The Hyper Connected and Data Rich City

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Previous UK Demonstrators: OPEN Glasgow

- Innovate UK awarded Glasgow £24m as part of the Future Cities Demonstrator competition in 2013 to develop the following key strands of activities:

Glasgow Operations Centre	**State-of-the-art integrated traffic and public safety management system**	**City-wide**
Active Travel Demonstrator	Demonstrate how the city can be made friendlier for both cyclists and pedestrians	City-wide
Energy Efficiency Demonstrator	Creating a detailed, data-rich portrait of Glasgow's consumption to inspire ways to cut emissions, reduce overheads and address issues of fuel poverty	City-wide
Integrated Social Transport Demonstrator	Smart integration and route scheduling software to help some of Glasgow's most vulnerable citizens access social and educational services	City-wide
Intelligent Street Lighting	Show how the city can use smarter streetlights to improve lighting quality, reduce energy usage and make maintenance more efficient.	Two test street locations

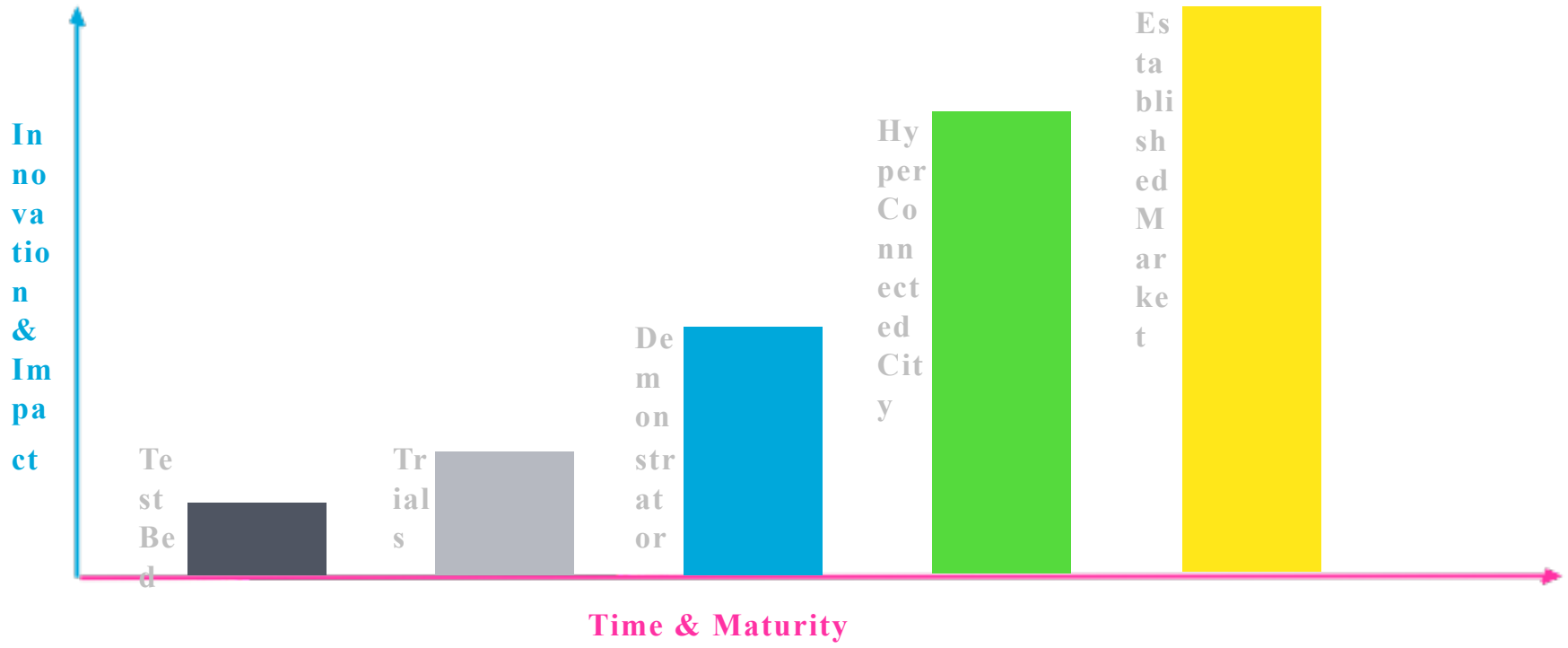
UK Demonstrators, in delivery: CityVerve

- Innovate UK awarded Manchester £10m as part of the IoTUK competition in 2015 to develop the following key strands of activities in the Manchester Corridor*:

Smart air-quality monitoring	**Street furniture and connectivity infrastructure such as lamp posts and street cabinets will be used to monitor air quality at different heights and locations.**
Talkative bus stops	Convert 'flag and pole' bus stops into safe places with location-based services, sensors/beacons, mobile apps and intelligent digital signage, allowing people to alert bus operators they are waiting for their service.
Management of chronic respiratory conditions	'Biometric sensor network' will help improve responses to patients' conditions and improve how local healthcare services work.

* Manchester Corridor is Manchester's innovation district: 243 hectares, 60,000-strong workforce, of which over 50 per cent are employed in knowledge-based sectors. It also houses 72,000 students, and the largest clinical academic campus in Europe.

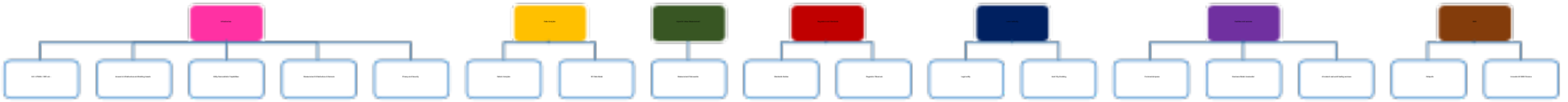
Emergence of the Hyper Connected City



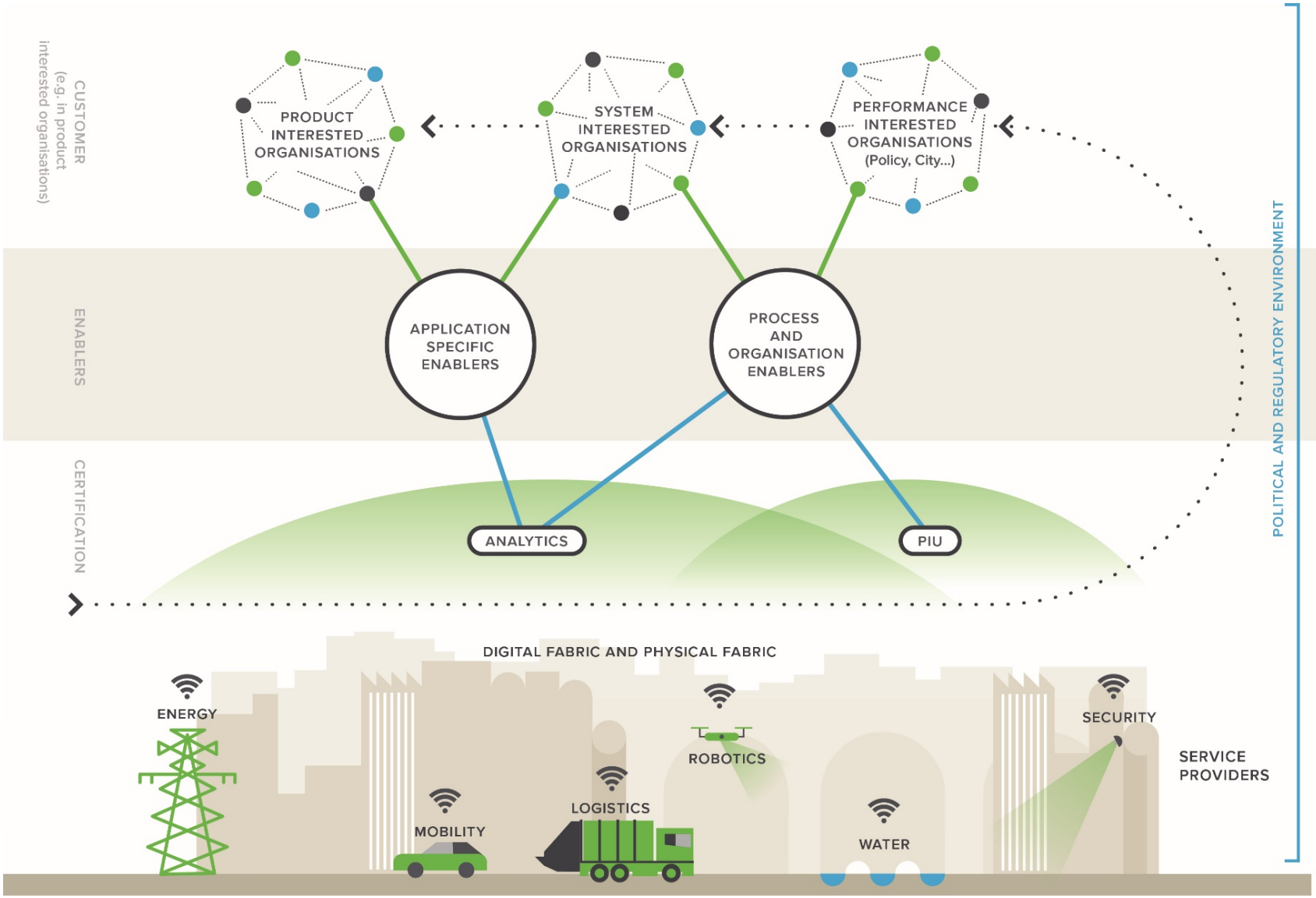
HCDRC – Why is it different?

- Provides a large enough scale (city or sub-regional) for companies to test and trial their innovations for commercial viability and product development.
- Special-Purpose Vehicle organisation (SPV) will ensure the longevity of the projects during and after the demonstrator.
- Procurement of city-wide services will be achieved through joint Local Authority/SPV procurement.
- Enable delivery of multiple use cases at scale through integration with existing city systems.
- Working with regulators from the outset to shape project.
- Access agreements in place for physical and digital assets.
- Emphasis on processes to protect IP and create collaborative environment between public and private sector actors.

HCDRC – Capabilities and Services



User Journeys



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Hyper Connected & Data Rich City

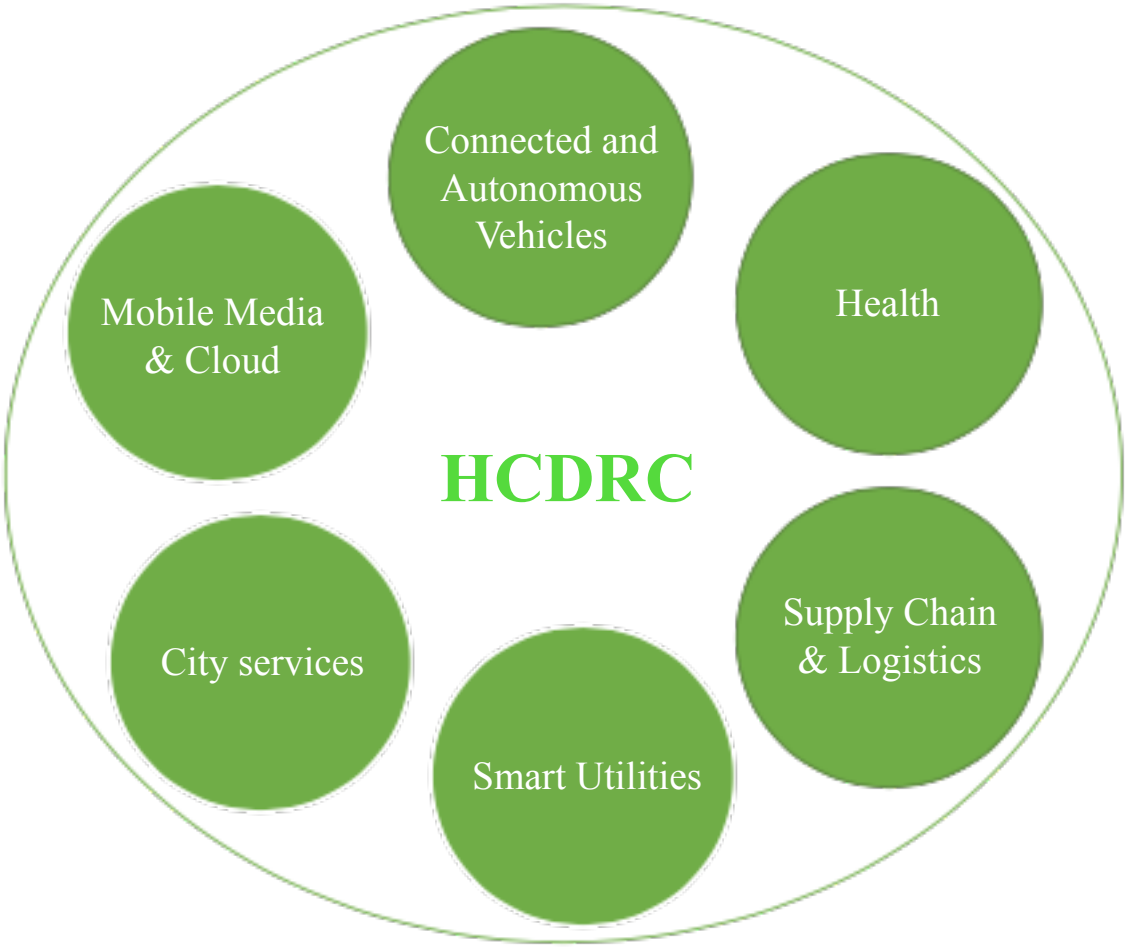
Outcomes

- Secure UK leadership position
- Faster entry to market / commercialisation
- Reducing R&D cycle and cost, fully developed product with performance evidence
- Leadership driving regulation and standardisation of new technologies
- Lower barriers to entry for SMEs

- Develop a self-financing model that can be repeated
- Increased resilience of cities
- Attract significant investment to the host city
- Potential for commercial opportunities with host city and consortium delivering use cases

Programme structure – Use cases

At the core of the project are a series of 20 use cases spread across 6 key themes.



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Expected Impacts: Market Opportunity

- UK automotive industry worth £71.6bn in turnover (11.8% of UK exports), with all UK produced vehicles having a significant level of automation by 2028.
- Cloud computing was expected to be worth £13bn at the end of 2016, 70% of the UK population consuming digital video.
- Global digital health market valued at £23bn in 2014.
- World wide power and utility companies expected to invest $200bn by 2015 in the upgrade of transmission infrastructure and metering services.
- Supply chain & logistics expected to generate an additional £20bn in revenues for UK manufacturers.

Expected Impacts: Social, Economic and Environmental

- Autonomous vehicles: Improved efficiency in operation of the road infrastructure, reduced journey times, fewer accidents, lower negative impact of transport on the environment.
- Mobile Media & Cloud: Increased productivity and collaboration within the workplace environment, better gaming experience and effective advertising.
- Health: More effective health service delivery through remote consultations, e.g. reduce the number of missed appointments with GPs which currently cost the NHS in excess of £1bn per year
- Smart Utilities: Reduction in energy consumption and carbon emissions, lower costs for consumers, reduction in the requirement for new generating capacity.
- Supply Chain & Logistics: Reduction in carbon emissions, shortened delivery times, reduced congestion on the roads and improved competitiveness.

Programme structure – Use cases

Theme	Description	Example Use Cases
Connected & Autonomous Vehicles (CAVs)	A range of technologies with increasing levels of automation that will use information from on-board sensors and systems to understand their global position and local environment. This enables them to operate with little or no human input (be driverless) for some, or all, of the journey.	*Platooning* – a group of vehicles travel as a convoy very close to each other with perhaps only driver of the lead vehicle retaining manual control of his vehicle. *Driver Assistance* – advanced systems that use on-board sensors and connections to other vehicles and back office systems to improve safety as well as reduce congestion. Vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) connections provide better control to road operators as well as enhancing on-board sensing capabilities.
Mobile Media & Cloud	A range of services which are delivered primarily via streaming or downloading from the cloud to a mobile device. It includes use cases that are mass market applications, require high speed connectivity on the move, gaming industry, mobile/virtual office applications	*Augmented reality* – uses existing environmental information and overlays other information on top in real time to enhance decision making. *Collaborative working* – a cloud based function that combines a number of business related functions within a web interface enabling users to have a mobile office allowing file sharing and other key functionalities

Programme structure – Use cases

Theme	Description	Example Use Cases
Health	Digital healthcare covers areas such as remote and robotic surgery to assisted living technologies as well as improved access to patient records	*Preventative health services* – using wearable technologies and sensors to monitor patient health providing real time information to practitioners on vital signs and symptoms via mobile technology *Assisted living* – sensors placed around the home can provide details to care providers on movement, occupancy and behaviour within the home of vulnerable individuals
Supply Chain & Logistics	Transparent interworking between every element in the supply chain, involving ubiquitous connectivity between every human and component, the latter based on sensor tracking. This can boost efficiency and delivery times and help coordinate on a complex project.	*Fleet and logistics management* – distribution, storage and transportation of goods between various points of the eco system – typically from manufacturer or retailer to consumer. *Drone delivery* – delivery of packages and parcels by autonomous drone equipped with sensors reducing delivery time

Programme structure – Use cases

Theme	Description	Example Use Cases
Utilities	Smart utilities involve various applications aimed at optimising existing infrastructure assets; reducing consumption of water and energy; decreasing costs to the consumer; reducing carbon emissions and reducing the need for investment in new infrastructure	*Smart metering* – connecting utility meters to a central server to provide real-time consumption and cost information with ability to predict and manage peak flows *Smart grid* – deployment of a range of generation, storage and demand side technologies providing real-time consumption and capability to manage during peak periods
Integrated city-wide services	Integrating the delivery of city-wide services such as waste management, and street lighting can improve the efficiency of service delivery and reduce costs.	*Smart waste management* – optimising the routes of waste collection vehicles. *Smart lighting* – improve lighting quality, reduce energy usage, make maintenance more efficient, utilise lamp posts infrastructure to collect data on air quality, etc.

HCDRC Potential programme (2017 – 2021)

Commercial at scale testing

Theme	Use Cases (0-5 Years)
Connected & Autonomous Vehicles	Platooning V2V and V2I In Vehicle Connectivity Vehicle Management
Smart Utilities	Smart Metering – Energy Smart Metering - Water Smart Grid – Water Smart Grid – Energy
Cities (Local Gov + Local Partners)	Smart waste Smart bikes, parking and roads Smart lighting / energy management Wayfinding / highways Community Engagement Platforms Planning / Digital Built Britain?
Supply Chain and Logistics	Fleet Management and Logistics Drone
Mobile Media and Cloud	Immersive Gaming Augmented Reality Collaborative working HD Video 4K, 8K
Health	Preventative Health

HCDRC programme (2021 – 2026)

Commercial at scale testing

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Theme	Use Cases (5 -10 Years)
Connected & Autonomous Vehicles	Platooning V2V and V2I In Vehicle Connectivity Autonomous, shared, electric fleets in cities
Smart Utilities	Autonomous Smart Grid – Water Autonomous Smart Grid – Energy
Cities (Local Gov + Local Partners)	Integrated Systems BIM L3
Supply Chain and Logistics	Autonomous Logistics
Mobile Media and Cloud	Immersive Gaming Augmented Reality Collaborative working
Health	Remote Health & Tactile Internet Assisted Living & Robotics

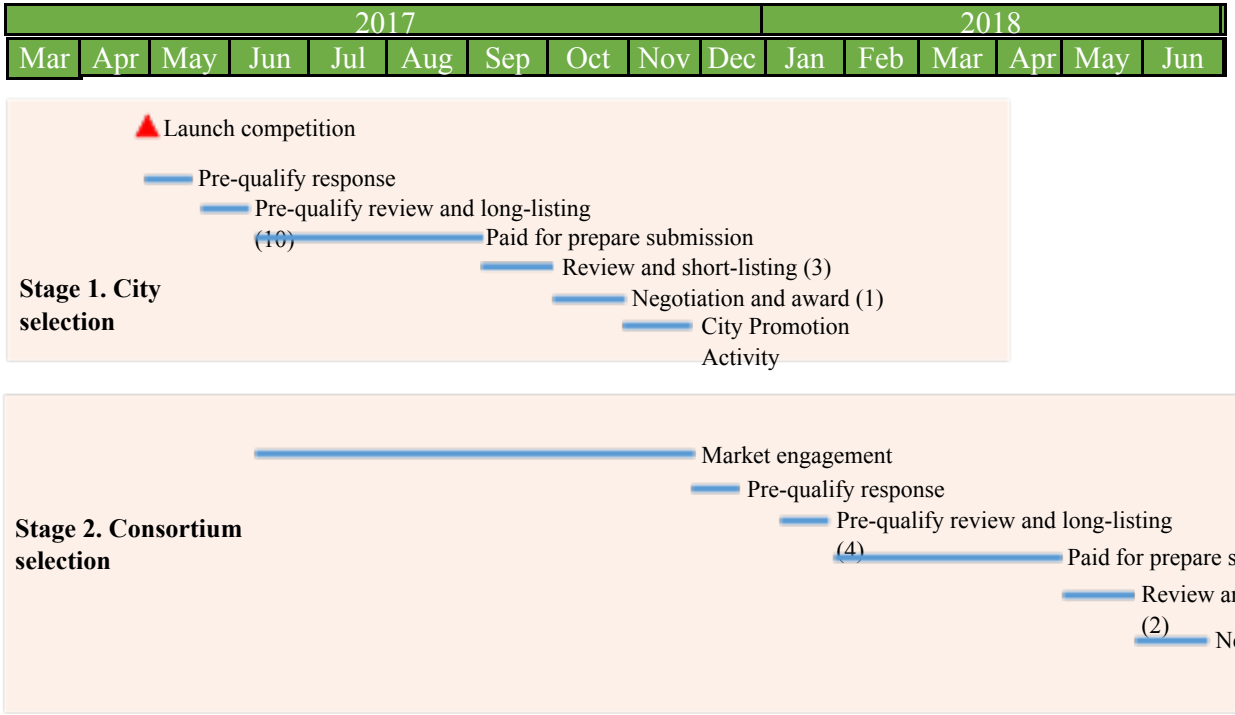
Cross-Sector / System large-scale deployments - examples

Description	Use cases	HCDRC digital/ICT enablers	Regulators	Physical Assets Access Requirements
Large scale smart grid, logistics, telco and connected vehicle trial	Smart Energy, logistics, CAV, cities, AR	Connectivity, advanced modelling, 3D data model, etc.	ORR, Ofgem, Ofcom, UKRN,	Access to roadside infrastructure, traffic management system, road space, land assets for distribution
Large scale trial of connected healthcare and smart energy	healthcare, cities, smart energy	Connectivity, advanced modelling, patient data	Monitor, Ofwat, Ofgem	GP surgeries, hospitals, buildings, street furniture, council housing, care homes

SME large-scale deployments - examples

Use cases	HCDRC digital/ICT enablers	Regulators	Physical Assets access requirements
Assisted living	Advanced connectivity infrastructure, Data analytics hub, patient data	NHS entities	buildings, street furniture, council housing, care homes,
Collaborative working, VR, In-car entertainment	Advanced connectivity infrastructure, 3D data models, Data analytics hub	Ofcom, ICO	Buildings, street furniture, billboards (advertising infrastructure/assets)

DRAFT Programme design



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Next Steps

- Develop investment and project model with industry and government
- Map social, environmental and economic benefits
- Programme and cost the technical, legal and engineering challenges of delivering next generation telecoms use cases at scale in a single geographic area
- Clarify public sector role in delivery
- Establish programme parameters and timing of roll out
- 2 stage process
- Develop funding options

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