



Future Digital Connectivity and 5G Networks

**A Report for Enterprise M3 to inform the
Local Industrial Strategy**

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Purpose

This report outlines the need for digital connectivity and 5G networks in the Enterprise M3 (EM3) Local Enterprise Partnership region. It focuses on how these networks can improve productivity and growth within the region and how a connectivity infrastructure could be developed through collaboration with commercial partners and stakeholders. It also identifies specific use cases and new business models that such a network would enable

The Case for Digital Connectivity and 5G Networks

Research has shown that countries that digitalise first enjoy significant advantages in productivity, efficiency and global reach over those that don't. Indeed digital technology has been shown to be the single biggest enabler of economic growth and global competitiveness. For mobile connectivity specifically, research by the Boston Consulting Group (BCG) for the GSM Association (GSMA) found that companies who lead in mobile connectivity grow revenue up to two times faster and have added jobs up to eight times faster than laggards. Companies that do not take advantage of Digital Connectivity and 5G networks will soon then find themselves outpaced by those that do and so we must encourage companies in the EM3 region to act now, or risk being left behind. The train is leaving the station; we must make sure we are on it

Digital connectivity and 5G networks then are key to future economic success and more must be done to promote them. They enable VR, AR, MR and Smart technologies that will provide efficiency gains throughout the EM3 region and beyond. Productivity gains can be made in transport through cooperative logistics, traffic management and parking. Together they will deliver automation and supply chain advantages through connected products for manufacturing companies that operate just-in-time systems. Also in healthcare they can deliver Smart asset management for hospitals, personalised care and “Tele” and Precision medicine direct to homes. Additionally in energy markets smart grid management systems will result in more efficient and environmentally friendly use of energy and the coordination of unpredictable renewable energy sources. Finally they can deliver an enhanced experience in public spaces, retail and leisure providing a new level of detail and navigation. They can deliver all the things that the Government has set as the five foundations for productivity in the National Industrial Strategy and the EM3 LEP's nine major priorities for the region. The region should make sure it is placed to be a centre of excellence for all these technologies and specifically a leader in digital connectivity and 5G networks

What is the picture within the EM3 region?

There is a clear rationale for better connectivity in the future but what is the situation on the ground today in the EM3 region. Research has been conducted with companies across the EM3 region and in a variety of businesses from Gaming and Virtual Reality to IT management, Product Testing and Professional Services. These are the findings:

- All companies would like access to high-speed connectivity but few have it today
- Lack of connectivity is cited as hampering the efficiency and growth of their businesses already
- All cited the biggest problem with getting high speed connectivity was that operators are not interested in businesses, only consumers
- Many of the companies only had access to speeds in the ten's of Mbps and those that had access to higher speeds (typically 100 Mbps) had to pay for expensive leased lines to get it
- Companies have therefore developed sometimes expensive "work-arounds" to enable their businesses to function in the absence of high-speed connectivity.

Generally the issue is the time taken to move data from one place to another but more specifically the following were common problems:

- Most companies want to back-up data in the cloud but, it takes too long with the connectivity they have. Companies are therefore forced to absorb the cost of putting dedicated, on-site infrastructure for back-up of data
- Companies that have more than one site experience problems with moving data around from one to the other. Some have resorted to using physical media that is shipped by courier as the fastest way to move this data. Productivity suffers here as progress is stopped while the data is in transit
- Increasingly companies have people working remotely or at home who need to be able access data at their office. Ironically the bottleneck here is not at their homes but at the office. Again productivity is affected by having to wait for data to arrive

These problems reflect those highlighted by BCG's research and are already proving to be a drag on productivity and growth for companies in the EM3 region. There is clear demand for fast and reliable connectivity already, that will only grow, and its absence is holding back businesses in the EM3 region already. There is also evidence of market failure where the focus of commercial operators is on consumers rather than businesses. Businesses that need fast connectivity have no option but to pay for expensive leased lines to get it

Companies and Testimonials

nDreams

nDreams are an award-winning VR studio, dedicated to high-end games and experiences. Since 2013, they have launched numerous titles, whilst building a team of over 80 video games pioneers, bringing a wealth of experience in their specialist fields

"We are a world renowned VR gaming company that relies on the fast transfer of large amounts of data and consequently we have had to absorb the expense of a leased line to get the high speed Internet connection we need. Added to that we are rapidly expanding so office space is an issue and at the same time we have people that could work from home. However, that's just not practical with the connectivity we have. 5G connectivity to solve that would be a dream for us"

TVision

TVision is one of the largest and most experienced providers of Microsoft Dynamics 365 solutions in the UK. As a Microsoft Gold Partner, they bring expertise in implementing Microsoft Dynamics 365 ERP solutions and understanding of how they fit seamlessly with their client's business

"In our business we hold a lot of data, so making sure we don't lose anything is crucial. We have to take regular back-ups to avoid this but the amount of data is growing all the time and therefore back-up in the Cloud is very attractive for us. However, even though we have access to 60Mbps broadband it still takes too long for us to back-up data in the Cloud. Our only answer for back-up today is to invest in local on premises equipment"

Indigo

Indigo IT focuses on ensuring that their clients get the most from the technology systems their businesses rely on. Based in Lightwater & Central London they have been delivering pro-active IT and Telecoms services since 1991 to clients in a wide range of business sectors

Global Step

Global Step provides QA and Testing for games, VR, and film & television. They have facilities in the US, the UK and Poland and over 20 years of experience partnering with video game and entertainment companies from around the world. They provide Quality Assurance, Localisation, Compliance, Certification and Customer Support. Making sure games function flawlessly or are localized to fit every market. They have been credited with numerous AAA titles and are well renowned for their values of integrity, innovation and efficiency

ei²

The ei² team is a niche consultancy that works in big companies and small to medium enterprises. Their team has many years' experience in software – from Data Analysis, Insights and Reporting, Performance and Systems/Data Integration to Business Intelligence, Development, Solution Design, Quality Assurance and Testing. They have worked in a wide variety of industry sectors including postal and media licencing, investment banking, telecommunications, travel, defence, manufacturing, retail, finance, HR, Legal, Housing, Pharmaceutical and Education.

"In our business we have many contractors that are working remotely and so quickly moving data between them and the client is paramount. Depending on where the contractor and the client are located this can be quite variable and can adversely affect productivity in our business and our ability to serve clients. If we could have access to fast connectivity across the region it would help us to remove these inconsistencies and provide a more efficient service to our clients"

UL

UL is a global safety testing and approvals company providing certification such as CE marking for global companies. They employ exacting scientific processes and the highest ethical principles to help create a better world. As safety challenges and concerns expand to include sustainability, well-being, connected technologies and security, they provide broad leadership, deep expertise and vital services to guide these transformations

"The advanced digital connectivity offered by 5G will enable UL to explore innovative solutions for our business and support our clients providing new opportunities in consumer, enterprise and industrial sectors"

Bohemia Interactive Simulations

Bohemia Interactive Simulations (BISim) is a global software company at the forefront of simulation training solutions for defence and civilian organizations. They use the latest game-based technology and a large, experienced in-house team of engineers to develop high fidelity, cost-effective training and simulation software products for defence applications

"We are an international software company that relies on the fast and efficient transfer of large amounts of data and consequently rely on access to high speed Internet connection. The solution today has been to install a leased line at a cost of £1,600/quarter but that only gives us 100Mbps. In many cases this is still not fast enough and for some cases has resulted in us having to ship physical media via a courier, as this is the fastest way to move the data. As well as requiring us to pay for physical shipping, these delays in transferring data between our sites has a serious impact on productivity and potential growth of our UK business. It is hard to put a precise number on the cost of this lost productivity, but we have estimated it at around £6k per month. This estimate doesn't include the potentially missed revenue, which would be enhanced with access to a high-speed Internet connection. Access to 1Gbps via 5G would be a significant help to our business"

Implications for EM3 Region

Given the economic impact that these technologies deliver it is imperative to ensure that technology infrastructure across the Enterprise M3 region never inhibits productivity improvements or growth. There are many businesses in the region already that have the potential to be leaders in Gbit applications but they lack access to 5G networks for product development and testing and the necessary business support to effectively scale and grow. However, it's not realistic for 5G networks to be immediately available everywhere, rather the approach should be to "seed" 5G networks with strategic deployments in so called "5G Islands" that build capacity and reach step by step

EM3 LEP and the Local Authorities will likely have to facilitate this development because, as already identified, commercial operators are unlikely to meet this demand if left to their own devices. Correcting this market failure then justifies the case for public intervention by the EM3 LEP and Local Authorities to:

- Provide infrastructure in the form of a regional Fibre Spine and 5G networks to strategically connect regional assets based on business and community demand
- Build open access 5G test-beds such as the 5G Living Lab that allow for product development and testing of Gbit applications ahead of real world deployment
- Provide Business Incubation and Acceleration to develop businesses that can exploit 5G and create a global leadership position in applications for Gbit connectivity
- Plan areas of redevelopment such as retail, leisure, housing and enterprise zones, to have 5G networks from day one and create "5G Islands" for commercial deployment
- Encourage and provide the skills training for Local Authorities to facilitate "Neutral Hosting" as a way to accelerate the roll out of digital connectivity and 5G networks

Connecting Regional Assets

The deployment of 5G networks necessitates a fibre backbone to support it. All 5G base stations have to have fibre infrastructure to connect back to the core network; they go hand in hand. Combine that with a region that has many towns without large populations then inter-connecting them with a Fibre Spine becomes essential. Such a Fibre Spine will create scale across the region and beyond and convince commercial partners to act but the route of the Spine must be driven primarily by business demand, considering other users where possible. It will also need to be supplemented by 5G breakout networks to cover last mile delivery to existing well-developed business parks where "Hard Dig" is costly and disruptive. Indeed, delivering the Fibre Spine itself is potentially costly and disruptive too so a "Soft Dig" route using soft roadside verges has been identified and mapped against regional business parks to mitigate this

5G Test-beds

In the end, it's what we do with 5G that matters so as a region we have to encourage and develop businesses that are at the forefront of Gbit applications because 5G is a global market. Fortunately, we have a head start with many of these companies in the region already but we need to position EM3 as the place to develop these technologies. Building the Fibre Spine and 5G networks is key but additionally companies need somewhere to develop and test their ideas. Public networks are not a practical solution because companies need access to the core network to develop and test ideas in both a controlled environment and at speed. Building 5G test capability will also create the opportunity to position the region as a 5G centre of excellence that will be a magnet for companies in this space

Leadership in the 5G World - Incubation and Acceleration

In the future 5G connectivity will be like electricity, we will assume it to be there, and so it's what we do with it that matters. As a region we have to encourage and develop new businesses that are at the forefront of the Gbit applications it enables. Typically these businesses understand the technology well but lack the business skills to effectively commercialise it and to grow and scale. Providing business incubation and acceleration wrapped around a 5G test-bed like the 5G Living Lab is crucial to support these new businesses to grow, get investment, scale and ultimately employ people in what will be a global market. Additionally though we need incubators and accelerators to build the technology ecosystem and tech scene in the region to make the EM3 a centre of excellence for this cutting edge technology. Breaking down the silos between corporates, SMEs and start-ups is essential for creating the collaboration needed to progress at speed

Delivering Scale - 5G Islands

Delivering scale in the deployment of digital connectivity and 5G networks will be essential in order to aggregate enough demand to make a viable business case. One way to do this is by using existing redevelopment in local buildings and infrastructure, across the EM3 region, as a way to effectively kick-start 5G deployments. Areas such as the redevelopment of the Leisure Park in Basingstoke and the town centre in Aldershot can be seen as an opportunity to build digital connectivity and 5G networks as part of the construction from day one to create so called "5G Islands". "5G Islands" are self-contained entities; the 5G experience is localised to a certain area, immersive experiences in retail for example, and only need to be experienced when you are actually there. Such an approach will be necessary as digital connectivity and 5G coverage is likely to be patchy at first and these sites can provide early access at some scale and for specific needs. Adopting a step-by-step approach will be fundamental. These initial deployments will be pilots that can then be "stamped out" in other locations providing a powerful way to build a region wide capability and governance

Return on Investment

Local Authorities in partnership with commercial developers could facilitate development of these networks as part of construction work. However, Local Authorities should also see this as a revenue generating opportunity through “Neutral Hosting” where they can lease bandwidth on the network to mobile operators. This capability is unique to 5G. Such networks could also be used to collect localised data that could either be resold or instead made “Open” to promote new businesses that create products and services based on it. There are then opportunities for Local Authorities to get a return on their investment but this should be regarded as a long-term opportunity rather than generating quick returns. Patience will be needed to see returns but it could be lucrative revenue stream in the future

The Focus of Corrective Action

The development of the propositions to support this will take into account existing assets and infrastructure such as the 5GIC at the University of Surrey and regional expertise in Gaming, Creative Technologies, Aerospace and Defence and consider how to build on these strengths to create a new regional ecosystem that can link and scale outside of the EM3 region. A strong collaborative effort between public and private partners and stakeholders will be essential for successful delivery of this programme and fostering that spirit should be high on the agenda. The opportunities are many but we must act now. It is fair to say the demand is there but it’s there today already. The research with local companies showed there is appetite but also a healthy scepticism that, as Government is involved, it’s not going to happen any time soon. It is then essential that we act quickly and get high profile wins to create the momentum that will engage and carry businesses with us

Propositions

A Regional Fibre Spine

Fibre is an essential part of any 21st century digital network. It is the backbone that connects major assets with mobile infrastructure to create a ubiquitous connectivity fabric. Given the economic impact that digital connectivity will deliver it is imperative to ensure that technology infrastructure across the Enterprise M3 region never inhibits productivity improvements or growth. However, research conducted with companies across the EM3 has shown that operators have little appetite to service businesses and are focused on consumers first and foremost. Connecting consumers then will determine the route of commercial fibre infrastructure rather than the location of business users. There exists then a market failure that would justify public intervention

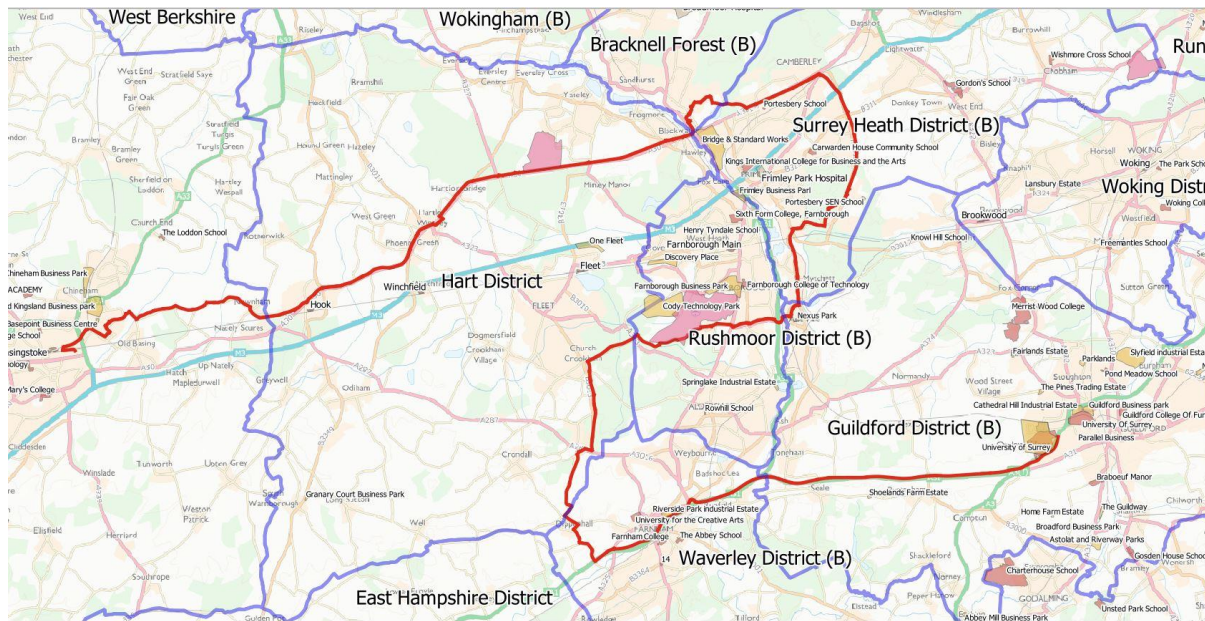
The route that new fibre connectivity takes will be a major contributor to the cost of such an intervention. Where “hard dig” is required the cost is much higher than if “soft dig” routes using existing grass verges could be used. However, many businesses are located on already established business parks where “soft dig” is not possible. There are a number of such cases along the A325 in Farnborough, which is a popular area for companies involved in VR/AR and gaming that have demand for bandwidth. How then can we overcome this problem?

The Proposition

If we could build a Fibre Spine that followed a “soft dig” route that is in proximity of major business parks and combine it with 5G infrastructure we might provide high-speed digital connectivity with little disruption, at reasonable cost and crucially within a reasonable timeframe. In this case 5G would provide the last mile connectivity that obviates the need for Fibre to the Premise (FTTP) and associated cost of “hard dig”

Work has been done with Ordinance Survey (see map below) to identify a route between, at one end, the 5G Living Lab in Basingstoke and the 5GIC in Guildford taking in the major towns in between. As a result of this work a route has been identified that is currently 98% “soft dig”. There now needs to be some further work to map this route against major business parks in the region and the location of 5G infrastructure needed to reach them from the Fibre Spine. With this work complete it should be possible to cost the project

Soft Dig Route from Basingstoke to Guildford - Developed by Ordinance Survey



One further point to be made here is the need for rapid deployment. If we are to carry business with us we need to move at speed, to show progress. We should not therefore envisage this as a big monolithic project where you have to wait for all of it before you have any of it; rather a series of short sprints is what's required. Therefore any implementation plan should build the network piecemeal and consider two things 1) where there is demand and 2) ease and speed of build. Plan to build those parts first

Lead in Gbit Applications for 5G

5G will change all our lives like never before. In the end it will touch all of us in every aspect of daily life but that's still a little way off so what applications are in the vanguard of 5G? Well, those that involve masses of data: VR/AR, Gaming, Streaming, AI and Machine Learning. The EM3 region is well placed in all of these and they play to the "Audience of the Future" strand of the Industrial Strategy. In the end 5G will be like electricity, it will fade into the background and we will just assume it's there. It's what we do with 5G that matters. As a region we have to encourage and develop businesses that are at the forefront of these applications because 5G is a global market and if we don't do it someone else will. Fortunately, we have a head start with many of these companies in the region already but we need to position it as the place to develop these technologies

Companies are great at figuring how to creatively use new technology so we don't need to do that for them, they are more than capable. What we need to provide is opportunities to use and engage with new technology and to deploy it in real world scenarios. As outlined already in this report building the Fibre Spine and 5G networks is key but before that companies need somewhere to develop and test their ideas. Public networks are not a practical solution because companies need access to the core network to develop and test ideas in both a controlled environment and at speed. This why we need test-beds, they allow companies to try things and when they break or don't work to find out why in a controlled environment

The Proposition

With this in mind a 5G Living Lab and VR Studio is being built in Basing View. Deliberately targeting the vanguard applications, the 5G test-bed and VR Studio will cover all the applications identified above, as the GPU technology used in graphics is also great at dealing with the heavy computation required for AI and Machine Learning. Couple that with 5G connectivity and you have it all. It enables the concentration of resources, building more powerful systems in one place that can be accessed from anywhere rather than distributing a number of less capable systems across the region. This is a model that could be duplicated across the region with other Living Labs based on specific specialisations and expertise. The other requirement to consider is once the product is developed companies need somewhere to deploy it. The redevelopment sites and "5G Islands" should provide this

To really lead in Gbit technologies though we need two more things: 1) The ability to start and build new companies that can exploit it and 2) a skills base to feed those companies. Ultimately it's the availability of talent that will draw companies to the region. That's why incubation support needs to be built as a key part of the 5G Living Lab, helping companies to form, grow and get investment is key to expanding regional capabilities. Incubation support though needs to go further, it needs to engage with education to help inspire students and provide real world experience for the Creatives, Developers and Entrepreneurs of the future. It needs to be the technology focal point in a connected EM3 region. If we can do all this, the 5G Living Lab will become the model for other deployments across the region all linked together by a Fibre Spine

Local Redevelopment with “5G Islands”

There is massive redevelopment across all parts of the EM3 region from the Leisure Park and Manydown housing in Basingstoke to the Town Centre in Aldershot and Camberley. These developments should be used as opportunities to deploy 5G networks. As part of the construction we should create so called “5G Islands” that will seed the market for the technology. Targeting developments in retail and leisure in particular makes a lot of sense as firstly, they are natural users of the immersive technology that 5G enables and secondly, they are hyper localised. In other words what you experience is location specific and only while you are in that location. What this means is you don’t have to wait for wider 5G coverage, which is likely to be patchy at first, as long as you have coverage in that location. The thing to understand with 5G is that unlike 4G, which was more like a switch, it will be a gradual evolution. 5G and 4G will coexist for likely 15 - 20 years so 5G must be located firstly where it provides the most benefit

The Proposition

The focus on immersive technology also plays to regional strengths in VR/AR, Gaming and Graphics and these “5G Islands” act to provide early test and deployment opportunities for companies to prove business models and gain market leadership. This should be fundamental to the approach adopted. In a region that has many towns without large populations these initial deployments can act as pilots that can then be "stamped out" in other locations. Providing a powerful way to build a region wide scale and capability that will seed the market and encourage commercial operators to act

Indeed some forward-looking retailers are already considering such moves. AEW that owns Festival Place in Basingstoke is one. They operate a Mall that houses familiar high street stores such as M&S, Next, Debenhams etc. but stand out as one of the more successful malls in the UK. How are they doing this when the stores in the main are not unique? They realise that the future of bricks and mortar retail is in creating a shopping experience that creates footfall for their retailers. They already have a number of schemes in place such as entertainment for children while parents shop that have increased footfall by more than 2 million, a 10% increase. In recent discussion with them they indicated they are actively looking at a 5G deployment within Festival place to facilitate the type of immersive experience that they foresee retailers will increasingly rely on. These are opportunities for the LEP and Local Authorities to engage with business to create a joined up strategy around the Fibre Spine and 5G networks as we gradually transition to 5G

The use of redevelopment in local buildings and infrastructure projects across the EM3 region can then be an effective way to kick-start 5G deployments. Here again Local Authorities in partnership with business and commercial developers should facilitate development of these networks as part of building works and redevelopment

Neutral Hosting

Many Local Authorities are struggling financially as funding from central Government has been cut in recent years. As a result they are looking for ways to generate extra revenue in the form of regular income. Real estate has traditionally been a way to do this but increasingly ownership of technical assets in their region could be a lucrative opportunity to supplement stretched budgets

5G creates a way to this, it's called "Neutral Hosting". In essence it gives the owner of the 5G assets the capability to lease time and bandwidth to a number of different users. It uses a 5G capability known as "Network Slicing" to do this. Network Slicing enables the network to be divided into many virtual networks, or Slices, each of which is self-contained with specific capabilities. It is then possible to create a slice for O2, Vodafone, EE, Three or anyone else for that matter with the Local Authority charging a lease to use its network

The Proposition

As has been already stated the roll out of 5G will be very gradual and expensive to do so operators will prioritise locations that are commercially attractive. This might leave the towns in the EM3 at a disadvantage, as they don't represent a big enough catchment. There is then an opportunity for Local Authorities to step into this void and provide 5G connectivity, which they own, to deliver benefits to local residents and at the same time create a revenue stream. There is of course a substantial initial outlay to be considered and the ROI might take some time, it is essentially a long game, but in the end it could prove very lucrative

Such a network could also be used to collect localised data on traffic flows, pollution and environmental conditions that could be sold as another revenue stream or instead could be made "Open" to promote new businesses that create products and services based on it. Use it for economic development in other words

So what's holding this back? Well two things 1) Neutral Hosts need spectrum and 2) Local Authorities are new to this. They will need to understand the business model and its implications including financial risk

Spectrum in cellular networks is licensed and currently all the licenses are held by the big operators. However, central Government is very keen on Neutral Hosting and so Ofcom is looking at releasing spectrum for Neutral Hosts but, not quite yet unfortunately. Also, there are moves to force operators to release their licensed spectrum in areas where they are not using it, in other words use it or lose it. All said Neutral Hosting should be technically viable in the near future

Neutral Hosting is a new concept for Local Authorities and so that's currently holding them back. This is an issue that needs to be overcome. Local Authorities can contract third parties to build, maintain and run the network but they need to understand the business and revenue model and the timeframe for ROI. The main point here is about support and capacity to help Local Authorities make the transition. EM3 is already working on that through the Connected Places Catapult. If 5G is truly to reach all our residents it won't happen if left to the operators alone, public intervention or legislation will be required

About the Author

Adrian Braine



Adrian is CEO and founder of Candescence a company providing innovation, entrepreneurship and go to market expertise and consultancy to the hi-tech industry. In a career spanning more than 40 years he has been Director of Marketing for the global Connectivity business at Oxford Semiconductor and Director of Engineering at Metawave Video Systems; founding Candescence some 10 years ago

He has international director level experience in management, marketing and engineering that has produced a rare combination of technology innovation, commercialisation and go-to-market expertise. As a business innovation leader and product and go to market expert, he has been the driving force behind more than twenty, multi-million dollar products in the electronics, software and semiconductor industries. He brings a wealth of experience in hi-tech markets, combining more than 20 years of marketing and business management with over 20 years of technical leadership

Working at the cutting edge of technologies like 5G, VR/AR/MR, Gaming, AI and Machine Learning, he provides consultancy to help companies and local authorities to understand technology and adapt to its impact. He regularly presents to businesses and local authorities on the benefits and impact of 5G in order to raise awareness and help them to capitalise on this new technology. This work has been instrumental in bringing the 5G Living Lab and a state of the art VR Studio to Basingstoke

For the last 4 years he has been working with hi-tech start-ups and SMEs in this space and ran the SME engagement program in Basingstoke for the University of Surrey's 5G Innovation Centre. He is also part UK5G's SME Engagement Working Group a national group tasked with increasing SME engagement with 5G technology and is a key member of the recently launched "Train the Trainer" programme. He is also co-founder of Root21 a hi-tech business incubator and accelerator, based in Basingstoke, for innovative companies that are exploiting 5G and Immersive technologies. During this time he was also Entrepreneur in Residence for SETsquared's hi-tech incubator, mentoring more than 40 companies, and designed and delivered SETsquared's award winning Entrepreneurs Programme that has trained in excess of 800 companies over a three-year period

