digital strategy for the district would have to be an incremental approach. The first of these is laying the foundation. Can we make progress with essential capabilities we know we need as our strategic vision and priorities for the district continues to develop? This approach would ensure that progress in our digital infrastructure continued.

Bradford's approach – incremental, pragmatic and deliverable

Ambition should match readiness. Bradford should take precautions not to be too overambitious in its initial plans. Think building blocks; Build, Increment, Review, Grow

Laying the Foundations

Initial focus on Core Capabilities, building resilience & sustainability

- Identify Key Building Blocks
- Baseline Current Activity
- Assess Maturity & Identify Gaps
- Strategic Options Assessment
- Business Cases for investment

Building our Capabilities

Focus on the district's unique strengths and distinctive opportunities

- Incremental Steps – pilot, learn
- Build Confidence & Consensus
- Build Partnerships
- Develop Smart City Roadmap
- Build our innovation capability on Data.

Lifting our Ambition

Smart City Landscape developed based on citizen priorities and data insight

- Apply Core Capabilities to Scale
- Smart City architecture & governance in place
- Data-driven decision making
- Whole-Systems Approach to solving challenges and exploiting opportunities
- Innovation that delivers digital growth

Developing Vision for Bradford District »

1. **Laying the foundations for success** – by creating the environment to prosper. This includes investing in digital infrastructure and the foundation platforms needed to build a smart district and achieve our clean growth aspirations.

2. **Building our capabilities in emerging technologies** – such as industry 5.0 technologies, Artificial Intelligence (AI), Internet of Things (IoT) and other emerging technologies driving future productivity to ensure Bradford District's citizens benefit from technology development and its use.

3. **Lifting our ambitions on digital growth** – building an environment where we can be confident in setting and achieving high aspirations in developing as a recognised Global Hub for Data / Citizen Science and a dynamic and emerging technology sector.

We are ambitious, but also take a pragmatic approach to deliver clearly identifiable results in achievable stages. In the short-term there is a focus on governance, baselining, a focus on engaging with stakeholders to form partnerships and an effective approach to selecting and prioritising digital projects, building on existing initiatives, setting clear targets for activity, and clarity of roles in advancing the digital agenda. This will build on the many achievements to date discussed under each theme. Medium term we will see executable programme development and delivery of the more ambitious projects, secured inward investment and working in collaboration with stakeholders. Longer term is scaling up initiatives for growth and innovation and measuring and reflecting on progress and impacts.

Whilst this strategy is focused on laying the foundations, it also proposes steps we can take now in order to begin improving our capabilities and lifting our ambitions. What are those core capabilities, what is our maturity assessment against them, can we prioritise those which builds on our strengths and where we can deliver progress as we emerge from the constraining landscape subjected by the pandemic?

It is in this spirit that this strategy document is published as the first part of the strategic journey. There is still a need to develop, as a collective group of stakeholders, a vision for Bradford District on how it wishes to digitally transform and use these new technologies. The core capabilities we seek to progress now will support that emerging vision. What

'smart city' use cases emerge will be determined by our citizens' priorities and contributing to our clean growth aspirations. In our view it would have been very difficult to develop all that detail in one go and would have been likely to be counter-productive. There is much still to collaborate and consult on our strategic and tactical thinking and this document should be seen in that context.

It is our intention to work with all stakeholders to develop further these capabilities and the next stage of the strategy. It is hoped this document acts as a call to arms to work with our partners on a programme to develop our strategic thinking further and produce an effective roadmap integrated to our Local Plan and Clean Growth Delivery Framework. The Council will put in place a development framework to enable this.
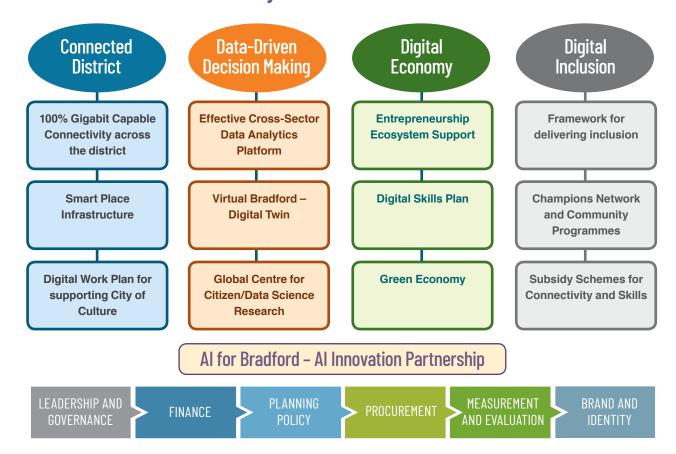
Key Themes & Core Capabilities

A review of digital strategies across the UK and beyond presents an array of ambition, priorities and scope. Our research shows the overwhelming focus is on improvement in the local quality of life, linked to improvements in economic opportunity, community engagement and integration, and a reduction in the environmental footprint.

They highlight common challenges faced, economic, political, and environmental, but there is also a common set of core capabilities that are essential to success, pursued with different priorities. Understanding and having a focus on these core capabilities provides us a framework to help structure our roadmap and deliver our goals.

Below depicts each of the key themes and their associated core capabilities we have identified whilst taking account of our own strengths and baselining. Also identified are a set of cross-cutting key enablers. Why these are important, our current maturity, the actions we will take and what the future could look like are discussed under each theme within the document.

Key themes and enablers

Connected District	Data-Driven Decision Making	Digital Economy	Digital Inclusion
100% Gigabit Capable Connectivity across the district	Effective Cross-Sector Data Analytics Platform	Entrepreneurship Ecosystem Support	Framework for delivering inclusion
Smart Place Infrastructure	Virtual Bradford – Digital Twin	Digital Skills Plan	Champions Network and Community Programmes
Digital Work Plan for supporting City of Culture	Global Centre for Citizen/Data Science Research	Green Economy	Subsidy Schemes for Connectivity and Skills

AI for Bradford – AI Innovation Partnership

LEADERSHIP AND GOVERNANCE → FINANCE → PLANNING POLICY → PROCUREMENT → MEASUREMENT AND EVALUATION → BRAND AND IDENTITY

Outcomes

There are many outcomes we can envisage if we deliver all of the above. By building on those capabilities and continuing to develop the strategy with our partners we believe together we can achieve the following five outcomes within five years. These are:

● All premises across the district, domestic, business and academic have access to affordable gigabit capable connectivity and Bradford District is one of the first areas in the UK that mobile operators look to when implementing their new generation of mobile technology (5G, 6G, 7G).

● There is a high density of high tech companies, a thriving Green Economy of entrepreneurs with less reliance on legacy industries such as low tech manufacturing and low wage service sectors. Bradford is home to several new businesses, from start-ups and SMEs to larger businesses actively developing, adopting and applying new technologies to identify new service applications, commercial products, disease diagnoses, improving health and tackling climate change. The AI Innovation Partnership is well established having a great impact making the district a leader in innovation and creating skills and employment opportunities through the attraction and creation of highly innovative companies.

● A smart city architecture together with advanced analytics tools is supporting a 'whole systems' approach to service planning across the district in areas such as Environment (air quality, flooding, ground temp), Transport (traffic management, parking, fleet tracking), Health (movement and activity monitoring for elderly), Energy, Buildings management and many other areas to improve the everyday lives of our citizens.

● Bradford District is a recognised leader of Citizen Science and a global centre for research backed by a number of prestigious awards for its work with citizen science and public policy. The digital twin application provides a 3D model of the district, and is now having a profound impact on a number of fields, from local architecture and urban development to healthcare, manufacturing and cultural heritage.

● We have closed the attainment gap for disadvantaged learners, so that each of our communities are able to access and progress in learning, and experience the economic benefits of being part of a highly skilled, diverse and flexible workforce. An inspired student population, increased apprenticeship uptake for ICT, growth of graduate skills retention in the region and provision of more work-ready students to support the West Yorkshire economy.

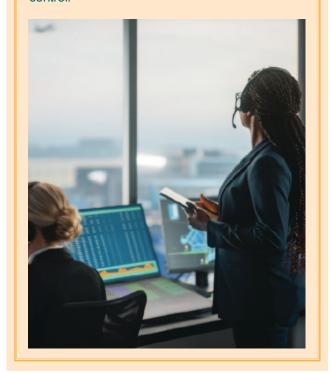# Opportunity for Bradford as a UK Leader in AI & Data Science Innovation

In addition to enhancing our digital capabilities, the strategy makes the case for a unique opportunity for Bradford to combine our strengths to promote innovation, growth and inward investment.

There is an opportunity for Bradford to position itself as a leading centre for data research if we can join the dots and link our world class data science programmes to a developing skills base and our excellent University capability, to entrepreneurship and investment.

Employers in the UK and US tell us they struggle to find talent with data science skills - data capture, analytics, visualisation, AI, Machine learning, business analysts. We believe there are investor opportunities who are looking to support skills and innovation programmes in AI & Data science and AI innovation.

Bradford is strong in these areas, has a very young population, is leading in data programmes, can demonstrate studies that are globally recognised, has a forward thinking university, successful AI innovation programmes, a Health Tech sector and creative businesses.

A team of Bradford researchers in the Bradford Renduchintala Centre for Space AI developed a ground breaking AI based system to combat cyber-attacks against aeroplanes and air traffic control.

We believe the ingredients are there to seize the opportunity of an explosion in demand for AI and data skills and programmes. AI innovators need data, skills and engagement in real world programmes to succeed. Bradford District can offer it all.

There is also a need to support our businesses to digitally transform with industry 5.0 technologies and the need to provide the platforms for start-ups and scale-ups to thrive. The University already support Knowledge Transfer Partnerships with small businesses. There are also many support agencies helping businesses to pivot such as our own Invest in Bradford Team and other agencies providing mentoring support such as UK Innovate Edge that provide a vital service.

We believe there are additional opportunities to develop our support ecosystem to achieve digital transformation and growth of businesses, where innovation has the opportunity to develop driven by collaboration, data sharing and innovation. Under Digital Economy Theme we make the case for the need for a more formal collaboration partnership between public, private and academia to drive innovation. This would form part of, and leverage from, a wider research landscape already in place across Bradford District providing a unique opportunity to ensure its success in driving economic growth and place development.

This collaboration will help transform the district, based on a reputation for high quality research with industrial impact and relevance, with the aim to attract millions of pounds of inward investment to the district, drive global businesses and create jobs, whilst helping develop highly qualified graduates and postgraduates.

Artificial Intelligence will soon become mainstream in much of the economy and action will be required to ensure every sector and region of the UK benefit from this transition. The key drivers of progress, discovery and strategic advantage in AI are access to people, skills, data, computational power and finance – all of which face huge global competition. Bradford District has an opportunity now to capitalise on its emerging strengths in data science and skills and turn innovation into growth sectors such as Circular and Green Economy, Health Tech and advanced manufacturing.

The aim of this theme is to create the foundations for success by delivering a core digital infrastructure that supports economic growth, skills development, inclusion and effective public services

100% Gigabit Capable Connectivity / 5G / Fixed Wireless Access

Why is this important?

The evidence is conclusive that having world-class network connectivity is a significant enabler and pre-requisite capability to driving economic growth. It can encourage new business start-ups and business expansion enabled by easier access to markets, lower barriers to entry and the development of new business models that are digitally dependent and more flexible. Improved broadband speeds and greater penetration of gigabit fibre in an area will lead to new employment opportunities and a reduction in migration away from the area. Citizens will also have a general wellbeing benefit from better access to new and valuable services and can support community cohesion.

Bradford District has suffered from decades of under-investment in our infrastructure capacity and inadequate connectivity has been part of that. It is a barrier to growth and is affecting business location decisions, property values and our ability to attract new jobs and higher skilled residents. COVID has also highlighted that many of our citizens and businesses are digitally excluded whilst accelerating the need to "pivot" their business models.

Furthermore, 5G mobile connectivity is much more than a simple connection speed upgrade over 3G and 4G for consumers – it promises to underpin enterprise applications for a new generation of technology, with cities and urban environments set to see some of the most significant benefits. Our research has allowed us to develop insights into how pervasive 5G connectivity is supporting smart city innovation, linking up IoT devices in new ways to deliver real-time insights to provision and planning of public services. A full fibre and 5G deployed district will provide the backbone for our smart city and clean growth aspirations.

What is our ambition?

The ambition is that Bradford District is the best connected region in the UK and has a digital infrastructure that enables our ambitions.

Where are we now?

Analysis of DCMS & Telecommunications company's investment plans has shown that some areas within the district will still be without adequate broadband for some years. Telecommunication companies state 100% fibre to the premise won't be achieved by 2033 without further public sector intervention.

It is difficult to construct an accurate picture of the current situation with inconsistency in available information, vendor claims and an ever changing landscape. From published information, we know there are commercial plans from OpenReach to build fibre into Baildon, Shipley and Idle by April 2024. By which time CityFibre will have completed their current published investment plans, totalling some 150,000 homes. Virgin are also active in the area with significant investment providing 218,000 homes with a range of high speed connectivity.

From the ThinkBroadband data, we can see that the situation is patchy elsewhere suggesting possible dead spots providing slow superfast speeds with coverage

marginally better across the North & South West of the city. It is recognised that some areas within the district are less commercially viable, particularly in rural and less populated areas of the district. With no foreseeable planned commercial investment, approximately 20% of the district will remain with inadequate connectivity. These areas will continue to suffer inadequate connectivity without action.

As part of our strategy review we undertook an infrastructure audit across the district – connectivity, street furniture, fibre & ducting coverage, 4G coverage etc and began building a GIS Map to understand the levels of 'digital maturity' and identify gaps and opportunities. This work is on-going and will be maintained as the position progresses including mobile coverage.

We held a "soft market test" with commercial broadband providers to identify opportunities to extend connectivity investment, accelerate programmes and where possible, remove barriers and improve internal coordination. This included workshops with the mobile operator representatives to see how we can accelerate investment and rollout on 5G.

What are we going to do?

As the owner of significant land and property assets, a sizable consumer of connectivity and digital services as well its statutory role in respect of the entire development process, the Council has the opportunity to significantly influence the infrastructure position of the area and deliver Fibre to the Premise (FTTP) and 5G which will provide a ubiquitous digitisation across the district.

The Council is developing its planning policies to support the roll out of new digital infrastructure in line with policies in the National Planning Policy Framework (NPFF) which calls on Councils to "...support the expansion of electronic communications networks, including next generation mobile technology (such as 5G) and gigabit broadband connections."

The Council is also actively seeking ways to ensure our whole district including those rural hard to reach spots receive the connectivity they need; such as securing a partner to build and operate a Fixed Wireless Access Network which will deliver gigabit capable connectivity to public building sites in rural areas (including village halls and schools), creating the potential for local digital hubs which in turn will empower local residents, businesses

and the public sector and become a catalyst to attract fibre and wireless to benefit the wider community.

We will:

1. Establish a Digital & Data Board which will oversee the development of network connectivity across the district, monitoring progress on commercial build plans and removing barriers where appropriate to ensure a smooth and accelerated deployment.

2. Maintain a strategic map of connectivity across the district to identify current low spots and not spots and monitor progress. A number of data overlays will allow analysis of opportunities and priorities e.g Council assets, local, regional and national funding opportunities. This will help us to accelerate improving gigabit connectivity, optimise investments and prioritise implementation across Bradford District.

3. Through our network procurements, stimulate social value investment in fibre-infrastructure in rural areas with no current plans for adequate connectivity.

4. Create a Bradford Council small cell licence agreement and standard Heads of Terms which will be utilised for access to public sector owned street furniture including Street Lighting, CCTVs, etc to accelerate deployment and attract further investment from the mobile operators. This will ensure Bradford District is a priority area for 5G deployment and that Bradford secures an 'early mover advantage' in the investment and development of capability and skills as future 5G products, services and applications evolve.

5. Create a Planning Guidance Journal for future 5G and ..nG mobile deployments across the district to assist mobile operators achieve their deployment plans whilst ensuring best practice for engaging with communities on sensitive siting of the masts.

6. Using the fibre backhaul, create the environment for gigabit Fixed Wireless Access (FWA) network to create multiple 'base station' locations around the district and deploy FWA to difficult-to-reach locations particularly in our rural areas.

7. Gain maximum value from Council's own ducting/fibre including generating revenue to support funding the digital programme.

8. Explore the opportunity for railway trackside ducting to leverage assets and opportunities to connect households, businesses, rural schools and care homes in areas such as the Worth Valley. This will provide gigabit capable connectivity and supports Visitor Economy hotspots such as Haworth.

5 YEARS ON

What does 'good' look like?

1. All premises across the district, business, academic and domestic have access to affordable gigabit capable connectivity.

2. Bradford is one of the first areas in the UK that mobile operators look to when implementing their new generation of mobile technology (6G, 7G).

Smart Place Infrastructure

Why is this important?

Smart Place Technology is mature and now widely deployed, allowing the interconnection of computing devices embedded in everyday objects, enabling them to send and receive data. Sensors are embedded in physical infrastructure such as street furniture, buildings, practically anything physical.

There are a range of sensors that can read data such as air quality, traffic flow, footfall count, road temperature, condensation in rooms etc. This data is then transferred via a network, such as a LoRaWAN (Long Range Wide Area Network) to a back office data analytics application that can analyse and present visually the detail captured to assist in real time and long term planning decisions on the provision of services.

It can be the basis of a system embedded in the decision making process for governing every day decisions on running a city to make life better for citizens. From data capture, to connectivity to storage and advanced analytics to inform decision making in whole series of areas to make everyday life for our citizens better.

It will also support strategic objectives such as tackling Climate Change and contributing to Clean Growth.

What is our ambition?

Our ambition is to implement a smart place infrastructure providing the foundation for a whole ecosystem that will transform our economy by:
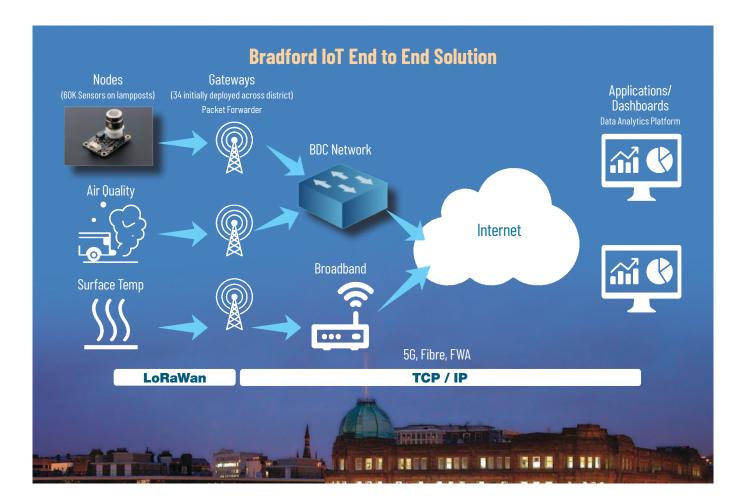
- delivering local service efficiencies

- allowing entrepreneurs to try out and demonstrate their ideas

- supporting the creation of new businesses in Bradford based on innovation.

- Enabling smart-tech solutions where mobile phone networks are inadequate.

- Teaching school children and students about the technology, increasing interest in coding careers.

Where are we now?

The Council was an early adopter of this technology and carried out a number of pilots, to begin the learning on how best the technology can be applied at a local level. Some of these were no more than the implementation of one or two sensors to understand what data can be captured, its usefulness, what works and what doesn't, a technical assessment of what is needed, what are the GDPR issues, security issues etc. The application areas varied from flood monitors and CO_2 sensors, to motion sensors for footfall count and bin sensors.

In addition, as part of the Council's multi-million-pound Smart Street Lighting programme, an end-to-end IoT Solution has been procured where every lamp post will be installed with a sensor. These in turn will be linked through a LoRaWAN network of 34 gateways. This provides the basis of an initial network sensor ecosystem located across the district providing an excellent capability to deploy a range of applications that can deliver real time data and real value across the district.

An analytics tools will receive the captured data, interpret and present the data to provide real time insight and knowledge to decision makers and service planners. The end-to-end solution is based on open standards to aid interoperability with other platforms and avoid proprietary lock-in. This is a key core capability already being established to help us meet our digital aspirations for the district.

Bradford IoT End to End Solution

Nodes (60K Sensors on lampposts)

Gateways (34 initially deployed across district) Packet Forwarder

Applications/ Dashboards Data Analytics Platform

Air Quality

Surface Temp

BDC Network

Broadband

Internet

5G, Fibre, FWA

LoRaWan

TCP / IP

The challenge now for the Council and its partners is to decide how best to use this capability, what are the priority needs of the citizens of Bradford that this technology can help with? How best do we collect, store and analyse data at the 'edge', and how can AI-enabled data analysis help with smart city planning? How can we leverage the significant investment made on IoT capability and how together with 5G can it deliver value to the citizens of Bradford?

From our own proof of concepts and the insight from our research we have concluded the following learning points to help guide us:

1. The landscape is "littered with pilots" and it was difficult to find large scale use cases. Moving from pilot to scale is a real challenge and some have struggled due to poor design choices.

2. Some areas have ended up "stuck in proprietary" and locked into vendor technologies creating a fragmented landscape across their area.

3. There is a need to shift thinking from what we can do with this technology to what are our needs and be smarter in procurement in the market place.

4. It is about narrowing it down and "getting the plumbing right".

5. Need to take a holistic view on how digitally enabled are our citizens and what are we doing about it. people's ability to use technology.

6. It is crucial to get the data strategy right, the right data platform and analytical resources. There is also a need for data sharing agreements; COVID shone a bright light on this and helped remove some barriers.

7. We need to put the citizens of Bradford at the centre of the solution design.

8. It is important to get local partners to work together and collaborate to leverage the investment landscape.

What are we going to do?

In summary, we will:

1. Draw from our learning to date to ensure we avoid the pitfalls identified.

2. Hold workshops with service representatives to demonstrate the art of the possible and capture service needs/priorities.

3. Develop a business case tool to capture, filter and prioritise application ideas to ensure success in delivering value to Bradford citizens.

4. Implement robust governance in place including effective citizen engagement to allow progression with confidence with the investment already made to date, from pilot to scale, applications that address the needs and priorities for Bradford Citizens.

5. Invest further in appropriate sensors for the chosen priority use cases.

6. Promote the network to businesses, entrepreneurs and the public and facilitate collaboration about their experiments/achievements/products/sales.

7. Promote and explain the LoRaWAN network across Bradford District and allow potential market suppliers to analyse locations and assess the potential market opportunities.

8. Provide briefings to the Wellbeing Board and LEP sector groups and their members and hold CBMDC Business Breakfasts promoting the technology.

9. Present school, college and university briefings to highlight the opportunities for student and teacher developments.

10. Promote achievements, capture outputs and outcomes.

5 YEARS ON

What does 'good' look like?

A 'Bring Your Own Gateway' programme has encouraged new innovations and provided a platform for developing schools and student talent, and is offering new opportunities where people are living and working now.

The application of this technology will be determined by local priorities, local need and delivering real value to the live-ability of Bradford Citizens. Robust business cases will be developed. We are confident that in five years we will have implemented a range of applications providing real value, typically in the areas of Environment (air quality, flooding, ground temp), Transport (traffic management, parking, fleet tracking), Health (movement and activity monitoring for elderly), Energy, Buildings management and many other areas.

Why is this important?

Bradford have secured City of Culture status for 2025, triggering a celebration of its people, its heritage and the district as a whole. It is expected to attract many visitors to the local economy to enjoy a whole range of events. The significant increase in visitors will require us to improve levels of connectivity, particularly in event spaces.

Where are we now?

The actions outlined above and further engagement with the market, working with the City of Culture team will ensure the district has adequate connectivity to support the festival of activity across the district in all event spaces.

What is our ambition?

To ensure that connectivity supports the City of Culture as a successful celebration of Bradford, and residents and visitors are able to fully engage with events.

What are we going to do?

1. Produce a Digital Work Plan for supporting City of Culture 2025 to ensure adequate connectivity and mobile coverage across venues, pop-up spaces, key buildings etc.

2. Ensure connectivity is of sufficient bandwidth and speed to support mass participation events and immersive technology installations where required.

3. Based on strategic mapping, intelligence of expected venues and performance sites, temporarily / permanently increase broadband and mobile coverage.

4. Procure a managed service or temporary broadband and / or mobile boosting infrastructure for city centre and other key performance sites.

5. Consider the potential for attracting sponsorship opportunities from procurements.

5 YEARS ON

What does 'good' look like?

A lasting legacy will be enhanced connectivity beyond the City of Culture to support large cultural and sporting events.

How Does the Connected District Theme Support District Plan Outcomes?

Children have the best start in life	Contributes to high-quality education in every setting. World-class connectivity will help reduce health and social inequalities and child poverty.
Residents achieve good health and wellbeing	It will create equitable access for patients supporting Primary Care Networks and Community Partnerships supporting new integrated models of care using virtual technologies Smart Place tech will allow people to live longer in their own homes, with access to high-quality care at home or in care settings when needed. Digitally enabled communities are able to connect with each other, collaborate, link support group tasks, share information and address isolation.
Sustainable economic growth and decent work for all	Excellent connectivity is critical to creating the conditions that enable people to secure good work, to reducing inequality in income, housing and ultimately in wellbeing. It will help attract and grow high value businesses in digital, health and green industries and support local people to develop the necessary skills and knowledge to access these jobs.
Safe, sustainable and inclusive communities	Smart Place Infrastructure will improve the live-ability of citizens in Bradford with more effective services, better planning and design on the use of space. Community applications will enhance social cohesion, create strong social bonds and active community involvement through volunteering and networks.
Action at all levels to address climate and environmental change	Excellent connectivity and smart place applications can make significant contributions to tackling climate change and reduce local carbon footprint of the region. Bringing improvements in our buildings, infrastructure, services and natural environment. The technology can help minimise waste, reuse and recycle resources, reshape and optimise supply chains movements. It will support the green economy and can help local businesses produce clean and safe products that are life-enhancing and support wellbeing in the home, community and working life and contribute to the district becoming an exemplar sustainable place. There is so much that smart place technology can do to address climate change. These applications will be developed as part of our Clean Growth Programme. AI can map the region and identify and track changes to the ecosystem year-on-year, providing stakeholders with evidence of environmental deterioration or recovery, information that confirms if the district is on track to meet its climate change targets.

DATA-DRIVEN DECISION MAKING FOR BETTER PUBLIC SERVICES AND DISTRICT PLANNING

The aim of this theme is to build on the foundations set in theme one by using the digital infrastructure to drive insight to support economic growth, place development and deliver more effective public services

Effective Cross-Sector Data Analytics Platform

Why is this important?

Together with advanced technology we have the opportunity to improve quality of life. The technology discussed in Connected District theme is only part of the equation – we need to integrate the advanced technologies and new data methods into traditional workflows to inform (better) data-driven decisions regarding service design and delivery.

Our IoT investment will set up a network which can accept sensors used by a variety of organisations. This will allow the district to harness creative ideas and technologies from our partners in both public and private sector. This in turn will create a landscape of data being produced across the district on a multitude of applications across many sectors. It is important we harness these capabilities with the right data capture, storage, processing and analytical tools.

What is our ambition?

That we are at the forefront in using smart technologies and data analytics to enhance the lives of the citizens and businesses of Bradford.

Using data and digital technologies is enabling us to take a "whole systems" approach to the challenges facing Bradford's public services and environment.

Where are we now?

Bradford has an improving culture of sharing data driven further by the pandemic, however there is a need to go further including making people aware of what data we hold across all stakeholders.

Within the Council there is no corporate data repository or a common data schema but a series of data warehouses for our larger systems. Our current focus is mainly on operational data and could do much more if we can break out of the "data bubble" that people are used to. Reporting tends to be on very defined datasets and doesn't consider what other data there could be to improve decision making. Considerable investment has been made on corporate tools such as Power BI which we can build on.

We need the capability to bring in data from multiple sources. Council Services have had to deal with multiple interfaces for various products, pushing suppliers to help them access the raw data so they can bring it together in tools like Power BI. What is required is digital access via APIs (Application Programme Interfaces) or direct connection to the Cloud source and not just manual extracts at expense to the Council. This is a common problem faced by all Councils but the landscape is changing with more APIs becoming readily available.

Regards GIS and spatial analysis tools, the Council have already invested in most of the tools recommended by the Economic & Social Research Institute (ESCRI) and are therefore well-equipped to visualise data.

What are we going to do?

1. Commission a review of the Council's current state of data management, analytics and reporting and develop a Data Modernisation Strategy.

2. Building on the Council review, curate a series of workshops around priority themes open to key stakeholders such as Born in Bradford (BiB), Act Early, University of Bradford, Health Partners with the aim of identifying potential challenges and use cases. Identify external capability amongst research, start-up and small business community.

3. Develop a clearly focused data collaboration programme on the back of the workshops, which includes issues around data demand, data ownership, data quality as well as organisational capability.
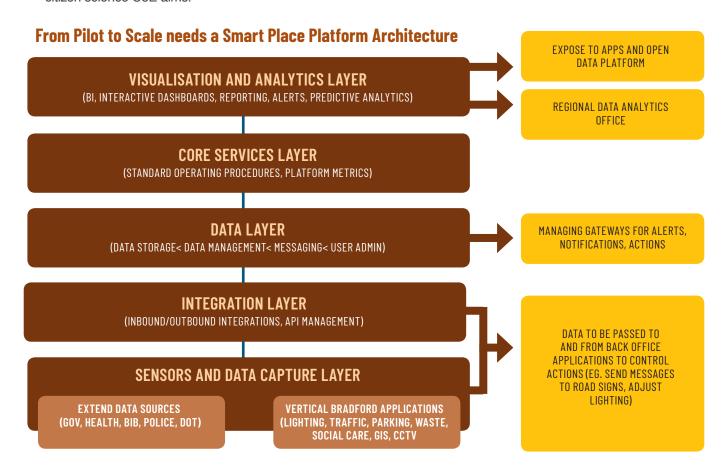
4. Produce a business case, priority use cases, adoption roadmap and Indicative Timeline – a set of actionable next steps and timelines for transitioning to the future state and how to execute on these.

5. Invest in training to give all staff a baseline understanding of data handling as well as ensuring our data specialists are equipped with advanced skills.

6. Develop a technology road map to establish the data and technical architecture and analytical tools to integrate with a range of data sources with clear milestones needed for the secure sharing of data, an operating platform capable of handling IoT data at volume and speed, and the broader aim of establishing district wide cloud-storage and the analytics potential it can support.

7. Establish a world class City Data Market, based on open standards and flexible interfaces

8. Engage with WYCA regional partners on a strategy for data and the business case for a regional data analytics office and appoint a Chief Information Role to oversee the development of a placed based data strategy delivering city data market and supporting citizen science CoE aims.

5 YEARS ON

What does 'good' look like?

We have in place central architecture that manages to bring disparate real time data streams from a range of sources into one place which advanced analytics tools can be applied to aid a whole systems approach to service planning and delivery.

Users can combine multiple data sets with a range of visualisation tools that will unlock the real value of data. Data can be mapped and the accumulation of data provide an insight into the issues facing both the citizens of Bradford and public services as it responds to the issues raised. Automation of processing and Self Service reporting is in abundance.

From Pilot to Scale needs a Smart Place Platform Architecture

VISUALISATION AND ANALYTICS LAYER
(BI, INTERACTIVE DASHBOARDS, REPORTING, ALERTS, PREDICTIVE ANALYTICS)

→ EXPOSE TO APPS AND OPEN DATA PLATFORM

→ REGIONAL DATA ANALYTICS OFFICE

CORE SERVICES LAYER
(STANDARD OPERATING PROCEDURES, PLATFORM METRICS)

DATA LAYER
(DATA STORAGE< DATA MANAGEMENT< MESSAGING< USER ADMIN)

→ MANAGING GATEWAYS FOR ALERTS, NOTIFICATIONS, ACTIONS

INTEGRATION LAYER
(INBOUND/OUTBOUND INTEGRATIONS, API MANAGEMENT)

→ DATA TO BE PASSED TO AND FROM BACK OFFICE APPLICATIONS TO CONTROL ACTIONS (EG. SEND MESSAGES TO ROAD SIGNS, ADJUST LIGHTING)

SENSORS AND DATA CAPTURE LAYER

EXTEND DATA SOURCES
(GOV, HEALTH, BIB, POLICE, DOT)

VERTICAL BRADFORD APPLICATIONS
(LIGHTING, TRAFFIC, PARKING, WASTE, SOCIAL CARE, GIS, CCTV

Why is this important?

Virtual Bradford is an ambitious project to virtually 'clone' Bradford city centre 'brick for brick' to create a 3D hi-resolution copy of the city centre, with the aim to expand the area in the future across the rest of the city. The project is a collaboration between the University of Bradford (UoB) and the Council and is part of the EU funded **Smart Cities Open-data Re-use (SCORE)** project, which aims to improve public service through smart open-data solutions.

The benefit of 'Virtual Bradford' will be to support various strategic priorities for the Council, including urban civic planning, improve traffic management, support the modelling of air quality, flood risk and noise pollution.

It will act as a catalyst to fulfil our clean growth agenda, and by being able to simulate the physical world of Bradford, the digital twin will help better utilise resources, reduce carbon emissions, optimise supply and transportation networks, understand and predict energy consumption and emissions.

It will also highlight the heritage of the city and its benefit to enhancing education, tourism and fostering civic pride. The virtual online model will be open source (or copyright free), meaning anyone can use it in their designs. For example, a games manufacturer could use it to create something interactive. The uses are limitless, from virtual heritage walks to 'virtual' shopping. There is no vendor lock in.

All the data will be provided through the Open Government Licence and the code for the open source platform that will be used to share the data will be made freely available on GitHub (open source development platform).

Unimpeded access to the digital twin will help to stimulate growth, regeneration and innovation in and for Bradford. Because the data is going to be made freely available to anyone, the uses are only limited by one's imagination.

The digital twin makes it possible to design and test city operations virtually before changing the real city environment. This type of policy-supporting instrument helps to make complex urban issues more comprehensible. It is also a suitable instrument for co-creation and collaborative decision-making and contributes to improving citizen engagement.

Virtual Bradford will also transform how people interact with the city - businesses could open virtual shops, allowing customers to browse virtual aisles, artists could install virtual exhibitions.

The development and adoption of Virtual Bradford digital twin will be integral to our ability to confront grand challenges, such as delivering locally on net zero 2050 objectives, reducing social inequalities, and driving R&D-led clean growth.
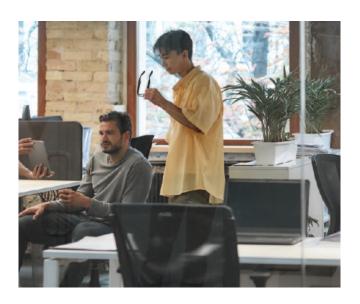
Where are we now?

The online clone includes most of the city centre but the virtual landscape will be expanded in future across the rest of the city with the Southern Gateway a priority development area. Data from 100km of streets has already been captured to create the first digital twin of the city, capable of showing accurate levels of detail for the built environment in 3D.

The University have already secured additional funding from the Arts & Humanities Research Council and Research England to complement and build upon the pump-priming from the EU-SCORE project.

This was followed by the recent announcement of the award of the Queens Anniversary Prize presented at Buckingham Palace in February 2022.

What is our ambition?

Our ambition is to capture all of the district's towns and villages into the Digital Twin application which is used by many stakeholders to stimulate clean growth, regeneration and innovation in and for Bradford District.

What are we going to do?

1. The Council will contribute further investment to assist in expansion of the digital twin modelling across the district, procure technical infrastructure and link it into the emerging smart place development programme.

2. Organise workshop(s) with key stakeholders, particularly University Immersive Technology Team to review Digital Twin work to date and define the vision and purpose of the Digital Twin application for Bradford.

3. Develop joint publicity with the University that draws upon the recent announcement of the award of the Queens Anniversary Prize to be presented at Buckingham Palace in February 2022.

4. Develop a business case for capital programme investment on a roadmap for the Digital Twin platform based on the Gemini principles and establish a 3-year investment programme.

5. Identify options for embedding digital within the Local Plan and the Local Infrastructure Plan so that it becomes an effective planning tool for the development of Bradford including designated areas for test beds as well as wider policies across the district over and beyond permitted development.

6. Establish the redevelopment of the Southern Gateway area as the city's digital demonstrator and link into the Digital Twin programme.

7. Building on the Digital Twin initiative, develop 3D modelling process for brownfield sites, design and adopt an approach and framework for Digital Master-planning to encourage developers to adopt.

8. Extend access to Digital Twin application to businesses and citizens for them to create their own content and extract value from the application to promote the town centre and economic growth.

9. This includes: People, Heritage & Place -Using Heritage to enhance community and wellbeing in Saltaire, Bradford. This Collaborative Knowledge Exchange Project on the Theme of Place will expand Virtual Bradford to digitally document Saltaire World Heritage Site and will digitally connect the two via the Canal Road Greenway/ Leeds-Liverpool Canal to signpost active travel.

10. The Virtual Bradford initiative, together with the investment in IoT and 5G, provides a solid foundation of core capabilities for Smart City intelligent planning. It will provide a dynamic data connection between the physical twin and the digital twin. How this data is updated between the physical and the digital will vary. The complexity will relate to the requirements, the level of data access, the physical situation and the business case. In time, algorithms and ultimately Artificial Intelligence (AI) will be applied to make the digital twin more sophisticated, more automated and to provide further insights.

11. Together with UoB, the Council will develop a clear plan and roadmap to foster the environment for the development of scalable, extensible, and interoperable digital twin.

5 YEARS ON

What does 'good' look like?

The Digital Twin application provides a 3D model of the whole district, and is now having a profound impact on a number of fields, from local architecture and urban development to healthcare, manufacturing and achieving sustainability goals. Its open source platform has allowed it to be picked up and embedded by third parties to support their product and commercial developments.

Why is this important?

Bradford has an opportunity to build its reputation on Citizen & Data Science and Research. A number of initiatives already make a strong research capability building a critical mass – the question is how do we best join the dots, optimise these initiatives and build a reputation around it which Bradford can leverage to attract more investment, stir up some civic pride and feed into a Clean Growth Strategy Plan for the future.

What is our ambition?

Establish Bradford as a recognised leader in Citizen Science and a global centre for research by 2025.

The chart below represents a selection of the research initiatives and centres in place already each doing excellent work in their own fields. For example, the **Bradford Life Critical Project** is a shared mission to strengthen local planning towards a resilient, healthy, and thriving district through the establishment of an open smart digital city and citizen observatory.

An ambitious project that will use the digital twin of the district and make use of connected sensor networks and citizen science to tackle policy, planning, monitoring and management of challenges identified by the Council and our communities. This includes health and climate resilience (clean air and flood risk), clean growth strategies, future transport approaches, evacuation and disaster planning, urban/civic planning and regeneration, and culture and tourism.

Where are we now?

There are a number of ground breaking projects engaging in various research and citizen science such as shown in the chart below.

Some of the others are focused on population health management, some on innovation and growth. The question we asked ourselves was given there is an emerging landscape of research capability already here how could we capitalise on this, join the dots and optimise citizen value and economic growth? What is/ are the missing ingredient(s) to turn Bradford District into a globally recognised hub for citizen / data science research?

Bradford – A Global Hub for Research and Citizen Science

CITIZEN SCIENCE CAPACITY	**ACT EARLY** UNDERSTANDING HOW WE CAN HELP FAMILIES LIVE HEALTHIER LIVES	**BORN IN BRADFORD** DATA SCIENCE POPULATION HEALTH RESEARCH	**AGE OF WONDER** HEALTH RESEARCH TRACKING ADOLESCENT TO ADULTHOOD	**DIGITAL MAKERS** WHOLE-SYSTEMS APPROACH FOR DIGITAL SKILLS DEVELOPMENT
COMMUNITY FOCUSED RESEARCH INFRASTRUCTURE	**WOLFSON CENTRE FOR APPLIED HEALTH RESEARCH** HEALTHY AGING, HEALTHY CHILDHOOD, QUALITY AND SAFETY	**CITIZEN-FOCUSED RESEARCH** DATA-DRIVEN COMMUNITY INSIGHTS TO IMPROVING HEALTH & EDUCATION OUTCOMES	**CENTRE FOR SPACE AI** CENTRE OF EXCELLENCE IN SPACE AI TECHNOLOGY TO ADVANCE RESEARCH	**CONNECTED BRADFORD** WHOLE SYSTEMS DATA LINKAGE ACCELERATOR
VISUAL ANALYTICS CAPACITY	**BRADFORD LIFE CRITICAL PROJECT** AN OPEN SMART DIGITAL CITY AND CITIZEN OBSERVATORY	**VIRTUAL BRADFORD** DIGITAL TWIN MODELLING	**WORKFORCE OBSERVATORY & VISUAL COMPUTING** DEVELOPMENT OF AI/VISUAL COMPUTING SOLUTIONS FOR REAL-WORLD PROBLEMS	**IOT INNOVATION LAB** IOT / LORAWAN / SENSOR TECHNOLOGY TO DELIVER CITIZEN VALUE

WHOLE-SYSTEMS DATA LINKAGE

What are we going to do?

Many of the actions stated earlier in this theme will contribute to Bradford District's reputation for data science research. Furthermore our proposal to strengthen our partnership working around AI Innovation and data discussed later will significantly contribute to our research capabilities. In addition to those actions we will:

1. Complete an audit of all the Citizen Science initiatives underway and build the narrative and marketing documentation to promote the great work happening in Bradford to promote the work we do and the opportunities it can deliver to attract inward investment.

2. A core aim of this theme is to drive societal transformation and adaptation by connecting citizens with science and public policy. We will explore options with partners for a 'living lab' approach to spaces that foster dialogues and shared learning for the co-design and co-production of knowledge, and allowing communities to frame social, economic, cultural, and behavioural change to work towards. The initial areas identified are centred on climate action and the creative economy. Our capacity is strong in these areas grounded in Engineering through the SCORE project and complemented by the UoB Visualising Heritage team.

5 YEARS ON

What does 'good' look like?

Bradford is a recognised leader of Citizen Science and a global centre for research backed by a number of prestigious awards for its work with citizen science and public policy and the impact it has had on the health and wellbeing of our citizens.

How Does the Data-Driven Decision Making Theme Support District Plan Outcomes?

Children have the best start in life	The whole systems approach to service planning and delivery fuelled by data insight will strengthen local planning towards a resilient, healthy, and thriving district.
Residents achieve good health and wellbeing	The whole systems approach to service planning and delivery fuelled by data insight, utilising the wealth of health & wellbeing data we have in our research programmes outlined above will strengthen local planning towards a resilient, healthy, and thriving district.
Sustainable economic growth and decent work for all	Bradford being recognised leader of Citizen Science and a global centre for research will attract inward investment and talent.
Safe, sustainable and inclusive communities	The digital twin application will provide a 3D model of the district, and will have a profound impact on a number of fields, from local architecture and urban development to healthcare and manufacturing and ensure we develop inclusive solutions.
Action at all levels to address climate and environmental change	The digital twin application will allow planners to assess the environmental impact of programmes and new build solutions whilst the whole systems approach to service planning and delivery fuelled by data insight will contribute towards a more sustainable district.

SUPPORTING BUSINESSES TO GROW IN THE DIGITAL ECONOMY

The aim of this theme is to ensure the support and conditions are in place for the digital & creative sector to continue to grow but also support digital transformation of all businesses where needed

Entrepreneurship Ecosystem and Support

Why is this important?

There are two reasons. The first is there is a need to ensure businesses in Bradford are adopting digital technologies to improve productivity and continue to be competitive.

It's about helping our existing small-to-medium businesses – the foundation of our economy – to realise the benefits of fully developing their digital capability for their own future. They comprise 99% of all businesses, employ 132,000 people which is 58% of all jobs and contribute around 52% of all district annual output, which is £6 billion per annum. It will be those businesses that incorporate digital strategies that will thrive as they will be able to raise the profile of their businesses, provide better or new services to their existing customers and gain new ones.

We want all our businesses in our local area to have the infrastructure and connectivity, as well as the information, skills and capability, to engage with and benefit from digital technology. This strategy seeks to build on the many good initiatives already delivered or underway to ensure we achieve this goal.

Secondly, we need to support those businesses in the digital and creative sector whose products and services are centred on new and emerging digital technologies. We need to ensure the conditions are in place for a thriving collaborative ecosystem of support.

We want to ensure we develop high quality sustainable jobs. Evidence shows that jobs in the digital sector pay well above average pay rates. A recent Tech Nation report noted that jobs requiring digital tech skills command higher salaries by an increase of over 30% compared to those that do not.

If we do not grasp, learn from and grow with the digital world, we risk limiting our potential to benefit from the digital future. Bradford will need to attract and retain the best talent from around the UK and beyond to be competitive.

What is our ambition?

We aim to be at the forefront of this new economy just as we have led before, through innovation and investment and by building on our strategic assets – our people, our businesses and our places. We aim to be the UK's fastest growing economy over the coming decade, increasing the value of our economy by £4 billion, getting 20,000 more people into work and improving the skills of 48,000 residents.

Where are we now?

Bradford is a big economy worth £11.6bn and is the eleventh largest city economy in England. It is the third largest economy in the Yorkshire and Humber region after Leeds and Sheffield.

Growth in the district's Gross Domestic Product between 2014 and 2019 was 15.9% compared to UK growth of 18.9%.
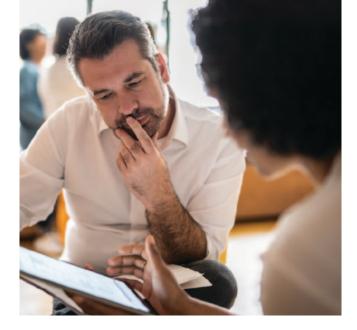
Bradford is home to over 16,000 businesses employing around 250,000 people across the UK with a combined turnover of over £30 billion.

The district has a number of large headquarters including the grocery giant Morrisons, Yorkshire Water, Hallmark Cards, Arris and Yorkshire Building Society.

It has been identified as the best place in Britain to start a business, as ranked by Barclays Bank SME Growth Factors Index and we were listed as one of the top 20 cities for business growth by the Sunday Times in 2020.

Sector strengths include advanced engineering, chemicals, automotive components and food manufacture alongside financial services and digital technologies.

Bradford has 1,200 manufacturing businesses employing 27,000 people – 13 per cent of all employment compared to just 8% nationally and the 4th highest of any city in the UK after London, Birmingham and Leeds.

Our thriving digital sector already includes 700 businesses employing 4,500 people and is home to leading businesses such as:

- Arris - a world leader in technologies, products and services for PayTV and broadband;

- Radio Design - award-winning world leaders in wireless telecommunications product design,

- ECSC – leading UK developer and provider of Cyber Security services, BTL an industry leader in e-learning and on-line training.

46,000 people commute between Bradford and Leeds each day, the largest flow between any two cities in the UK.

Bradford is the 4th largest metropolitan authority in England with a growing population of 542,000.

23.6% of the population are aged under 16 compared with 18.9% nationally making Bradford the youngest city in the UK.

Bradford has a diverse population with ethnic minorities making up 36% of the total population. There are 153 languages spoken by children attending schools in the district.

Bradford has been designated the world's first UNESCO City of Film,

Saltaire model village is one of only two World Heritage sites in Yorkshire while the National Science and Media Museum in the city centre is among the most visited museums outside London averaging 650,000 visitors a year.

An estimated 9.2 million tourists visit the district each year.

The advanced manufacturing sector in the Leeds City Region supplies mission critical components across a diverse range of high value sectors. The region accounts for between 20% to 25% of the UK's RF and microwave businesses in the UK, making the cluster both nationally and internationally significant. There are at least 65 companies in Yorkshire either designing and manufacturing RF and Microwave components, or in the associated supply chain. Bradford has an emerging cluster of these around the Saltaire corridor.

The Council also works in partnership to support the Northern Max Accelerator programme which is now in its 5th successful year with the aim to develop and grow the talented technology companies and supporting start-ups in Bradford District.
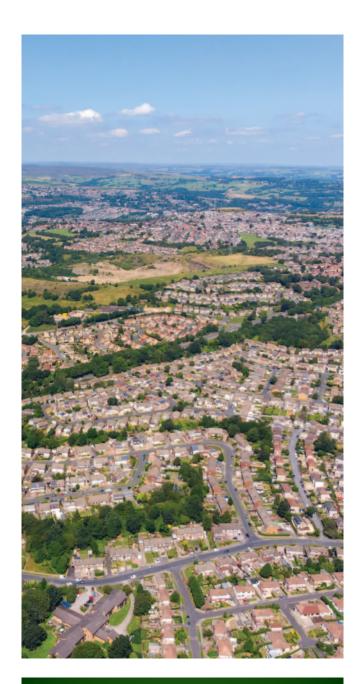
The key aims of Northern Max are:

- Grow the digital/tech sector in Bradford and wider Leeds City Region to create jobs and increase profitability

- Establish Bradford as the place to develop your digital business

- Increase collaboration, supply chain and innovation opportunities

- Boost digital capabilities of new and growing business

- Embed a legacy of success for the digital sector

We believe there are many positives to build on and with further targeted action we can ensure the right collaborative environment, and support ecosystem is in place to help accelerate growth.

What will we do?

1. Bradford Economic Partnership will direct collaborative actions to shape future growth. Closer partnership working within the Leeds City Region will bring new investment and greater local influence on how and where resources are spent.

2. We will encourage a wide spectrum of creative activity and exciting events. We will develop a network of creative entrepreneurs and cultural organisations, incubating and providing peer support for creative start-up businesses and taking over unused spaces.

3. Bradford has now been appointed as UK City of Culture 2025. The bid, driven by Cultural Places Partnerships seeks to capture game changing opportunities and platforms to tell the world about what Bradford can offer. Digital, media and creative sector opportunities will be key and will create clean growth spin offs by bringing that latest cultural trends and digital tools to the district.

4. We will establish peer group mentoring frameworks to nurture local tech start-ups.

5. Develop support for growing social business and voluntary sector and establish model to support neighbourhood innovation e.g. working with local partners to help develop and promote a "15 minute neighbourhood application" which will

6. Play a key part on the WYCA development of the Health Tech Strategy and bespoke programmes for, FinTech, CyberTech and the Creative Catalyst initiative developed by the LEP to help drive growth and establish an ecosystem for creative businesses.

7. Review the case for a Creative Exchange Programme (CEP) bringing together academia, SMEs, individuals, public sector agencies and social enterprises who want to share and discover exciting new ideas, and collaborate to create compelling new experiences, products and services.

8. Continue to support through business support agencies, that help local businesses to adapt and pivot to exploit developments in digital technology and drive innovation.

5 YEARS ON

What does 'good' look like?

- There is a high density of high tech companies and of entrepreneurs with less reliance on legacy industries such as, low tech manufacturing and low wage service sectors.

- There is a well-developed network and ecosystem with strong support services and collaboration with our local educational.

Why is this important?

Digital skills help people into work, increase wages boost local and national productivity and the economy.

Digital skills can be categorised at three levels:

- **Basic** – the skills needed to live in a digital world

- **General** – the skills needed to work in a digital world

- **Advanced** – the skills needed to become a tech professional

There is a growing demand for digital skills. in the last twenty years, circa 4 million digital jobs have been created paying an average of £10,000 per annum more than the job it replaces, contributing to greater productivity and a net £140 billion boost to the national economy. All regions have benefitted from employment growth in higher skilled occupations.

The digital economy is growing fast, nationally growing a third faster than the rest of the economy. A growing digital economy creates new jobs not only in the IT sector, but in many other sectors such as in financial services, manufacturing, health and social care.

Where are we now?

Bradford District has strengths and assets which place it in a competitive position in the Northern economy. We have a large young, entrepreneurial and digitally savvy population which is home to innovative creative and digital businesses.

However, there is still a significant digital skills gap, leaving significant vacancies particularly in "Tech" jobs. More young people need to be equipped with the digital skills required for today and the future. There is an opportunity to do this by equipping them through education with the digital skills needed to be 'work-ready'. Careers education for people of all ages is also key to this through quality careers that helps people understand the training pathways to enter, retrain and upskill.

Many businesses have needed to pivot through the pandemic to engage with their customers, however, over 40% of the workforce continue to lack 'Essential Digital Skills for the Workplace'. SMEs need to be supported to navigate the skills system to access opportunities to

develop those skills in their workforce, and the case made to business leaders and entrepreneurs about the benefits of digital transformation on growth and productivity. The growth of digital skills is essential in supporting the development of a thriving and successful economy.

The digital skills offer across West Yorkshire is vast and difficult to navigate. Whilst the amount of provision is encouraging, the burden of choice poses a dilemma to those in need of skills support: "What do I need to learn, and where do I go to get this?". This is the biggest barrier to many and at all levels of digital skills. There is a need to coordinate the existing offer, and to simplify learning-pathways and the support available, especially for those most in need to access skills provision. There is also a lack of investment for adult skills, including digital skills.

Regional and national skills provision is a cluttered and confusing landscape for those requiring access to learning. Provision is often disjointed and not delivering the local needs required to support the region.

There is a real need to invest and engage organisations rooted in local communities to ensure that skills provisions reach and engages those most in need of support. Employers and learners need the opportunity to co-design learning.
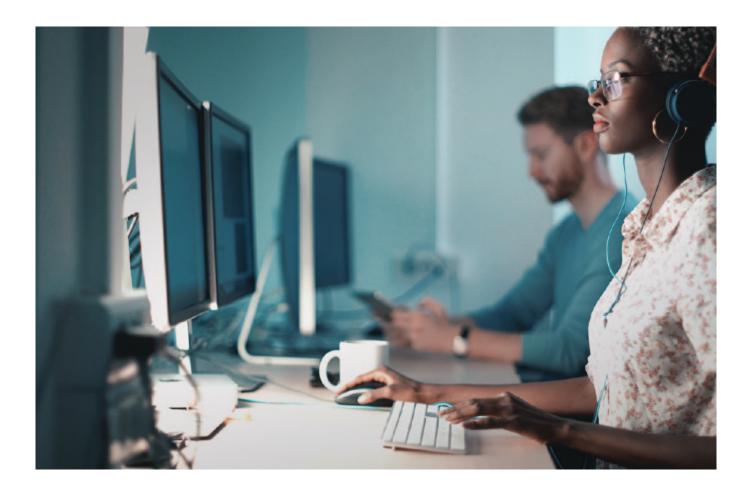
There is an opportunity to make more use of 'bootcamp' style learning, digital badges and MOOCs (massive online open courses).

Digital skills need to be embedded in all types of learning, and at all ages including through the national curriculum.

What is our ambition?

To create a fully inclusive society and a thriving economy by the growth of digital skills ensuring Bradford District has a high value, high skills economy delivering high value jobs, increased productivity and opportunities for all.

What are we going to do?

There are a number of key initiatives already in place to address these challenges and realise our ambition:

1. Digital Skills Partnership - set up with agreed priorities to deliver digital skills growth across the West Yorkshire region in response to the 'Digital Skills for All' ambition of the Leeds City Region Digital Framework. These priorities form the foundation of a Digital Skills Plan.

2. The Digital Skills Plan draws together ambitions around regional transformation through digital skills into one cohesive delivery plan:

   ● Social Digital Inclusion

   ● Workforce of the Future

   ● SME & Charity Digital Growth

   ● Simplify Provision

3. The Plan is to be developed in partnership with business, education, the third sector and local government organisations across the region.

4. SkillsHouse Partnership - We will promote and support SkillsHouse partnership as the districts careers and employability service where employment, and skills development needs of individuals of all ages are met.

   CTE Partnership Boards - Bradford has a well-developed Careers and Technical Education (CTE) Partnership which provides a mature framework and governance in driving forward the skills agenda for our children and young persons to support their career pathways.

5. There is a fantastic array of work and programmes that have been developed by and through partnership working arrangements successfully supporting outcomes for our children and young people. Each career pathway is governed by a CTE Partnership Board that includes representatives of the industry that the pathway is designed to serve. Critically, employers, particularly SMEs, help shape the local skills curriculum and provide other benefits— employers and public relations, internships, job shadowing, mentoring, recruitment, professional development for teachers, equipment donations, and adjudication at student competitions, to name a few.
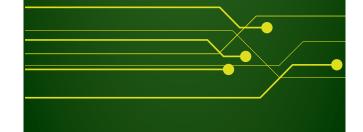
6. We now we have an excellent starting point with over 78 employers sitting on one of the nine CTE Sector Boards, close to 2,000 employers offering work experience placements, and over 14,000 Learners receiving careers information and interacting with business each year. In addition, local employers and Bradford Chamber of Commerce run the successful 'Manufacturing Weeks' and 'Tech Week'. Digital skills cuts across many of these pathways.

7. We will further implement the CTE partnership Career Pathways approach to strengthen the collaboration between employers and educators in direct response to industry's current and future talent demands.

8. Digital Makers – a programme to bring schools together with industry, policy makers, universities, cultural organisations, and the NHS to learn how to transform digital education for young people. Digital Makers is overseen by an Executive Steering Group – chaired by the CEO of City of Bradford Metropolitan District Council. Its aim is to use science to build the next generation of the digital talent pipeline, bridge the skills gap blocking employment and give young people the ability to protect themselves in an increasingly hostile digital world.

9. Through the Digital Makers programme we will develop a suitable programme to support digital skills within both primary and secondary schools to complement the national curriculum. This could include engagement with wider aspects of the digital strategy and focus on AI and Machine Learning, Design for UX, Cloud Computing, Digital Art.

10. We will establish a task force similar to Digital Makers for Post-16, assess gaps and develop programme through the CTE Partnerships on improving the scale of provision and building on the SkillsHouse partnership initiative

11. Cyber Bradford – There are a number of initiatives being implemented to engage with young people on the career pathway of cyber security. Also the University of Bradford is creating learning programmes for residents who may have IT job experience to gain knowledge, skills and certifications to enable them to work in Cyber Security Analysts and related roles – 6 month programmes with Saturday workshops. The ultimate end goal is to create future Cyber Security Ambassadors for the City.

5 YEARS ON

What does 'good' look like?

We will have:

- Addressed and closed the attainment gap for disadvantaged learners, so that each of our communities are able to access and progress in learning, and experience the economic benefits.

- Greater accessibility and connectivity to the Bradford population to support engagement in the increasingly digital society.

- A productive, resilient and innovative economy that offers a higher standard of living and is based on a highly skilled, diverse and flexible workforce.

- Stronger relationships between employers and training providers with good quality skills and training opportunities that reflect the unique needs of our labour market.

- An inspired student population, increased apprenticeship uptake for ICT, growth of graduate skills retention in the region and provision of more work-ready students to support the West Yorkshire economy.

- Simplified access to a widely used and valued digital skills provision creating a more inclusive society and high quality careers information and support service, and for people to understand how to access their entitlements in relation to careers guidance and training.

Why is this important?

The green economy is economic growth that is low carbon, resource efficient, prevents the loss of biodiversity and ecosystem services and is socially inclusive.

Bradford Council is committed to delivering sustainable development, that is clean and environmentally regenerative, will bring growth to the local economy, and is socially inclusive for everyone in the district.

What is our ambition?

Our ambition is to ensure Bradford District is a UK leader on the green economy.

Where are we now?

The Department for Business, Innovation and Skills (BIS) divides the Low Carbon Environmental Goods and Services Sector (LCEGS) into three Level 1 sub-sectors - Environmental, Renewable Energy and Low Carbon. These are in turn divided into 24 Level 2 sub-sectors which in turn identifies over 2,800 product and service activities including non-core that are derived from sector supply chain activities and value chain activities (R&D, Supply & Training).

We are currently assessing the region's strengths in the Green Economy and current and future markets to provide the evidence-based market intelligence data for the LCEGS sector, and nature of the LCEGS sector locally in the Bradford region and some analysis of the split between the core and non-core activities within the sector and sub-sectors.

A more detailed assessment of our strengths in these areas will provide sector insight and intelligence on the current value of the sector and its potential opportunities within the region.

It will show market characteristics such as sector strengths, sub-sector resilience (the ability of a company to achieve longevity, but also the length of contracts and other factors that provide stability), market opportunities that are being created by regulation, policy and customer demand for businesses operating in the Low Carbon and Environmental Goods and Services sector and how it compares with the UK average. This will guide the

strategy and where the Council and its partners will want to focus its efforts, priorities.

What are we going to do?

- Complete Green Economy audit as part of our Clean Growth Strategy.

- Continue to develop our Clean Growth Strategy and plan which will establish Bradford as a leader in the Green Economy.

- Development of the supply chain for hydrogen LGVs - Position the district's automotive businesses to win opportunities in the fuel cell electric vehicles supply-chain through having a UK 'test-bed' fleet of hydrogen light goods vehicles

- Construction of a circular economy demonstrator - encourage local businesses to invest in reprocessing of recycled or bi-product materials and positioning the district as an exemplar of the circular economy in the UK.

- Ensure that the economic value of the energy produced is retained in the local area of Bradford. The local energy strategy will assess how the region can capitalise on renewable opportunities, supporting the growth of businesses.

5 YEARS ON

What does 'good' look like?

A 3-year trend analysis shows an increasing market share year-on-year. Annual sales, the number of companies and number of jobs in the sector has increased year-on-year with strong sub-sector resilience (length of contract and other factors that provide stability) to make Bradford District a leading region in the Green Economy.

AI for Bradford" - Bradford District AI Innovation Partnership

Why is this important?

Artificial intelligence (AI) systems are designed through data acquisition, to capture, interpret, process, reason and decide the best action(s) to take to achieve a given goal. AI systems can adapt their behaviour by analysing how the environment is affected by their previous actions. AI includes several approaches and techniques, such as machine learning, machine reasoning (which includes planning, scheduling, knowledge representation and reasoning, search, and optimisation), and robotics (which includes control, perception, sensors and actuators, as well as the integration of all other techniques into cyber-physical systems). The potential for new applications in all sectors to address societal challenges and deliver opportunities for economic growth are enormous.

The Government recently published its AI Strategy and Action Plan which highlights AI innovation driving significant growth over the next decade. It encourages local authorities and partners to work together to support businesses in their adoption of AI and other "5.0 technologies" to build resilience, increase their productivity and growth, through new products and solutions. It highlights increasing opportunity for exponential growth for AI start-ups and scale-ups with the UK market investment, private and public, running into £billions. Data shows the UK ranks third in the world, behind the USA and China, with global investors pouring £13.5 billion into more than 1,400 UK private technology firms in just six months of 2021.

The full benefit from using AI and data, in both small and large companies is still to be fully realised, and the true impact of AI and data will be in our health sector, green economy, advanced manufacturing, on our roads, in our warehouses and at home. Every sector of the economy will benefit. It will be used to solve the greatest challenges we face, environmental sustainability, energy, food and water security, improved health and quality of life.

The Case for an AI Partnership

The opportunity to address these new markets is growing as new applications emerge, challenges are overcome, regulatory standards are established and the barriers to adoption are lowered. We also know, in order to succeed, AI innovators need access to data to develop solutions. We believe Bradford District has an opportunity to

be a UK leader in AI research if we can co-ordinate our academic AI expertise, our digital infrastructure and our ground breaking data science projects. A partnership will help achieve this, establish maturity in our processes, better target inward investment, identify use cases and collaborative opportunities that address societal challenges and boost business growth. It will provide a focal point where ideas can flourish and AI and Data can merge together and where innovation and commercial reality meet to drive progress and uptake.

The "AI for Bradford" Partnership would:

- federate and combine the diverse communities that underpin our local AI and Data capabilities to build up an effective innovation ecosystem.

- seek and stimulate private investment and position public funding to address the key challenges that matter in areas of economic importance including advanced manufacturing, health & wellbeing, innovation & entrepreneurship and clean growth.

- guide policy and strategy around investment creating new levels of dynamic collaborations and productive outcomes.

AI technology has reached a level of maturity where wide-scale impact is possible. "Industry 5.0" technologies such as AI, advanced automation and robotics are transforming how businesses operate by connecting the physical with the digital world. Without a local functioning innovation ecosystem that supports research and translation, our district won't capitalise on these opportunities. No single organisation alone can achieve the required level of coherence across our district necessary to maximise uptake and impact; this requires a collaborative partnership.

The Partnership should have a broad remit to road mapping and engagement and support the whole of the research and innovation pathway from lab to application. It should encompass all paradigms, techniques, methods and applications of AI and Data and develop the opportunities for joint and collective actions between these technologies and data more effectively than if each were isolated. It would be open to industry, academia, public bodies and to organisations both small and large. In particular, SMEs, start-ups and entrepreneurs would be encouraged to take part and it would connect with other related partnerships and innovation organisations in the UK and beyond.

The "AI for Bradford" Partnership would also be able to support broader applications of AI for social good, facilitate access for AI start-ups and scale-ups to advocacy groups, local data scientists and social purpose challenge owners from specific sectors, to

curate and label data sets that solve defined problems by applying the correct specialist knowledge to the types of data needed to solve a particular challenge.

We also need to bridge the gap between the end of early stage AI start-up support and the scale-up phase, to help build additional sales pipelines for AI companies and provide a more collaborative environment for industry to adopt the technology. The approach could be to work with the Accelerator Programmes and various business support programmes already in place to promote and support broader applications of advanced digital technology for social, environmental and economic good. This could be delivering six-month sprints that create opportunities for under-represented and diverse innovators, and providing access to mentorship, courses and Knowledge Transfer Partnerships (KTPs). By encouraging and enabling AI start-ups to build sales pipelines and bridge the gap between proofs of concept/ pilots and enterprise adoption, we can create the perfect market conditions for growth. The "AI for Bradford" Partnership can be the 'glue' to plug these start-ups into various public sector initiatives and schemes. This could help to ensure a sustained supply of AI innovations coming to market.

Government Support

There is now a lot of focus, and investment being made in AI spearheaded by the Government's National AI Strategy, building on the success of investments made through the AI Sector Deal. The Government has also pledged to continue to invest £billions in coming years into developing this market to make the UK a global leader. A National AI Research and Innovation Programme is being launched to improve coordination and collaboration between the country's researchers and help transform the UK's AI capabilities, while boosting business and public sector adoption of AI technologies and their ability to take them to market.

Also being launched is a joint Office for AI (OAI) and UK Research & Innovation (UKRI) programme aimed at continuing to develop AI in sectors based outside of London and the South East. This will focus on the commercialisation of ideas and could see, for example, the government focusing investment, researchers and developers to work in areas which currently do not use much AI technology but have great potential, such as energy and clean growth.

There are also actions being taken to support copyright and patents for AI through the Intellectual Property Office (IPO) and trialling an AI Standards Hub to coordinate UK engagement in setting the rules globally. There is ongoing work with The Alan Turing Institute to update

guidance on AI ethics and safety in the public sector and create practical tools to make sure the technology is used ethically.

Clearly AI is an area which will command much attention and investment throughout this decade. Bradford District needs to position itself to ensure it benefits from public sector investment and secure Foreign Direct Investment (FDI) opportunities. Now is the time to co-ordinate our efforts and build on our local strengths through an "AI for Bradford" Partnership.

Linking in to Bradford's Advanced Digital Infrastructure

Implementation of this Digital Strategy will establish the foundations that most future services will be built on and will be fundamental to Bradford's future economic success, particularly universal gigabit fibre, 5G connectivity and the Internet of Things (IoT) infrastructure. These capabilities will be crucial to the deployment of AI applications.

There will be opportunity to leverage the increasing deployment of IoT across the district. This transformational technology will help businesses develop new products and services, improve efficiency, productivity and organisational performance through IoT-enabled devices that can also harness AI's predictive capabilities. The maturity of the IoT market will accelerate over the next five years and will bring significant improvements in how AI and the IoT are used, for example in capturing and visualising data to drive better decision making.

As the IoT market continues to grow, new and existing devices, software and capabilities will be linked with IoT sensors to address real world issues, connected by 5G networks which will move the use of IoT from simple data collections and analytics to allow real-world processes to be autonomously influenced and made adaptive to real-world events, for example, industrial processes, supply chains and logistics, energy management, water flow and traffic management.

The deployment of IoT will play a key role in the emerging urban data economy by providing a rich set of real-time data that can be used beyond the initial application or service for which the IoT infrastructure was initially deployed. Over the next five to ten years, a significant amount of the data required by AI-enabled services will come from IoT devices deployed as part of the advanced digital infrastructure in buildings and public spaces, or from those being worn by or attached to people, assets and goods. The explosion of data will mean more IoT data processing being moved to

'the edge' to avoid a great deal of unnecessary data communication and transfer. This deployment of edge IoT devices will be a crucial enabler for AI solutions, as part of the advanced digital infrastructure of Bradford District.

The "AI for Bradford" Partnership will provide the opportunity to research and develop solutions around the security and ethical implications of using AI at the edge, to ensure that data privacy is considered. Applying AI systems responsibly inevitably requires a great deal of development before getting anywhere near the physical world. Virtual Bradford, the Digital Twin application discussed under our Data theme, will provide insight into how complex physical assets and citizens behave in real time. Our expanded programme to advance the digital twin capability, with open source and interoperable data standards, will help developers explore the potential for applications in the physical world but cheaper, faster and with less risk, as well as a better understanding of the implications and impacts to society and the economy. AI thrives when connected with digital twins, using machine learning algorithms to analyse complex patterns and make decisions between different processes and systems alongside generating new insights with newly combined datasets.

What do we need to invest in?

Investment in the following areas are needed to be a success:

AI and Data Ecosystem Stimulation - The Partnership will contribute to creating a connected and rich innovation ecosystem for AI and Data across the district. It will provide strong leadership for AI and Data that ensures

the district has a clear, unified voice that is rooted in its widespread deployment of these technologies. This will support the district to develop a leading position in AI and Data that aligns with our values. Government and private investment will be needed to stimulate the ecosystem. No single business or local body will secure the scale and range of investment that working in partnership will achieve. Working together will give us a better chance of securing investment in areas such as community building, roadmap development, challenge based competitions and infrastructure development such as digital innovation hubs and Living Labs.

Skills Development - This is a very competitive space and investment will be needed to develop, attract and retain the relevant skills. Data from an ecosystem survey conducted by the AI Council and The Alan Turing Institute showed that 81% of respondents agreed there were significant barriers in recruiting and retaining top AI talent in their domain within the UK. Further research into the AI Labour Market showed that technical AI skill gaps are a concern for many firms, with 35% of firms revealing that a lack of technical AI skills from existing employees had prevented them from meeting their business goals, and 49% saying that a lack of required AI skills from job applicants also affected their business outcomes. To support the adoption of AI we also need to ensure that non-technical employees understand the opportunities, limitations and ethics of using AI in a business setting, rather than these being the exclusive domain of technical practitioners.

Two of the 16 centres announced by the UK Research & Innovation Agency on Doctoral Training in AI are in the Yorkshire region namely, the University of Leeds and the University of Sheffield. However, University of Bradford continues to strengthen its AI capabilities with AI courses at undergraduate and post graduate level, whilst running complimentary courses in cyber security, Internet of Things, and Big Data Science.

Furthermore, its AI and Visual Computing Research Unit already focuses on the development of novel AI and visual computing solutions for real-world problems in collaboration with variety of academic, industrial and clinical partners and has strengths and expertise in all areas of AI and experience of applied projects. This research unit has four knowledge transfer arms: The Visual Computing Centre, the Advanced Automotive Analytics Research Institute, the Computing Enterprise Centre and the newly established Health Data Analytics Lab. The University has recently been awarded £700,000 by the Office for Students (OfS) for new innovative programme design and funded scholarships for AI and Data Analytics, creating future AI and Data Analytics visionaries. There is also the Bradford-

Renduchintala Centre for Space AI developing innovative solutions such as the AI-based system to combat cyber-attacks against aeroplanes and air traffic control. This contributes to a real strength in the region.

The Partnership will work to build on these strengths and seek investment to ensure that AI and Data skills are developed throughout the district. Our initiatives outlined under Digital Skills capability such as the Digital Skills Plan, Digital Makers and CTE Partnerships, should help increase the capacity of AI and Data education and vocational training to support a strong skills pipeline in AI and Data at all educational levels; this will increase the supply of talent. Longer term it will ensure that the successful adoption and deployment of these technologies is not limited by a lack of skills in the workforce.

Investment will be needed in developing the Digital Skills Plan, supporting schools through Digital Makers, creating Hackspaces, Makerspaces and an entrepreneurial ecosystem. The AI Partnership would contribute to the setting of objectives for skills development, and in monitoring the state of skills development, examining future need and current provision. It also has a role in fostering career paths and professional development and certification.

The "AI for Bradford" Partnership will help provide linkages for start-ups and SMEs to engage directly with academia and become closely connected to AI academic programmes. Start-ups and scale-ups that do not have access to data science capabilities cannot compete with tech giants for data science talent. It will be advantageous to utilise academic programmes and skilled graduate students to bridge any talent gaps. This is beneficial for the University who are keen to provide real world challenges to its students. We need to create the environment to enable the next generation of technologists to gain industry experience and build products and solutions with exciting young start-up businesses.

Investment will be needed to spread best practice on collaborative change and increase the awareness of AI and Data within both public and private organisations and with citizens. This collective approach to skills development can create transformation and set out transferable skills that enables the labour market in AI and Data.

Innovation and Market Enablers - We need to target both public and private sector investment to support the translation of AI and Data from the research lab to the market. Agile technology and service based SMEs are a critical element in delivering deployment of AI and Data technologies as is the engagement of large scale vertical

end users. Funding will be needed in innovation scale-up, in providing testing infrastructure and innovation support and in developing demonstrators such as large scale pilots operating within regulatory "sandboxes". Securing public funding will also trigger venture capital and private investment in start-ups and SMEs that own key technologies thereby reducing investment risk.

In regulatory matters, a system's autonomy raises unique questions around liability, fairness, risk, safety, ownership of creative content, transparency and bias which arise from decisions made by AI systems. The Partnership will seek to ensure businesses adopt common standards and approaches to the certification and validation of AI and Data based products and services, led by the national IPO and AI Standards Hub. This will enable the smooth translation of innovation into the market by enabling innovators to rapidly deploy products and services across and beyond our district.

The University of Bradford are keen to build on their research to date on the human and ethical aspects of AI. Investment would be needed to build a practical AI Ethics testbed to ensure that AI developers are well equipped in the ethical considerations required for sustainable solutions that can be used at scale by the public and private sectors. This is an area of much focus and much sought after nationally and internationally and work on this aspect will help put Bradford on the AI map.

Promoting Research – Investment will be required to improve cohesion of the innovation ecosystem, including academia-industry collaborations. This will create a leadership position in AI and Data built on a foundation of academic excellence based on industrial relevance. It will improve the rate of technology transfer and adoption of AI and Data from the lab to real world deployments. In addition, the Partnership will encourage the development of blue-sky research, by maintaining tight links with other dedicated national institutions and instruments.

Bradford District needs to find its USP (Unique Selling Point) in AI and Data. It must set its own path and ambition in a way that fits our culture, local market, skills and technical specialisations. The maintenance of a strong front end to the innovation pipeline is critical to long term future success because of the expertise it generates and the skilled workforce it creates. Innovative AI research, such as that carried out by the Space AI Unit will give the district an advantage. However, there will never be sufficient funding to develop every idea. Careful prioritisation will ensure ideas with relevance to business, society and economic promise are funded first, whilst leaving space for blue sky disruptive ideas to be developed.

Investment will be needed in building research

strength, identifying and addressing key challenges and innovative approaches, co-ordinating and aligning research excellence across our academic institutions, identifying supporting and growing specialisations, joint road mapping and connecting research to industry and vice-versa. We will also need to invest in mission based challenges - identifying, exploring and enhancing impact on key missions and societal challenges, particularly climate change and our clean growth aspirations, connecting and translating research into public good.

Healthcare is the fastest-growing global market for AI and with our existing strengths in the health sector in the region, Bradford is well placed to become a 'go to' location for investment in this sector, creating new jobs and transforming health and social care delivery. A recognised strength of our region is in evaluation of digital healthcare solutions to effect system change, improve system performance and enhance patient health and wellbeing. We have Europe's first AI-powered hospital command centre in Bradford; researchers at the city's university have contributed expertise to analyse the influence on safety and patient health and, more widely, analysis of the effect of computerised decision support systems on healthcare professional performance and patient outcomes.

General Operation of the Partnership – There will be funding opportunities for project based activity and to develop the ecosystem but how would the Partnership operate and fund itself? There are a number of models which we need to explore with partners. Should it be

informal to begin with? Do we create an independent, non-profit entity funded by charitable contributions from philanthropy and corporate entities? Should this be done at a West Yorkshire regional level? Should it focus on strategic only or include operational delivery? Many of these questions will be explored with partners and the subsequent roadmap development will set out an options appraisal on how we best take this forward. However, the strategy is clear that a partnership approach is necessary to build an effective "Front Door" for the district (to market the area nationally and internationally) and leverage and build on our considerable capabilities already in place.

Building an ecosystem like this is likely to have a far bigger long-term impact than a pure education and skills programme on its own. We do not underestimate the amount of energy and goodwill required to support an ecosystem in the long term. Involving partners and maintaining their involvement is important (it needs to be win-win). Having clear roles and providing initial case studies will be critical. A small/agile scaling model to begin with is ideally suited to building such a partnership ecosystem.

Where will the investment come from?

The direct sources of funding for AI and Data innovation are varied, some examples outlined below:

a) Government framework programmes & innovation support funds including SME based programmes; the British Business Bank for the growing AI sector; or the National AI Research and Innovation (R&I) Programme that will align funding programmes

across UKRI Research Councils and Innovate UK, stimulating new investment in fundamental AI research; or the Future Fund: Breakthrough, a £375m UK-wide scheme to encourage private investors to co-invest with government in high-growth, innovative firms backed by a partnership innovation ecosystem. The government has committed to funding innovative firms developing AI technologies across every region of the UK and is set to publish a report in the "autumn of 2022" on addressing any significant investment gaps. We must be ready to seize these opportunities.

b) Local Industrial and business investment in innovation who are willing to invest in developments if they can access Partnership resources such as data scientists and data programmes.

c) Partner and Private Sponsorship to support general operating costs, including in-kind resources, use of locations and facilities.

d) Angel Investment & Venture capital who are keen to support the development of prototypes at zero cost/risk to the innovator, from embryonic idea to a commercially viable product.

e) Foreign Direct Investment (FDI) – our own initial research and networking have highlighted significant opportunities to target FDI from US investors who are keen to access innovative AI and Data programmes.

f) Skills based funding for example national PhD programmes, Fellowships etc.

g) Procurements - for example specific public procurement such as transport or healthcare or smart city architecture where we will be able to solicit added value investment and partner sponsorships in AI Innovation investment.

These are just some examples and represent short to medium term investments that will take multiple forms, from direct grants, competitive funds to loans and equity. What is important is that Bradford has a partnership and plan in place to successfully target these funding opportunities and is ready to act. These will be complemented by our local partnership resources and in kind commitments as well as business case led capital investments.

What is our ambition?

The "AI for Bradford" Partnership will help transform the district. Based on a reputation for high quality research with industrial impact and relevance, it will attract £millions of inward investment, drive global businesses and create jobs and develop highly qualified graduates.

What will we do?

1. Together with our partners, we will evaluate the different partnership models and recommend the model suited to our needs, assess the investment requirements and make the economic detailed business case, develop the plan, seek and secure funding and the right collaborations to create "AI for Bradford" Partnership.

2. Work with our partners and all stakeholders to document our core principles and values for responsible and ethical use of AI innovation and deployment.

3. Fund and advertise training programs to educate the stakeholders and employees on the opportunities and importance of responsible AI practices.

4. Create a network of Business Ambassadors to spread the word more widely.

5. We will explore a pilot program to establish AI Test Lab capabilities within our existing local assets to take embryonic ideas, develop and test them in a real life scenario within an academic-business partnership. Local SMEs can benefit from a network of open innovation and effective test bed environment to new markets aiding them to develop new solutions and monetising their products.

6. We will network at a national and international scale to create bigger markets by leveraging the European network of Living Labs and collaborating with our local academic institutions on research, development and innovation (RDI).

7. We will develop an AI Strategy for Bradford District that puts people at its heart. We will conduct an extensive consultation with input from our people, our businesses, our public sector and our academics to help shape and set out a vision and an AI Strategy that will work for all of the district.

8. We will seek investment to catapult start-ups in AI and to provide the tools for zero cost prototyping to every bright digital idea, manage the ideas to successful venture throughout its life cycle and accelerate development to prepare validated and regulated technologies for this market.

9. We will collaborate with our local academic institutions to offer students for their final year projects through our partnership, working in local economy directly with the Council or local companies to help them to turn their ideas to successful AI ventures if they wish to explore more. This could be widened to support internships, and other skill building activities.

What does 'good' look like?

1. The "AI for Bradford" Partnership is well established, overseeing a mature innovation ecosystem, making the best use of our assets across the district, and contributing to the district being a-leader-in-innovation, developing and retaining skills and employment opportunities through the attraction and creation of highly innovative companies.

2. Bradford is home to several new businesses, from start-ups and SMEs to larger businesses actively developing, adopting and applying AI and other 5.0 Technologies to identify new service applications, commercial products, disease diagnoses, improving health and tackling climate change. These companies have opportunities to collaborate with international partners as our reputation grows.

3. The cutting edge research continues to secure external funding from major UK Research Councils such as EPSRC, Innovate UK, NHS (National Innovation Centre) and Industry etc.

4. Research-active clinicians and innovative SMEs collaborate on key clinical questions and ultimately solving health and social care challenges more quickly and efficiently.

5. People from all walks of life, especially the most disadvantaged and vulnerable are participating in co-design and decision-making through our network of Living Labs to shape initiatives that benefit them.

How Does the Digital Economy Theme Support District Plan Outcomes?

Children have the best start in life	The comprehensive programme of initiatives through the Digital Skills Partnership and CTE Partnership Boards will help provide opportunities to young people. Strong relationships between employers and training providers providing good quality skills and training opportunities will inspire a student population, provide increased apprenticeship uptake for ICT, growth of graduate skills retention in the region and provision of more work-ready students to support the Bradford economy. Closing the attainment gap for disadvantaged learners, so that each of our communities are able to access and progress in learning, and experience the economic benefits.
Residents achieve good health and wellbeing	The "AI for Bradford" Partnership will have a great impact in making the district a leader in AI innovation and creating skills and employment opportunities through the attraction and creation of highly innovative companies. A productive, resilient and innovative economy will offer a higher standard of living and is based on a highly skilled, diverse and flexible workforce. Many examples of AI in health e.g. it can improve accuracy and efficiency in breast screening. It can use algorithms to identify poor quality services at an early stage and inform corrective action e.g. poor Care identified and passed to inspectors for further assessment and action.
Sustainable economic growth and decent work for all	It will contribute to a high density of high tech companies and of entrepreneurs with less reliance on legacy industries such as, low tech manufacturing and low wage service sectors. The Innovation Partnership will have a great impact making the district a-leader-in-innovation and creating skills and employment opportunities. Increasing the sales, the number of companies and number of jobs in the Green Economy sector with strong sub-sector resilience will provide opportunities for decent work.
Safe, sustainable and inclusive communities	A productive, resilient and innovative economy will offer a higher standard of living and is based on a highly skilled, diverse and flexible workforce.
Action at all levels to address climate and environmental change	A thriving Green Economy will encourage and provide opportunity for best practices to address climate change.

DIGITAL INCLUSION

The aim of this theme is to ensure no citizens of Bradford District are digitally excluded

Framework for delivering Inclusion, Champions Network & Community Programmes, Subsidy Schemes

Why is this important?

Digital Inclusion is a key priority and is identified within the district Plan as a key component of achieving Outcome 4 - Safe, sustainable and inclusive communities. Digital Inclusion is defined here in three parts:

1) access to a device,

2) an affordable and adequate digital connection and

3) having the basic digital skills to use them.

Digital exclusion is often part of complex challenges including poor literacy and English language skills, disability, ill health and poverty. The most excluded are also the biggest users of government services, however are the least likely to be able to access them online.

COVID-19 pandemic has only laid bare the inequalities within the district and further exposed the impact of the digital divide on people's livelihoods and health and wellbeing. Data poverty, or the affordability of broadband or mobile access in particular is a real challenge.

What is our ambition?

No citizens of Bradford District will be excluded from having access to digital devices, adequate affordable connectivity and the necessary skills to use them to improve their livelihoods.

Where are we now?

A baseline review of current digital inclusion activity within the district has been carried out. Whilst there are many activities, the general view is this could do with a more co-ordinated approach with renewed governance.

The focus during COVID-19 has been primarily on addressing access to devices (laptops, tablets) and digital connectivity. A large amount of work is also ongoing in communities operating independently to provide digital technologies for fellow residents and businesses. This has taken a variety of forms across numerous organisations including the distribution of new tablets and laptops, reconditioned equipment donations and the issuing of 4G mobile dongles, SIM cards, Wi-Fi and other options.

The Council's Neighbourhood team are part of a local multi-partnership working group to support the needs of vulnerable migrants, refugees and asylum seekers with digital devices and internet access. This includes a needs assessment and estimated costs. In a separate piece of work, the Neighbourhoods team and voluntary sector partners are seeking to assess the digital inclusion needs of the Roma community in the district. Bradford also has a number of voluntary schemes supporting inclusion through local businesses, charities and outreach services across the district.

A number of schemes are currently in operation across the district through the Charity and Voluntary sector. These are operating through a district arrangement working in collaboration with colleagues in Neighbourhoods, Adult Social Care and Economic Development. For example, charities such as Solidaritech are repurposing laptops, desktops, tablets and smartphones, for asylum seekers and have negotiated bulk orders of "Pay-As-You-Go" three-month internet access from O2 to distribute to local refugees support groups.

In addition to the above, a national roll out of devices from the DfE, combined with Council funds, supported children to access devices and internet access where they had a social worker. This scheme began in June 2020 and has allocated over 3,000 devices. Our innovative approach includes working with local partners to map and connect both need and supply. This is a precursor to the development of a community application and our aspiration for the 15 minute digital neighbourhood over and above GIS. This work is on-going.

What are we going to do?

A review of best practice was carried out to identify the core capabilities required to ensure a successful approach to digital inclusion. The following capabilities have been identified:

1) Governance Framework for Delivery

We have renewed a Bradford wide governance framework for delivery to look at co-ordinating and co-investing in digital inclusion activities across the district.

We appointed a dedicated resource to programme manage and co-ordinate activity and provide capacity-building support to VCSE organisations and deliver tailored digital inclusion support at a local level.

To ensure the insight and intelligence is readily available to inform priority targets and actions, we are in the process of:

- Mapping on to the Council's GIS data such as Free School Meals, Pupil Premium, other social-economic demographic data.

- Contact Telcos on usage data and other insights on data poverty to map. Cross reference data and establish priority targets and specific local challenges not yet catered for.

- Plot tailored delivery for each area taking into account the specific needs identified through the mapping work and highlighting the potential for cross-district collaboration.

- Agree a common framework to measure the impact that Digital Inclusion support has on residents, communities and organisations.

2) Establish Inclusion Champions Network Scheme & Community Programmes

- Build networks and partnerships to share best practice, improve signposting and co-ordinate activity to optimise impact and empower an ecosystem approach.

- Create meaningful relationships with VCSE organisations to engage and deliver sustainable support to target resident groups.

- Build capacity for community-based organisations by training staff and/or volunteers as Digital Champions. From this basis, community organisations can then support residents to access digital networks and services, particularly learning and information portals.

- Develop an approach for engaging communities in digital inclusion, with Schools, Colleges, Community Groups, Social Housing, local businesses, NHS Organisations and GP Practices.

- Mapping of existing digital inclusion activities, Complete the mapping of activity around the district to provide a district wide view of all activity to ensure better co-ordination and building relationships.

3) Subsidy Schemes for connectivity and skills

- **Devices** – develop a targeted plan for Bradford, supporting VCS to register and benefit from the free data and device banks that they can provide to individuals in their communities.

- Digital Inclusion Programme Manager will ensure a strategic approach working with a range of stakeholders, including VCS organisations, across the district and nationally, maximising on the opportunities for the people of Bradford.

- An effective process is in place to support voluntary groups in accessing funding and donations and allocations are matched to priority targets.

- **Basic Skills Development** – Enable target resident groups have the necessary skills to use digital devices and services through Learn My Way centres, Libraries, Colleges, VCS, Digital ambassadors, National skills & resources from Corporates. Link into the Digital Skills Plan and Digital Makers Programme initiative where appropriate.

- **Connectivity** – Facilitate target resident groups have adequate and affordable connectivity to internet with the work being carried out under Theme 1.

- Ensure future procurement utilise the Government's Social Value TOM framework which seeks to enhance social value, particularly into social housing estates with poor connectivity.

- Explore targeted expansion of free Wi-Fi into community centres where necessary.
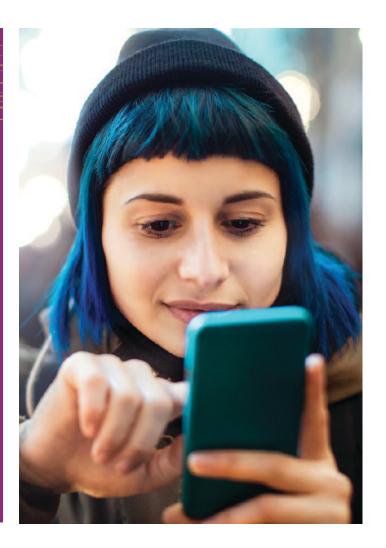
We have a legacy of working together as a district and the existing Wellbeing Board Governance structure offers an obvious platform and strength to tackle our ambitions in this area with leaders across key stakeholders represented. A Digital Inclusion Board is now formed, chaired by a senior officer from the Council

and reports into the Wellbeing Board as its sponsor board with a standing item on the agenda.

The Digital Inclusion Board membership includes a number of cross-portfolio officers from the Council together with key stakeholder partners from Health, Voluntary, Social Enterprise and private sectors.

These actions together will form the basis of an effective continuous programme with the right focus to ensure none of our citizens are digitally excluded.

5 YEARS ON

What does 'good' look like?

1. The well-established Governance Framework is effective and coordinated to respond to organisations and citizens in need of support.

2. All target priority areas and communities in terms of geography and demographics are now digitally included.

3. Necessary capacity is in place in communities through access to equipment, connectivity, funding, training and other interventions.

4. We have successfully secured year on year grants and private sector investment to tackle inclusion priorities across the district.

How Does the Digital Inclusion Theme Support District Plan Outcomes?

Children have the best start in life	Many children and young people have struggled to access remote learning, hindering their progress on attainment, job prospects and life chances. The Inclusion programme will ensure they have the digital tools to give them the best start in life.
Residents achieve good health and wellbeing	It will ensure residents have access to new models of care using virtual technologies and knowledge. Having adequate digital skills will ensure they can access these services.
Sustainable economic growth and decent work for all	It will help people to secure good work, reducing inequality in income and ultimately supporting their wellbeing. It will contribute to increasing the value of Bradford's economy and getting more people into work and improving the skills of residents to close the gap with UK skill levels.
Safe, sustainable and inclusive communities	It will help people to secure good work, reducing inequality in income and ultimately supporting their wellbeing.

KEY ENABLERS ESSENTIAL TO SUCCESSFUL DELIVERY OF THE STRATEGY

These are a set of cross-cutting key enablers that the Council need to act on together with its partners.

LEADERSHIP AND GOVERNANCE	FINANCE	PLANNING POLICY	PROCUREMENT	MEASUREMENT AND EVALUATION	BRAND AND IDENTITY

Leadership and Governance:

Bradford District already has a mature and effective partner leadership and governance framework in place through the Wellbeing Board Governance Structure. We will utilise this relationship and set up a Digital & Data Board with a clear terms of reference of delivery oversight and guide the further development and implementation of the strategy.

SPONSORSHIP
WELLBEING BOARD

DELIVERY OVERSIGHT
DIGITAL AND DATA BOARD

DELIVERY ROLES — Review of prioritisation self-assessment against the prioritisation model

DELIVERY ROLES — Ongoing benefits monitoring

We will appoint a dedicated Digital Programme Lead to drive the agenda forward and report to the Digital & Data Board. Other resources will be identified and added as per project requirements. The Programme Office function will integrate with our Clean Growth Delivery Framework.

This is a multi-year, incremental journey in which a clear, compelling and shared vision of what a "smart future" looks and feels like for the district will emerge and we will ensure stakeholder engagement and buy-in.

We will seek to galvanise practical action and planning together with stakeholders across the district and ensure we understand the role that each of us needs to play to build successful and sustainable integrated systems.

Digital and Smart City project ventures are known in general to be characterised as fragmented, not part of an overall plan or capability. We also know from our research that most smart city pilots end with no sustainable plan to scale. Our efforts on pilot projects will be targeted and governed effectively to ensure they address real issues and add real citizen value.

Finance:

We will establish a five-year financial commitment to continue to drive forward the Digital Strategy. We will ring-fence capital funds each year, with release subject to business cases. The provision will be modest to begin with (£500,000) to seed development of our smart city infrastructure and Digital Twin Roadmap. This will increase each year as we demonstrate progress and build confidence in the capabilities and their value to our citizens. The profile has still to be determined but we are aiming for a contribution of £3m to £5m over the next 5 years on the Digital Programmes.

This is just the beginning. We will look to work with our partners to optimise funding opportunities. We will proactively seek funding opportunities for our digital agenda from government and regional funds, and innovation research grants. We will consolidate funding across the various connectivity programmes to optimise value and impact.

We will seek private investment and sponsorship for our AI Innovation Partnership plans. This will include targeting foreign investment such as FDI investors who are looking for investment opportunities in citizen science and AI innovation programmes.

We will identify opportunities for commercial revenue generation associated with digital programmes and projects. Potentially this could be self-financing e.g. leveraging Council owned Ducting and fibre.

Planning Policy:

We have already established a dialogue between providers, developers, planners, communities and elected members to develop a shared position around connectivity. The Local Plan will look at the potential options for embedding digital, including designated areas for test beds as well as wider policies across the district over and beyond permitted development.

Using the Digital Twin application, we will develop 3D modelling process for brownfield sites and design and adopt an approach and framework for Digital Master-Planning to encourage developers to adopt. The tool will also be used for supporting 'greening the city' activity and the creating of community spaces Furthermore, the Southern Gateway area of the City will be established as the city's digital demonstrator.

Procurement:

The Council and regional partners rely heavily on suppliers, particularly where services are commissioned. Legacy supplier relationships and procurement policies have raised significant barriers to digital and smart city developments in the past, for example around interoperability and access to APIs and data. We need procurement and supplier management strategies that act as enablers rather than blockers of more citizen-centric and integrated services.

Our research showed that from both the public and private sector sides of the market, there is strong evidence that traditional procurement of council services is stifling innovation and inhibiting the ability of local authorities and industry jointly to undertake real life R&D and to pool intellectual property for mutual benefit. Equally, there is increasing consensus on new, smarter approaches to public procurement, which are already starting to develop and should be more widely adopted.

The Council takes an integrated view of its procurement requirements, aligned with smart city procurement principles. We will focus on procuring business outcomes, build open data into all procurements: be clear that all data is to be owned by the council and its district partners not the supplier, and establish clear requirements for the supplier to make data available via open standards and fair, reasonable and non-discriminatory terms;

We will incentivise innovation and collaboration: ensuring that contractual arrangements encourage collaboration with others to create new value, and the sharing of common assets.

We will avoid supplier lock-in, by integrating interoperability requirements into all ICT procurement, using commercial off-the-shelf products and open standards wherever possible, and factoring in the costs of exit from the outset.

The need to nurture an innovation ecosystem of suppliers should be a major theme of stakeholder collaboration. In reviewing procurement policies, the council will seek to align contracting principles with open, service-oriented, IT architecture.

We will select suppliers based on long-term value for money rather than price, and in particular based on our degree of confidence that the chosen suppliers will secure delivery of the expected business benefits. Where it is appropriate we will establish governance arrangements that enable a region-wide overview of major procurements by the council and its partners. We will explore the approach taken through procurement to help meet climate change and clean growth ambitions.

We will explore opportunities to help harness the capability of small technology businesses, identify the opportunities and routes to innovation partnerships within the procurement process.

Measurement and Evaluation:

We will work with the University of Bradford to develop a framework for evaluation and monitoring which can be used to evaluate projects during their lifecycle but also be used to help define the design and scope of future programmes and projects. We will establish a benefit realisation strategy to ensure a clear line-of-sight between actions and vision, and that the intended benefits from the smart city programme are delivered in practice. The strategy should be built around benefit mapping, benefit tracking and benefit delivery. We will establish processes to ensure that critical success factors are identified, measured and managed.

Brand and Identity:

Our research showed that having a strong brand and digital identity for your area can go a long way to supporting growth. With our stakeholder engagement and as the strategy roadmap progresses, we will commission a piece of work to develop the region's digital identity and brand aligned to the digital strategy building on its known strengths.

We will identity a programme of events and activities around which to promote the strategy both amongst partners and stakeholders across the region as well as the wider global community.