CAMBRIDGESHIRE & PETERBOROUGH
COMBINED AUTHORITY

ADVANCED MANUFACTURING & MATERIALS

SECTOR STRATEGY FOR CAMBRIDGESHIRE & PETERBOROUGH COMBINED AUTHORITY

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EXECUTIVE SUMMARY

Advanced Manufacturing and Materials

Sector Strategy for Cambridgeshire and Peterborough Combined Authority

Executive Summary

In order to realise the potential of Cambridgeshire and Peterborough's advanced manufacturing and materials sector, it is vital to take effective action in bringing together all relevant stakeholders in the region. This will be done through a series of collaborative efforts between the combined authority and local business. By addressing the issues raised in the AMM strategy to completion it will be possible to enable the growth and continued success of this regions advanced manufacturing and materials sector.

This executive summary will highlight how the delivery mechanisms, necessary interventions and actions that are needed to enable the growth of this sector interlink with the focus of both the Cambridgeshire and Peterborough Combined Authority's (CPCA) Local Industrial Strategy and Local Growth Fund. Recognising and acknowledging the context in which current regional industrial and growth strategies are written provides a strong foundation for the actions and recommendations outlined the AMM sector strategy. Cohesion between all parties is necessary to create longevity in this strategy.

Context

Local Context

Cambridgeshire and Peterborough Overview

Cambridgeshire and Peterborough are an international hub for innovative businesses. With a thriving economy (contributing £22bn to the UK), the region is recognised across the world as a centre for advanced manufacturing, artificial intelligence (AI), food production and life sciences (C&P Local Industrial Strategy, 2019). The Cambridgeshire and Peterborough Independent Economic Review has identified three sub-economies in the region, all with slightly different sector specialisms. Greater Cambridge, the largest of the three and arguably more internationally recognised for its high levels or skills and outputs, has sector strengths including biomedical, pharmaceutical and AI, underpinned by two leading universities. With an established research and education infrastructure, which includes the University of Cambridge, the College of West Anglia Cambridge Campus, and TWI, there is a great opportunity to develop a localised skills supply chain; inspiring young engineers at college, to enrolling on a degree apprenticeship, to mastering specific skills at TWI.

The 'Cambridge Phenomenon' has already proven to be an effective method of developing high value sectors in Greater Cambridge, most particularly the growth of the life sciences cluster in this area which is currently worth around £3bn annually to the UK economy. There has also been a great increase in the success of the digital and artificial intelligence sector. Greater Cambridge is home to ARM, the well-know, international recognised digital and AI company that started with less that 20 employees and has grown to be a company valued at £24bn in 2016 (C&P Local Industrial Strategy, 2019).

The second sub-economy is Greater Peterborough. Greater Peterborough is one of the fastest growing cities in the last decade, and has a sector strength of manufacturing, but with a growing number of companies that fall within service and financial sectors. Peterborough has a strong manufacturing history, with 20% of business turnover in the city generated from high-tech manufacturing (and a further 6% coming from other manufacturing) (C&P Local Industrial Strategy, 2019). Peterborough is positioned well to replicate the Cambridge Phenomenon, and with a core underlying manufacturing sector, could benefit greatly from an increased focus in research and development. With the University Centre Peterborough having been established in 2009, the region is beginning to increase its effort in providing upskilling and education opportunities to its inhabitants. The region is also home to a recognised support network, in the form of Opportunity Peterborough, and allows businesses of all sizes to access support to grow.

Thirdly, The Fens, - a mostly rural area - has a rich mix of market towns and some of the best farmland in the UK, and therefore features world-class agricultural production. The rural economy of the Fens is also home to a number of niche manufacturing and service companies. Positioned close to the College of West Anglia, Wisbech campus, the Fenland corridor also has direct access to the emerging generation of engineers seeking employment in a fast-developing local economy.

With key subsectors in Cambridgeshire and Peterborough including Life science (worth £3bn annually to UK economy), Agritech (generating £4bn per annum), Digital, Information Tech and Artificial Intelligence (delivering 9% of the areas revenue and 8% of its employment), the Advanced Manufacturing and Materials sector has been identified as one with strengths all across the three economies of Cambridgeshire and Peterborough.). CPCA have recognised the opportunities that creating a focused strategy of growth for this particular sector brings, as the East

of England Science and Innovation Audit (2017) found the AMM sector to be "of foundational importance to the other themes" mentioned above (life sciences, agritech and IT).

East of England AMM sector Overview

Manufacturing is one of the largest sectors in the East of England and accounts for approximately 11.3% of regional GVA (10.2% of UK Manufacturing GVA). Manufacturing is one of the largest industries in the region, corresponding to 11.3% of regional GVA in 2015 and 10.2% of UK's manufacturing GVA.

The region boasts strengths in the aerospace industry with a large collection of centres based across the region. In Stevenage, Hertfordshire, MBDA and Airbus Defence & Space are situated, creating a large proportion of the world's low earth orbit satellites. The region is also home to Cranfield University, which specialises in postgraduate engineering degrees, and also houses the Aerospace Technology Institute.

The automotive sector is another industry in which the East of England performs strongly, especially within design and engineering. Ford's European design engineering HQ is based at Dunton in Essex, Nissan host their Technical Centre Europe at Cranfield, and Lotus Cars and Lotus Engineering being situated just outside of Norwich. Cambridgeshire boasts a selection of automotive specialists, including Caterpillar Engines in Peterborough, and Ricardo and Cosworth both housing electrical system tech centres in Cambridge.

The world leading research being performed across sites such as Adastral Park, in Suffolk, and the Cambridge Cluster, have allowed the region to develop a significant ICT offering. Major microprocessor designers are situated in the region, with ARM Holdings being the world's largest manufacturer of microprocessors in the world, with their products being found in 95% of smart phones. Further tech innovators are based in the region, including Apple, Amazon, Huawei and Microsoft but to name a few.

Both the number of jobs within manufacturing (4.3%) and businesses themselves (1.9%) have increased steadily over recent years, with a good quality of living, access to research and low house prices allowing businesses to move to the East of England, and for new organisations to start up in the region. Today, 7.7% of the region's total workforce is employed by the sector, and this could be set to grow with increased opportunities in energy, the automotive sector, and a strong food and drink sector resistant to market change.

With such a large sector in the East of England, CPCA stand to benefit through a focus on supporting it's emerging advanced manufacturing and materials sector.

Local Industrial Strategy

The Local Industrial Strategy for Cambridgeshire and Peterborough outlines a series of important goals for the region. It is part of the wider Oxford-Cambridge Arc and must be considered in context when making strategic decisions. The focus of the Local Industrial Strategy is to remove barriers to businesses and to enable increased productivity for the region (something also reflected in the National Industrial Strategy). The strategy for the Arc as a whole area is also important to consider, particularly targets relating to the Advanced Manufacturing and Materials sector. These targets include:

- *Bringing employers and skills providers together to understand the current and future skills needs, and planning provision to meet them.*
- *Maximising the economic benefits of new transport, energy and digital infrastructure within the Arc.*
- *Developing an improved business support and finance programme for high growth companies, a shared approach to commercial premises and an Internationalisation Delivery Plan to encourage greater trade and inward investment in the Arc.*

Cambridgeshire and Peterborough have experienced the biggest drop in productivity per hour of any combined authority, falling to 94.9% of the UK average productivity per hour [1]. With a focus on improving productivity per hour, CPCA aim to be above the national average by 2024; an entirely possible achievement considering additional Arc member Milton Keynes have one of the highest productivity levels in the country. Two ambitions for the Local Industrial Strategy play a key role in this strategy recommendation:

- *Expand and build upon the clusters and networks that have enabled Cambridge to become a global leader in innovative growth.*
- *Drawing on existing skills and capabilities, the Combined Authority can provide impetus to development of advanced manufacturing across the region. A specific opportunity lies in scale-up, developing facilities closely coupled to local universities where technologies can be developed and taken through the early stages of commercialisation.*

The potential that the region has to enable greater scale-up capacity is significant. With plans in the Local Industrial Strategy to look at the development of a university in Peterborough enabling a complimentary increase to the already world-renowned work done by other universities in the region. This will combine with the use of Launchpads, Mayoral Innovation funds, Innovate 2 Grow networks and the Growth Service. Combining these services into an ecosystem of improved business support and finance programs will enable not just the goals of Cambridgeshire and Peterborough, but the goals of the Arc region as a whole.

The Local Industrial Strategy is the standard by which each sector can hold itself to. In Advanced Manufacturing and Materials there is a significant opportunity to be part of a huge boost in productivity, as well as increasing the connectivity of businesses across the region. Focuses on projects such as the Fens Business Network will be vital to enable greater levels of innovation and cross-sector collaboration, supported by the business support network being established both in the region and across the Arc.

Local Growth Fund

The Local Growth Fund will be integral in supporting the success of the Local Industrial Strategy, as well as the development of the East of England AMM sector. £146.7 million of funding was successfully bid for by the previous LEP. Now a combined authority, Cambridgeshire and Peterborough has allocated funding of £98 million to the region with £50 million left to allocate [2]. This Growth Deal funding is designed to be invested in capital projects boosting the growth of the region. The subsequently created Local Growth Fund will create new services and projects including the Growth Service and a new University for Peterborough. The Growth Service will be offering coaching, inward investment and skills support. This funding has several key metrics for success: the creation of new jobs, productivity increase, trade and export increase, new business space, new apprenticeships, skills progression and new skills facilities. Some of the key targets within this are: the delivery of 10,000 new jobs to the region *(with a minimum investment of at least £5,000 per job)*, 13% increase in GVA and 7% increase in productivity hours worked.

Skills are a significant issue for many AMM sectors and Cambridgeshire and Peterborough is no different. The creation and effective use of a Skills Brokerage Service will enable businesses in the region to create better links with the future workforce. To create a sustainable economy, it is vital that young people are engaged in a variety of sectors and jobs so that they can better understand their options. A skills service will be able to highlight the possibilities available to young people in the AMM sector. The movement of this service away from employer focus to a whole-economy focus will also provide greater longevity to the scheme, enabling it to focus on the future of the economy in the area.

Inward Investment is also important as it will help to solidify Cambridgeshire and Peterborough's place as an AMM powerhouse. This dedicated service will be able to reach out of the region and demonstrate the potential for investment and the value that can be derived from working within the AMM sector in Cambridgeshire and Peterborough. This service will also be vital in the support of developing a new university in Peterborough.

The Growth Coaching service will play a significant role in the creation of high growth businesses. High growth businesses boost a region's economy dramatically as they help to draw attention to the success of the area. Being able to encourage this internally will also help to feed into the Inward Investment team's work as more high growth businesses enables more success stories to be shared with the world, drawing increasing investment into the area.

To support businesses in their growth and to make the best possible use of these new services, the creation of a Small Business Capital Growth Investment Fund and an Innovation and Re-Location Grant will enable a wider range of businesses to benefit. These sources of investment are where many SMEs find their transformation into high growth businesses. Long term internal investment for businesses can be difficult when they are growing and having access to external funding and accelerated programs will provide more opportunities for SMEs in the region to become more innovative, creating a stronger image for the region as a whole.

The transformation of the Growth Hub in the region will also help to support this. Focusing more on outcomes and less on individual activity will help it to work with the same focus as the Skills Brokerage Service, a whole-economy approach. This approach will also help the Growth Hub to look a more even spread of services across the economy, creating more potent investment across the sector.

Key Objectives

The key objectives for this strategy are an important overview of the wide-reaching impact it is possible to have with focused and considered planning.

These recommendations have been formed in line with the notion of developing 'knowledge bridges'. These 'knowledge bridges' are formed through the linking of key knowledge infrastructures i.e. manufacturing groups, academia, catapults, and so on.

The 'knowledge bridges' – linking knowledge infrastructure through Cambridgeshire and Peterborough – collectively form 'knowledge gateways', which in turn develops the region's competitive advantage within the Manufacturing and Materials sector.

NETWORKS & SUPPLY CHAINS – Building Supply Chains through Effective Cross-Sector Innovation Networks

The development of supply chains will come through work done creating and sustaining effective networks for businesses within the sector. By establishing a manufacturing network, manufacturing groups and 'Make-It' spaces it will then be possible to have more impactful and significant conversations with the businesses in the region. This direct link will not only empower the businesses involved, but will also generate more opportunities to network for businesses. Networking through sector specific groups will create more effective supply chain communication, will open up possibilities for new collaborations and will help to push the sector forwards. The establishment of a network like this will then encourage and provide confidence in programs such as Capacity Utilisation Programs and Innovation Platforms. Enabling these programs will help businesses involved have greater access to the support on offer, both financially and otherwise.

STRENGTHS & OPPORTUNITIES – Mapping our Advanced Manufacturing & Materials 'Blue Ocean'

Having a better understanding of the current position of the sector in Cambridgeshire and Peterborough and the surrounding area will create far more opportunities for collaborative and innovative work. It is important to be able to better articulate the strengths of the region. Naturally, this will lead to stronger relationships with current and future partners and selling the region's merits will be far easier. On top of this it will be possible to have more powerful conversations around where the region falls short and how to better address it. A by-product of this work will be increased knowledge transfer between partners, businesses and adjoining areas, as it will be clearer where Cambridgeshire and Peterborough can offer knowledge, as well as where the region could benefit from it.

SPACE & CAPABILITY – Developing Incubation Spaces and Mapping Technological Capabilities

Creating a more sustainable journey for businesses is important to keep innovative ideas in the region. Providing more accessible spaces for SMEs to use means that creating clusters and network will be far easier. Keeping innovation can also be aided by the creation of grow on space, this will provide a more natural pathway for businesses and encourage them to stay within the local supply chain and local networks.

SUPPORT – Revolutionising and Revitalising the Business Environment

Business support is the backbone of all this work to grow the advanced manufacturing and materials sector; without the right support at the right time a business may not grow and scale at the rate at which it could. The support of developing businesses is vital to enable growth of not only the sector, but the region more generally. As businesses grow and succeed so does the rest of the supply chain, and the businesses surrounding them. With the right support it is also possible to help draw further investment into the area as external investors will see opportunity in the region's ecosystem of businesses.

SKILLS – Creating an Effective, Business-Led Skills Supply Chain

Skills supply chains are one of the biggest factors in enabling the growth of a region. Keeping talent in the region, as well as attracting external talent, are two significant ways of enabling longevity in businesses and keeping the local talent pool sustainable. Good workers attract good workers and so there need to be a significant focus on growing local leaders to set the example, and then providing the right courses and education in order to enabling effective transitions into industry.

Delivery Mechanisms

STRENGTHS & OPPORTUNITIES – Mapping our Advanced Manufacturing & Materials 'Blue Ocean'

To ensure the strengths and opportunities of the C&P region are recognised, CPCA can work to facilitate business mapping, partnerships between research institutions and businesses, and engagement with catapult networks.

Building a smart specialisation strategy for the C&P region will guide the best places for future investment. One of the key take-aways from the AMM strategy report is that whilst C&P has a fantastic R&D sector, the overall density of businesses on parks in the region isn't as high as other counties. By shifting the focus of the strategy towards investing in more businesses entering and growing within the region, a better balance between business and research can be gained. An option for tackling this is to build more science or business parks that have a higher density of business space on them.

To ensure new hi-tech businesses that enter the region and existing tech businesses are best supported for growth, events could be held. A business forum where businesses would have an opportunity to voice aloud their concerns and the problems, they face with growth is a good example. CPCA can then look at planning into the smart specialisation strategy methods of helping to tackle these issues and enable better growth for businesses in the region.

The strategy should also include investment in more technical workers for the region, but first it will be crucial to understand where the current sources are to see if they can be bolstered to develop more workers. Mapping will need to be undertaken by an appropriate organisation or CPCA itself. If it is not possible to grow existing apprenticeships, colleges and universities then new sources of technical workers could be constructed to help create more technical workforce for growing businesses in the region. These sources would be institutions like new colleges, skills centres and sixth forms.

Knowledge transfer between business and research will assist in the development of new technologies within the region and establishing new KTPs will be useful in facilitating that transfer. This existing programme has seen success in many regions around the UK and is a straightforward option. To help this option, businesses could be targeted with specific KTPs offering them direct links to research institutions if the business is a growing hi-tech start-up or SME with a pioneering new product or service. A catapult centre established in the region with a focus on a sector specialism not covered in one of the other centres around the UK like logistics or quantum as examples could help with knowledge transfer and establish more successful technology platforms.

Networks are another viable way of connecting research and business, creating specialised focused networks for certain technology areas will create focus, but good bridges between networks are critical for ensuring that cross sector innovations are facilitated as well.

Strengths & Opportunities					
Deliverable	**Intervention**	**Delivered by**	**Delivered to**	**Timescale**	**Expected Outputs**
Develop Smart Specialisation Strategy within the region.	• Identify key area specialisms individually for Cambridge, Peterborough and Fenland by fully mapping the	LEP	CPCA	2 months	

	RTOs, businesses, catapults, incubators, universities and science parks in these regions.				
	• Hold a business focused forum in Cambridge, Peterborough and Fenland to identify challenges in business development within these different areas. Start by targeting business/science parks and other hubs or clusters and hold the forums on or as close to these as possible.	Allia or other business support organisations	Technology businesses in the region	2 months (including advertising time)	
	• Identify the main sources of low-skilled technical workers in the regions. As this is a highlighted area of improvement, mapping schools, colleges, apprenticeship schemes and universities across regions will allow better planning for investment in workforce development ready for building a smart specialisation strategy.	CPCA, student focused organisations, existing business networks.	Low-skilled, technical workforce and growing SME's looking to expand.	2 months	Jobs
Facilitate Knowledge Transfer between organisations	• Establish annual sector specialism conferences close to their busiest clusters in the region. Focus on exhibition of the latest breakthroughs in technology research from both academia and industry.	Allia, or other business support organisations	Tech businesses and academia	8 months	Inward Investment
	• Link up with Knowledge Transfer Partner Leads in region. • Establish new Knowledge Transfer Partnerships (KTPs) with promising start-up businesses in	CPCA and Knowledge Transfer Network	Start-up businesses and SMEs	6 months	10 collaborations per year

	the region by identifying them and linking them to regional universities.				
	• Establish a new catapult centre in Peterborough. Existing catapult centres started do not include three of the four identified specialisms: Precision agriculture, Quantum Technologies, and logistics. Create a bid for catapult and Innovate UK to try and win funding.	Innovate UK, Catapult	CPCA, businesses and academia	6 months	Inward Investment, Collaborations between businesses 5 NPPS per year
Maximise Growth Corridors	• Construction of a new science and/or business park in the Peterborough area, located close to the city or A1(M) for good links. Focus this Park on a sector specialism – such as logistics.	CPCA	Start-ups and SMEs	3 years	Jobs NPPS
	• Create an enterprise zone in or close to Peterborough, this could be for an existing site like Peterborough Business Park at the western edge of the city or for a new site depending on the existing capacity of that business park. The incentive needs to be in pulling in new businesses not providing perks to existing ones.	Government	C&P LEP	2 years	50 Jobs
	• Build sector specialism networks with websites that include forum/discussion pages and are connected well with social media like LinkedIn. These networks can begin as websites but could easily expand into	Allia or another business support organisation	Businesses in specific technology sectors	3 months	

	holding regular events.				

SKILLS – Creating an Effective, Business-Led Skills Supply Chain

A large focus of actions for CPCA to take forward to help improve skills in the region, centre around business-funded apprenticeships. Lower skilled workers have already been identified as a necessary area of investment to enable business growth in the region and there is a need to ensure that young people who do not want to go to university still have a means of entering hi-tech business careers. More courses offering specific industry led degrees at universities or colleges would also benefit the region in terms of narrowing the focus of a degree to make a student directly more employable within a specific sector.

Technical focused universities would help students get into specialist industries within the area and it was also be useful for bridging links with industry as sector specific businesses would find it easier to link with a university that performed research directly related to their field. Industry would also be able to fund apprenticeships and degrees through the university or other colleges in order to get the young but skilled workers they might need.

Skills					
Deliverable	**Intervention**	**Delivered by**	**Delivered to**	**Timescale**	**Expected Outputs**
Prepare for the future workforce and grow local leaders	• Build a dedicated skills development centre in Peterborough to compliment University Centre. This centre will teach young and older people technical work to provide a workforce for growing businesses.	CPCA	People looking for apprenticeships or new qualifications that don't want to go to University.	1 year	5 collaborations (university to business) a year 50 jobs a year
	• Implement a blended learning model similar to the one adopted by Cranfield University. This model is a more innovative approach to degree qualifications and includes STEM businesses and STEM educators coming together in one room for better industry relevant teaching.	University of Cambridge, University Centre Peterborough	University and college age Students	1 year	

	• Implement a roaming STEM support programme, utilising a team that can move around the region's various schools and colleges to work with students and help develop skills that are critical to STEM careers.	Student support enterprises or Business support organisations, CPCA	School age and college age students	6 months – 1 year	
Create Technical, Industry focused universities	• Buy and convert an existing building or build a new one in Peterborough to be repurposed into a technical university. Align the courses with industry, encourage businesses to fund qualifications	CPCA	Higher education students	3-5 years	At least 5 collaborations between the university and business in year 1 50 jobs in year 1
	• Map existing apprenticeship placements at businesses in the region and support these businesses with incentives to up the numbers	C&P, business support organisations	Start-ups and SMEs	6 months	
	• Identify growing businesses and provide them with incentivized offers for creating their own apprenticeship programmes. Support them in the creation of these programmes	Business support organisations	Start-ups and SMEs and higher education students	3 years	Year 1 – 15 jobs Year 2 – 25 jobs Year 3 – 40 jobs
Deliver Industry-led apprenticeship qualifications	• Provide support for skilled short courses across the region. These could be implemented in existing universities or a skills/business centre to help less qualified people gain	Schools, Colleges and Universities	Open to the public looking to widen their skills	1 year	

	access to employment in skilled jobs. Could also be used as an evening classes model at local schools and colleges.				
	• Offer more industry funded qualifications based on specialist areas for specific roles. These could be introduced into existing universities and colleges in the region and would be less broad than most of the existing courses. Students could be assigned to	University of Cambridge, University Centre Peterborough, Colleges throughout the region	Higher education students	2 years	
	• Organise a business skills event where you can pull businesses in from around the region to discuss their interest in specialist qualifications and their ability to fund them	CPCA, CPLEP	Medium and Large businesses.	1 year	

NETWORKS & SUPPLY CHAINS – Building Supply Chains through Effective Cross-Sector Innovation Networks

Networks are a great tool for bringing businesses together to share best practice and encourage innovation and knowledge transfer. Growth of individual sectors is best supported through the creation of knowledge-intensive sector networks that are open to supporting not only intra-sector innovation but cross-sector collaborative innovation.

The implementation of a region-wide Advanced Manufacturing and Materials network can be achieved through accessing a public funding program from organisations such as the UK Government, Innovate UK, or ERDF (European Regional Development Fund).

Alternatively, the sector itself could come together to fund the network and its associated activities. A successful network would consist of industry and business leaders providing on the ground support, representatives of academic institutions, and public sector members (i.e. county and district councils).

Network and Supply Chains					
Deliverable	**intervention**	**Delivered by**	**Delivered to**	**Timescale**	**Expected Outputs**
Build a regional manufacturing	• Create a network website	Website developers	CPCA	1 Month	

network, with a physical and virtual presence, to connect and inform the sector	• Create a brand and identity that resonates with the businesses it will support	Graphic designers	CPCA	1 Month	Increased chance of inward investment
	• Through the allocation of funding, create 'Make-It' spaces in areas of high populations, such as Cambridge and Peterborough, to allow businesses and startups to lease equipment for development of prototypes and small batch manufacturing.	CPCA Funding Bodies Industry Partners	Startups + Small Businesses	1 Year	24 NPPS per year
Develop manufacturing groups across Cambridgeshire & Peterborough to drive place-based growth and collaboration:	• Map the area for high concentrations of AME businesses and relevant academia.	CP Growth Hub	CPCA	2 Months	Increased chance of collaboration
	• Assess demand for the groups and what their focus would be (i.e. skills, digitisation, etc).	CP Growth Hub	CPCA	2 Months	
	• Find a host, such as Caterpillar or Metalcraft, and organise discussions to be held alongside a tour.	CPCA	Not Applicable	1 Week	
	• Confirm the agenda, market and deliver the session.	CPCA	Local industry and academia	1 Week	1 Collaboration per quarter
	• Continue the group, repeating at timespans decided by the attendees.	CPCA	Local industry and academia	Every 3 Months	
	• Hand over control of the organisation of events to the district economic development officer, continuing the support of marketing.	CPCA	C&P Economic Development Officers	Every 3 Months	10 Jobs Increased R&D Knowledge Sharing Adoption of new technologies
Develop Innovation Platforms to drive cross-sector innovation around shared challenges:	• Distribute quarterly newsletters to hear the needs of the region	Marketing Agency	CPCA	3 Months	
	• Launch an online platform for businesses to post challenges and opportunities	Website Developers	CPCA	1 Month	Adoption of new technologies Collaborations

	• Begin speaking to businesses, including using surveys, in similar sectors to realise shared challenges.	CP Growth Hub	CPCA	6 Months	
	• Invite organisations which would advance the group to a meeting where solutions can be discussed and considered for development.		Industry & Academia	2 Months	
	• Write up and circulate minutes, as well as inviting further parties for support.	Business Support Network (CPCA)	Attendees	1 Week	
	• Depending on the outcomes of prior meetings, advance the platform as the group sees fit (whilst being viable).	Business Support Network (CPCA)	Industry & Academia	0 – 1 Years	Adoption of new technologies Collaborations
	• Continue development of the platform until the members agree the challenge is solved, or a solution created.			0 – 1 Years	Adoption of new technologies Collaborations

SPACE & CAPABILITY – Developing Incubation Spaces and Mapping Technological Capabilities

Despite its reputation as a life sciences cluster, Cambridgeshire and Peterborough also houses a large number of Manufacturing businesses, with high concentrations in areas such as Cambridge, Peterborough, Huntingdon and Ely. Developing spaces in the region is vital to encouraging growth in SMEs in Manufacturing and Engineering. In order to encourage growth, sites must look to develop their offerings. The simplest way of encouraging growth is to provide incubation services, be it rent free start up space, or simply business support services.

Having a well-advertised site is key for development. If a site has good signage and a strong online presence, it opens up a large number of growth opportunities. Companies looking for premises are drawn to well organised sites, especially if incubation services are provided to nurture start-ups and help them grow.

Space & Capability					
Deliverable	**intervention**	**Delivered by**	**Delivered to**	**Timescale**	**Expected Outputs**
Establish Make-It Spaces to embed a culture of sharing and collaboration:	• Perform mapping to highlight clusters of businesses within the same sector to understand	CP Growth Hub	CPCA	2 Months	

	what resources would be required in a Make-It space.				
	• Identify sectors and themes of interest to local colleges and universities to understand viability and ease of funding.	CP Growth Hub	CPCA	2 Months	
	• Highlight locations next to or near to educational premises for building and expansion.	CP Growth Hub	CPCA	2 Months	
	• Source funding for the expansion of a building.	InnovateUK & Growth Hub	CPCA	3 Months	
	• Contact industrial and educational partners to donate equipment and resources.	CPCA	Industry & Academia	2 Months	NPPS Startups
	• Deploy marketing campaign to attract businesses	Marketing Agency	CPCA	2 Months	Inward Investment
	• Set up launch pads on grow on space / entice and support new start ups and businesses	CP Growth Hub Incubator Operators	CPCA	1 Year	Startups Jobs NPPS
Develop dedicated AMM Space from incubation to grow on with links to 'out of town' parks for scaling businesses, with access to Industry 4.0 and productivity support:	• Perform mapping to identify clusters of businesses ready for growth and expansion, particularly in business parks and industrial estates	CP Growth Hub	CPCA	2 Months	
	• Evaluate the capacity of industrial estates across the region to identify the order in which sites require expansion.	CP Growth Hub	CPCA	2 Months	
	• Contact industrial partners to provide Industry 4.0 and productivity support and decide on the frequency of visits or residency.	CP Growth Hub	CPCA	2 Months	
	• Identify relevant funding to fund the expansion of the sites, working with district councils.	InnovateUK & CP Growth Hub	CPCA	3 Months	

	• Consider creating an Industry 4.0 showcase facility working with industrial partners to donate or subsidise the allocation of equipment and machinery.	Industry Partners InnovateUK Growth Hub Architects	CPCA Industry & Academia	3 Years	Startups Jobs Adoption of new technologies R&D Investment Inward Investment
Maximise growth corridors to attract inward investment from across the UK and the globe:	• Engage and interact with directors and investors to understand the need for funding in the area, and the opportunities in the region.	Cambridge Norwich Tech Corridor	CPCA	2 Months	
	• Create a brand which clearly communicates the purpose and the goals of the corridor.	Branding and Marketing Agency	CPCA	1 Month	
	• Establish a group of ambassadors, with international business experience, to travel across the world amid their regular business duties to share the stories of the region.	Cambridge Norwich Tech Corridor	CPCA	6 Months	Increased inward investment
	• Create a website to communicate the needs and objectives of the growth corridor, as well as providing information on all of the businesses and key and emerging sectors.	Website Developers	CPCA	2 Months	
	• Organise and deliver events which bring together industry, academia and investors.	Cambridge Norwich Tech Corridor & CP Growth Hub			Collaboration Access to new technology Job increases
	• Facilitate events which give businesses the opportunity to pitch to investors	Cambridge Norwich Tech Corridor & CP Growth Hub			Increased investment
	• Organise trips overseas, giving businesses the opportunity to pitch to international investors.	Cambridge Norwich Tech Corridor & CP Growth Hub			Increased inward investment

SUPPORT – Revolutionising and Revitalising the Business Environment

The development of Cambridgeshire and Peterborough is directly entwined with the success or failure of the businesses within it. The support for those businesses will determine whether they can grow and prosper, or whether they stagnate and close; and when businesses are competitive it creates economic development, and growth.

Through the creation of 'journeys' which businesses can travel upon, the region's manufacturing and engineering environment will experience growth as they experience new and innovative organisational practices and technologies.

Support					
Deliverable	**intervention**	**Delivered by**	**Delivered to**	**Timescale**	**Expected Outputs**
Provide business support throughout the region's key 'make-it' clusters:	• Establish a limited trading company and identify the key themes and deliverables of the organisation.	CPCA		1 Month	
	• Seek funding to allow business support to be delivered free of charge across the region.	InnovateUK & UK Government	CPCA	6 Months	
	• Following mapping to determine the training needs of the region, create programmes which stimulate idea generation and sharing, ensuring collaboration between businesses.	CP Growth Hub	CPCA	3 Months	Collaboration NPPS Jobs Startups
	• Source funding for the expansion of a building.	InnovateUK, CP Growth Hub & UK Government		6 Months	
	• Advertise for recruits to lead the business, recognising a mixture of soft and technical skills.	Recruitment Specialists	CPCA	3 Months	Jobs
	• Create a brand which clearly displays the goals and objectives of the organisation: support.	Branding and Marketing team	CPCA	2 Months	
	• Establish connections with district councils, research institutes and local education institutes to build awareness of the organisation, and	CPCA		3 Months	

	to benefit from the space, and access to businesses, they possess.				
The implementation of an Innovation Journey for C&P to support businesses becoming innovative to ensure survival:	• Through consultation with businesses, including sole traders, start-ups, SMEs and established large businesses, agree on a journey and set of themes that all businesses must explore, to grow.	CP Growth Hub Industry Academia	CPCA	3 Months	
	• Working with industrial partners and academia create training programmes which can both educate and provide thought generation for businesses to consider investment or expansion.	CP Growth Hub Industry	CPCA	6 Months	Increased R&D Investment
	• Deploy start-up workshops to help new businesses create ventures which are aligned with the needs of the customer to ensure survival.	CP Growth Hub	CPCA	3 Months	Startups NPPS Jobs
	• Establish a network of demonstrators to give growing businesses the opportunity to see how to successfully implement technology and practices, including businesses on industrial estates and business parks.	CP Growth Hub	CPCA	3 Months	Access to new technology Collaboration Increase in R&D Investment
	• Work with partners based at innovative locations, such as research institutes and incubators, to deliver workshops and	CPCA		2 Months	Access to technology Collaboration R&D Investment

	training programmes.				
Grow existing businesses through scale-up and expansion funding and support journeys:	• Utilise innovation, productivity and sustainability journeys to provide guidance and directions for businesses looking to grow.	CP Growth Hub	CPCA	Ongoing	Jobs Startups NPPS Inward Investment Collaboration R&D Investment
	• Establish an investment readiness programme, allowing businesses to enrol and change their operations to seek funding.	Invest East	CPCA	3 Months	Inward Investment Startups Collaborations Jobs
	• Connect and engage with successful investors and business owners to work with start-ups and scaleups to provide mentoring support, increasing the likelihood of investment.	CP Growth Hub	CPCA	3 Months	Collaboration NPPS Jobs Startups
	• Provide opportunities for businesses to pitch to investors	Invest East	CPCA	Ongoing	Inward Investment

Supporting Documents

References

1. Cambridgeshire and Peterborough Combined Authority. 2019. *Cambridgeshire and Peterborough Local Industrial Strategy* [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/818886/Cambridge_SINGLE_PAGE.pdf.
2. Cambridgeshire and Peterborough Combined Authority. 2019 *Growth Prospectus.* [Online]. Available at: https://cambridgeshirepeterborough-ca.gov.uk/business-board/growth-funds/

KEY RECOMMENDATIONS

RECOMMENDATIONS SUMMARY

The following recommendations and actions have been defined as key drivers behind the growth of the Advanced Manufacturing and Materials sector within Cambridgeshire & Peterborough.

Implementation plans relating to recommendations for CPCA have been depicted within the following section.

NETWORKS & SUPPLY CHAINS – Building Supply Chains through Effective Cross-Sector Innovation Networks

1) **Build a Manufacturing Network** Across the Region to Connect and Inform the Sector
2) **Develop Manufacturing Groups** Across Cambridgeshire & Peterborough to Drive Place-based Growth and Collaboration
3) **Form and Brand 'Make-It' Spaces** as places to Commercialise Products (Design, Prototype, Manufacture and Scale Up)
4) **Develop Make-It Clusters** / Districts with Key Launchpad Sites and Strategic Satellite Locations
5) **Create a Capacity Utilisation Program** Around 'Make-It' Clusters to Maximise Productivity
6) **Develop Supply Chains** in to Cambridgeshire and Across the UK
7) **Form Technology Groups** Focused on Emerging Technologies to Collect Critical Mass
8) **Develop Innovation Platforms** to Drive Cross-Sector Innovation Around Shared Challenges

STRENGTHS & OPPORTUNITIES – Mapping our Advanced Manufacturing & Materials 'Blue Ocean'

9) **Develop Smart Specialisation Programs** within Cambridge, Peterborough and Fenland to Identify their Individual Strengths
10) **Develop Links in to Catapults** and Other Significant Hubs / Cities within LaunchPad Sites
11) **Maximise Growth Corridors** to Attract Inward investment from Across the UK and the Globe
12) **Facilitate Knowledge Transfer** between Organisations

SPACE & CAPABILITY – Developing Incubation Spaces and Mapping Technological Capabilities

13) **Utilise Existing Incubation Space**
14) **Develop New Grow-On Space** with Specific Support Programs with Conditions Relating to Industry 4.0 and Productivity

SUPPORT – Revolutionising and Revitalising the Business Environment

15) **Provide Business Support** throughout the Region's Key Make-It Clusters
16) **Incubate Ideas and Support Businesses to Startup** through Specific AMM Incubation and Acceleration Programs
17) **Grow Existing Businesses** through Scale Up and Expansion Funding and Support Journeys
18) **Increase Innovation Capacity within the Manufacturing Sector** with Supported Knowledge Transfer and Funding Calls
19) **Support Development of Productive Businesses** with Support to Automate and Digitise Businesses with Industry 4.0 Technologies

20) **Support Sustainability in Businesses**

21) **Increase the Competitiveness of Businesses** Helping Them Attract Inward Investment and Trade Opportunities

SKILLS – Creating an Effective, Business-Led Skills Supply Chain

22) **Prepare for the Future Workforce**; Developing Industry 4.0, Productivity, Innovation, and Entrepreneurial Skills

23) **Grow Local Leaders** that will Stay within the Region to Accelerate Economic Growth for the Best of the Community

24) **Create Technical, Industry Focused Universities** such as the University Centre Peterborough

25) **Deliver Industry-Led Apprenticeship Qualifications** in iMET, Focused on the Future Sectors

26) **Map Skills/Learning Provision and Infrastructure** to Identify Gaps and New Opportunities

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These recommendations have been formed in line with the notion of developing 'knowledge bridges'. These 'knowledge bridges' are formed through the linking of key knowledge infrastructures i.e. manufacturing groups, academia, catapults, and so on.

The 'knowledge bridges' – linking knowledge infrastructure through Cambridgeshire and Peterborough – collectively form 'knowledge gateways', which in turn develops the region's competitive advantage within the Manufacturing and Materials sector.

NETWORKS & SUPPLY CHAINS – BUILDING SUPPLY CHAINS THROUGH EFFECTIVE CROSS-SECTOR INNOVATION NETWORKS

1) BUILD A MANUFACTURING NETWORK ACROSS THE REGION TO CONNECT AND INFORM THE SECTOR

Networks are a great tool for bringing businesses together to share best practice and encourage innovation and knowledge transfer.

Growth of individual sectors is best supported through the creation of knowledge-intensive sector networks that are open to supporting not only intra-sector innovation but cross-sector collaborative innovation.

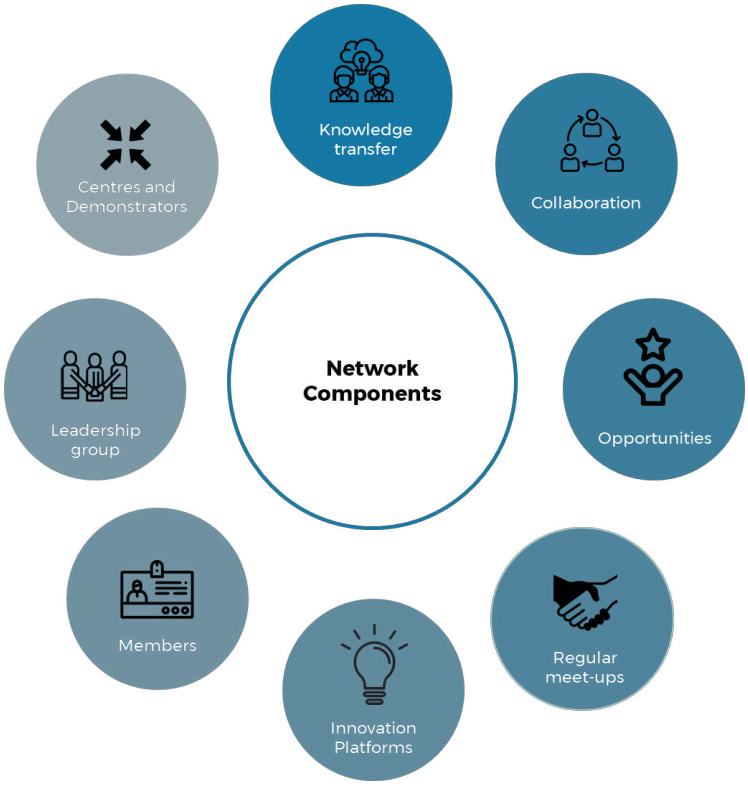

Figure 1 - Components of a Successful Network

For Cambridge and Peterborough, a Manufacturing and Materials sector network would provide a focused effort for growth on the sector. A key component of this network will be the creation of local manufacturing groups. There is a need to implement manufacturing networks (and groups) on a nationwide basis, and this is down to the sector as a whole.

Implementation

The implementation of a region-wide Advanced Manufacturing and Materials network can be achieved through accessing a public funding program from organisations such as the UK Government, Innovate UK, or ERDF (European Regional Development Fund). Alternatively, the sector itself could come together to fund the network and it's associated activities.

A successful network would consist of industry and business leaders, representatives of academic institutions, and public sector members (i.e. county and district councils).

For more information on this recommendation, go to P. 88

2) DEVELOP MANUFACTURING GROUPS ACROSS CAMBRIDGESHIRE & PETERBOROUGH TO DRIVE PLACE-BASED GROWTH AND COLLABORATION

Manufacturing groups are a platform for encouraging collaboration between local businesses to help businesses overcome problems or gain support for projects to help them grow. The focuses of manufacturing groups can be seen below.

Figure 2 - Focuses of a Manufacturing Group

- **Productivity & Performance** - Boosting productivity through best practice tours and lean talks
- **Innovation & Commercialisation** - Supporting innovation through discovery of new technology and collaboration opportunities
- **Competitiveness & Trade** - Discovery of new market entry and exporting opportunities
- **Sustainability & Carbon Reduction** - Introduction to methods of waste reduction and transformation to a cleaner business
- **Skills & Leadership** - Connecting with academia to discover apprenticeships and upskilling opportunities
- **Supply Chain & Networks** - Connecting with SMEs and industry leaders to develop existing and create new supply chains
- **Space & Incubation** - Discovery of new expansion opportunities and brokerage of shared assets

Implementation

The implementation of manufacturing groups across Cambridgeshire and Peterborough will ultimately be led by the relevant district council for the area in question. However, as previously discussed, could be funded by alternative means i.e. self-funded by the sector as a whole, or through pots such as the UK Prosperity Fund.

Manufacturing Groups have been successfully implemented throughout Norfolk and Suffolk, and this model can be replicated within the Cambridgeshire & Peterborough region through the following steps:

1) **Map the Area –** identify regions with high concentrations of manufacturing and engineering businesses.

2) **Assess Demand –** engage locally and identify businesses that are willing to network. SME's tend to have strong engagement.

3a) **Find a Host –** businesses can be apprehensive of welcoming other businesses in to their factories, so attendee lists should be managed to ensure direct competitors don't attend

3b) **Organise a Discussion –** to overcome potential reluctance to hosting a Manufacturing Group, organise a roundtable discussion at a neutral location to lay out the purpose and goals for the MG

4) **Confirm the Agenda –** working alongside the host for the manufacturing group, agree on a relevant topic for discussion and define speakers to deliver short presentations

5) **Market the Event –** using the mapping done in Step 1, invite local manufacturing businesses

6) **Coordinate the Session –** pilot sessions can yield low turnouts. Effective groups tend to bring together approx. 30 individuals. The Manufacturing Network can support the host in delivery of the sessions.

7) **Continue Group Delivery -** following the end of the first meeting, hold an open discussion where the next session of the manufacturing group can be performed. Continue group delivery on a quarterly basis and repeat from Stage 3.

For more information on this recommendation, go to P. 95

3) FORM AND BRAND 'MAKE-IT SPACES' AS PLACES TO COMMERCIALISE PRODUCTS (DESIGN, PROTOTYPE, MANUFACTURE AND SCALE-UP)

We recommend that the region (and the advanced manufacturing and materials sector as a whole) instils a 'Make-It Space' movement across key manufacturing hubs i.e. where the majority of manufacturing and engineering businesses are clustered.

We have identified these potential 'Make-It Spaces' through our research depicting the concentration of manufacturing businesses throughout Cambridgeshire (see Fig. 3).

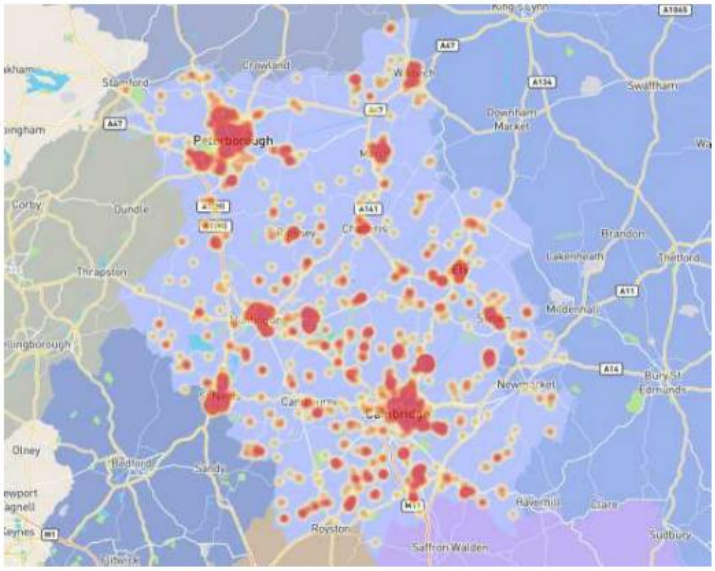

Figure 3 - Heatmap of Manufacturing Businesses in Cambridgeshire and Peterborough - http://maps.hethelinnovation.com/east_anglia_map.html

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What is a 'Make-It Space'?

A 'Make-It Space' is a manufacturing facility that has a specific technology or functionality that other businesses within the region can utilise. The purpose of these proposed make-it spaces is to aid the commercialisation of science, research, and new innovations, providing support to start-ups to make their ideas a reality.

For example, a business in Wisbech may have laser-cutting facilities within their factory, but these particular facilities are only used for 40% of the operational hours. The business would be able to effectively rent out these facilities to other manufacturing businesses in the region, during the times they are not in use.

Implementation

We are proposing a Make-It Space online platform is created, allowing manufacturing businesses to not only offer their facilities and become make-it spaces themselves, but also allow other organisations that may not have the necessary technologies or facilities in-house to utilise these on a booking timeslot basis.

The Make-It Space platform would create a tool that could significantly alter the manufacturing sector in the region, for the better. As the database grows, the capabilities and capacity of the individual make-it spaces (and make-it districts) would be further refined, highlighting the strengths and opportunities of key manufacturing hubs across Cambridgeshire and Peterborough.

A consistent, region-wide branding initiative throughout the AMM sector in the region must be implemented around the development of make-it spaces. The importance of building a consistent brand is threefold:

- **It's marketing on a higher level –** a brand that is synonymous with a positive make-it experience will help with repeat use from manufacturers across Cambridgeshire and Peterborough
- **Consistency makes your brand feel more dependable –** a consistent branding will help manufacturing businesses form a well-developed opinion of the scheme, and build trust
- **Consumers trust brands that they recognise –** giving manufacturing businesses a dependable experience across all channels works along the same lines as actually delivering a dependable scheme (in this instance, the make-it spaces)

For more information on this recommendation, go to P. 106

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4) DEVELOP MAKE-IT CLUSTERS / DISTRICTS WITH KEY LAUNCHPAD SITES AND STRATEGIC SATELLITE LOCATIONS

We recommend that manufacturing hubs are formed throughout the main manufacturing areas across the region, i.e. cities and market towns.

Building on our previous recommendation, each manufacturing hub within the region (see Fig. 4) would form 'Make-It Districts' containing a range of Make-It Spaces in their respective industrial estates and business parks, with varying capabilities.

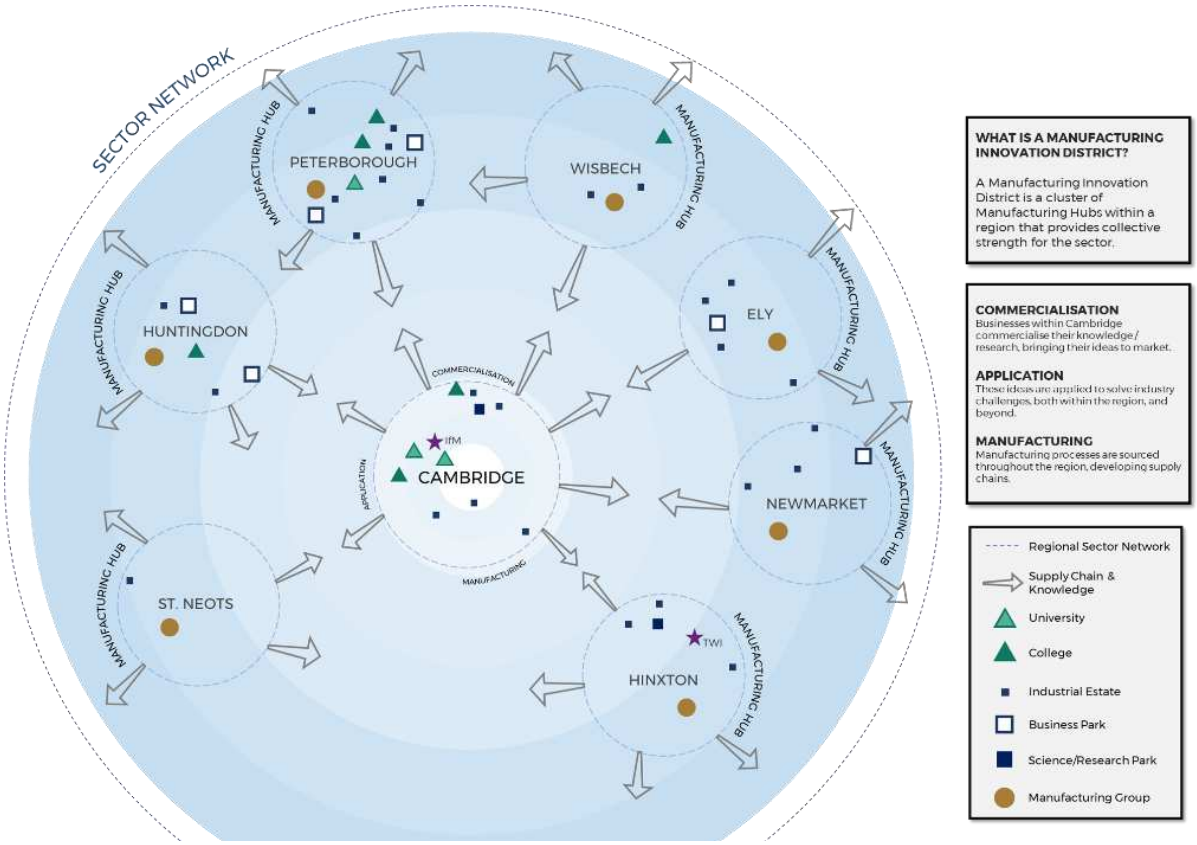

Figure 4 - Make-It Spaces: Manufacturing Innovation Districts

To deliver continued impact and support to the regions manufacturing and engineering sector, Manufacturing Hubs should be established. To create the greatest impact, effective Manufacturing Innovation Hubs should consist of:

- **Manufacturing Groups** - To bring together innovative businesses and share best practice
- **Incubation Space** - To provide opportunities to grow SMEs and contribute to regional, national and global supply chains
- **Academic Institutes** - To collaborate with academic experts to commercialise new ideas and access the future workforce
- **Industrial Estates** - To house cross-sector manufacturing and engineering businesses, developing supply chains and local excellence
- **Science Parks** – To collaborate with experts, creating new opportunities into emerging markets, such as Clean and Bio-technologies

Implementation

In addition to the mapping and branding of make-it spaces within Cambridgeshire and Peterborough, focus of the AMM sector should be placed on the development of sites identified (covered further in recommendation 14):

- Red Brick Farm (Peterborough)
- Pembroke Avenue (Waterbeach)
- Haverhill Research Park
- Spicers (Sawston)
- Alconbury Weald (Huntingdon)
- Chatteris Technology Park

For more information on this recommendation, go to P. 106

5) CREATE A CAPACITY UTILISATION PROGRAM AROUND 'MAKE-IT' CLUSTERS TO MAXIMISE PRODUCTIVITY

We recommend that an online platform is developed in order to maximise the utilisation of machines within 'make-it' clusters throughout the region.

The creation of a capacity utilisation program would allow existing, established businesses throughout the region to offer their capabilities in order to ensure maximum capacity. This will promote the development of local supply chains and collaborations, therefore boosting AME within Cambridgeshire.

This platform would allow organisations to access certain technologies and machinery that they typically would not have access to within their own facilities. The benefits of this initiative would predominantly lie with businesses at start-up stage but would also significantly aid the commercialisation of ideas formed by students in neighbouring academic institutions.

Implementation

- Launch the Make-It Districts online platform for Cambridgeshire and Peterborough, with sub-domains for each of the regions of the county
- Map potential businesses around key industrial estates, business parks etc. in each of the districts of the county, and their machine/technology capability
- Promote the online platform to potential make-it spaces and have them sign up as designated centres
- Make-it spaces map their machine capacity via the online platform on their respective page, which is accessible to members of the site
- Growth of the online platform is established through promotion of the manufacturing network and regional manufacturing groups

The development of the online platform outlined above will require input of the advanced manufacturing and materials sector as a whole if it is to be successful.

For more information on this recommendation, go to P. 106

6) DEVELOP SUPPLY CHAINS IN TO CAMBRIDGESHIRE AND ACROSS THE UK

Developing Make-It Districts throughout the region will result in expansion of current supply chains, and development of new ones.

As supply chains and knowledge are pulled from Cambridge, they are dispersed throughout the region, in to our identified manufacturing hubs.

The branding and formation of 'make-it- spaces and clusters will naturally develop supply chains within the region, forming connections between businesses that otherwise may not have worked together before.

Furthermore, the ongoing improvement of road infrastructure in and around the Cambridgeshire region, plus the development of growth corridors will significantly improve transport capabilities and coincidentally improved ease of access.

Implementation

In order to develop manufacturing supply chains throughout the region, larger organisations (i.e. the manufacturers/distributors) must invest further in their suppliers, and more must be done to establish new relationships between supply chains. This can be instigated through supply chain-focused networking events, workshops, etc.

The UK Industrial Strategy have highlighted their vision of encouraging industry leaders to improve their supply chains by adopting best practice from the automotive sector, which has committed to increasing local content to 50% by 2022.

A similar goal implemented through the CPCA can be transmitted by local district councils through the proposed manufacturing groups across the region, and the wider sector network. As stated in previous recommendations, the successful implementation of this will require input and effort from the sector as a whole.

We would recommend the development and delivery of an EU/UK Government funded program that would involve industry experts delivering 'on the ground' support to businesses within the region to build and enhance local supply chains. This has been highlighted as a key missing component with many programmes not having resources to support SMEs within their respective regions, more focused on international opportunities.

For more information on this recommendation, go to P. 110

7) FORM TECHNOLOGY GROUPS FOCUSED ON EMERGING TECHNOLOGIES TO COLLECT CRITICAL MASS

Building on the recommendation to develop manufacturing groups, it is also recommended that technology groups focused on current emerging technologies within the sector are formed.

Through our consultations with industry leaders, although manufacturing groups were identified as being beneficial for sector growth, they include limited cross-sector opportunities, hence the recommendation to develop tech-focused groups. Technology-specific groups (focused on AI or autonomous vehicles, for example) were created in order to pull together ideas from across sectors. The development of further groups like these would replicate these benefits.

Implementation

The implementation of technology groups across Cambridgeshire and Peterborough will essentially follow a similar process to that of establishing manufacturing groups:

1) **Map the Area –** identify regions with high concentrations of manufacturing and engineering businesses that are working in emerging technologies.

2) **Assess Demand –** engage locally and identify businesses that are willing to network. SME's tend to have strong engagement.

3a) **Find a Host –** businesses can be apprehensive of welcoming other businesses in to their factories, so attendee lists should be managed to ensure direct competitors don't attend

3b) **Organise a Discussion –** to overcome potential reluctance to hosting a Technology Group, organise a roundtable discussion at a neutral location to lay out the purpose and goals for the TG

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6) **Coordinate the Session –** pilot sessions can yield low turnouts. Effective groups tend to bring together approx. 30 individuals. The Manufacturing Network can support the host in delivery of the sessions.

7) **Continue Group Delivery -** following the end of the first meeting, hold an open discussion where the next session of the manufacturing group can be performed.

Like previous recommendations, the successful implementation of technology groups will require a collective effort from the AMM sector as a whole, from both public and private sector bodies.

For more information on this recommendation, go to P. 134

8) DEVELOP INNOVATION PLATFORMS TO DRIVE CROSS-SECTOR INNOVATION ON SHARED CHALLENGES

In order to capture opportunities and address challenges within the Advanced Manufacturing and Materials sector, we recommend the development of innovation platforms that will bring businesses together with other businesses, researchers and the wider community.

The technology groups (as per recommendation 7) will identify key areas and possible project ideas. These project ideas should be transferred into innovation platforms to create the right groups to take the idea / project to market.

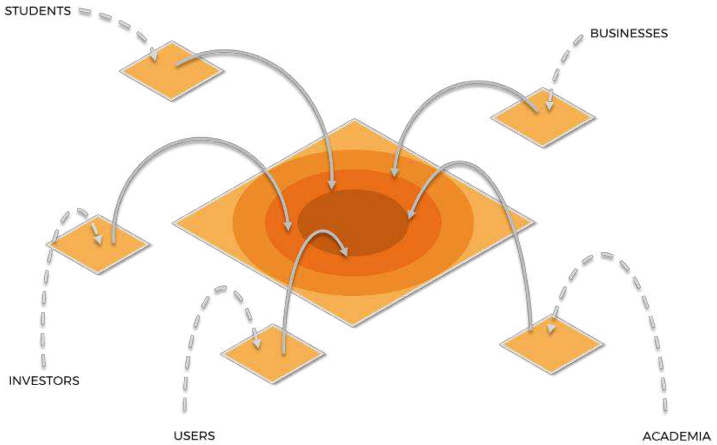


Figure 5 - Innovation Platforms

These platforms will encourage cross-sector pollination (sharing of ideas, brainstorming, best practice, workshops, sector mapping), fertilisation (finding partners, creating consortia, making plans, finding the right direction, Technology Road Mapping) and innovation (innovation projects, product/service development, taking technology to market), and will be inclusive: a range of platforms including digital platforms will be built which will allow a wider demographic of beneficiaries to engage with the sector.

Implementation

Networks can play a pivotal role in the formation, performance and closure of an innovation platform. The first contribution networks can make within an Innovation Platform is to identify members for involvement that will be able to input ideas and further progress. Networks engage with businesses on a frequent basis and can identify

whether an invitee would cause the group to develop or to falter. The steps to develop an innovation platform are as follows:

1. **Initiate Platform** – identify the various stakeholders, bring them together, and decide on someone to facilitate the platform

2. **Decide on Focus** – discuss the focus area of the platform and identify problems and opportunities

3. **Identify Options** – platform members decide what they want to do to address the problems or opportunities they have previously identified

4. **Test and Refine Solutions** – solutions must be tested and adapted to make sure they work

5. **Develop Capacity** – identify the needs of the user and find ways to develop the capacity required

6. **Implement and Scale Up** – if the innovation is successful, the innovation platform works with its member groups to get it adopted widely

7. **Analyse and Learn** – act upon what worked well and what didn't, so that feedback can be applied to future changes to be made

For more information on this recommendation, go to P. 88

9) DEVELOP SMART SPECIALISATION PROGRAMS WITHIN CAMBRIDGE, PETERBOROUGH AND FENLAND TO IDENTIFY THEIR INDIVIDUAL STRENGTHS

Building on current smart specialisation programs in Cambridge and the surrounding areas, there is now a need to replicate said programs in the northern end of the county, namely the Peterborough and Fenland regions.

- Asset mapping
- Capability mapping
- Challenge and opportunity mapping
- Technology road mapping
- Inward investment programs

Implementation

The UK Government have defined the following elements of implementation of Smart Specialisation at a local level:

- strengthening of local innovation 'ecosystem(s)' and building local capabilities;
- supporting local supply chains to invest and collaborate;
- catalysing and leveraging the differing opportunities of social innovation; and
- branding and positioning places as credible centres of smart specialisation.

To ensure the implementation of smart specialisation programs on a local level, we recommend the inclusion of these within market town masterplans for the region of Cambridgeshire, in order to develop regional comparative advantages. The UK Prosperity Fund could provide a solution to the development of said smart specialisation programs.

For more information on this recommendation, go to P. 119

10) DEVELOP LINKS IN TO CATAPULTS AND OTHER SIGNIFICANT HUBS / CITIES WITHIN LAUNCHPAD SITES

The majority of Catapult Centres within the UK are in relatively close proximity to Cambridgeshire. Relationships to these Catapults must be developed in order to facilitate the sharing of best practice, and the consolidation of knowledge to Cambridgeshire.

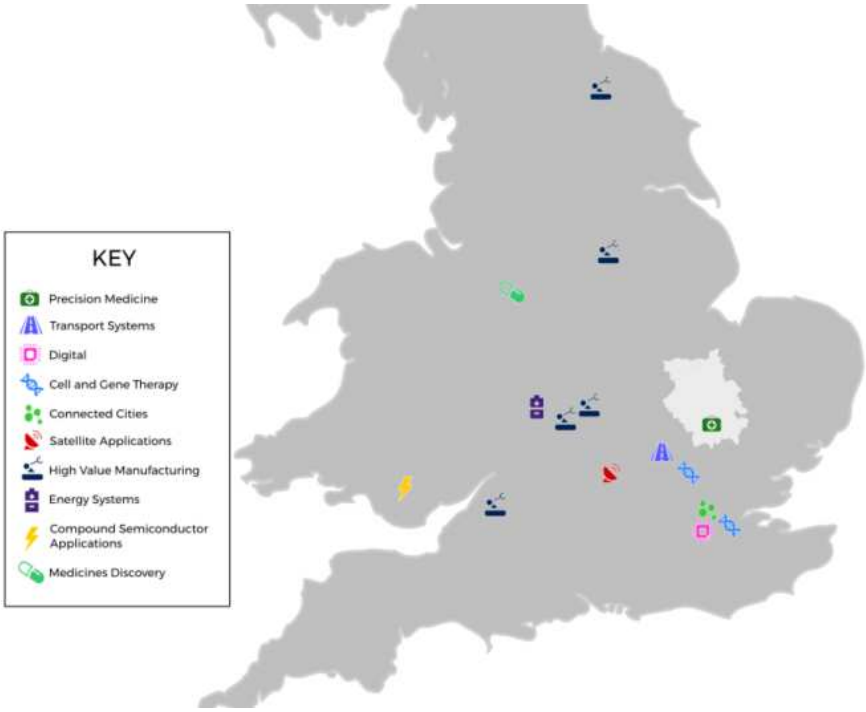


Figure 6 - UK Catapult Centres Surrounding Cambridgeshire

Implementation

In order to implement this recommendation, Catapults should have a presence within each of the six LaunchPad sites that we have identified within Recommendation 14. Below are our suggestions as to what Catapult Centres can be associated with each respective LaunchPad site:

- **Alconbury Weald (Huntingdon) – Manufacturing Technology Centre, Coventry (High Value Manufacturing)**
  As per one of our later recommendations (Recommendation 25), we suggest the formation of a link between iMET (based at Alconbury Weald) and the Manufacturing Technology Centre (MTC). The MTC offer their training services through a variety of courses and subjects already. Working in collaboration with the Manufacturing Technology Centre would allow iMET to learn from their practices, and implement this within their own programs.

- **Red Brick Farm (Peterborough) – Connected Places**
  The Red Brick Farm site in Peterborough is adjoined to an existing light industrial zone, in close proximity to Perkins. As part of Peterborough's 'Environment Capital' campaign, we recommend the development of a relationship with the recently formed Connected Places Catapult, an amalgamation of the former Future Cities and Transport Systems Catapults.

- **Spicers (Sawston) – Digital**
  With ICT giant Huawei having recently acquired the former Spicers site in Sawston, a connection with the Digital Catapult seems to be the most rational. Huawei plan to initially develop a research and development facility at the site, which would align with the UK Catapult network. There is significant space for development of more commercial space on site, and potential for Huawei to develop a 'hub and spoke' UK headquarters site spanning a range of technological developments.

- **Chatteris Technology Park – Compound Semi-Conductor Applications / Energy Systems**
  With there being aspirations for Chatteris Technology Park to have a focus on nuclear energy and energy storage, we would propose links are formed with both the Compound Semi-Conductor Catapult (South Wales) and the Energy Systems Catapult (Birmingham).

- **Pembroke Avenue (Waterbeach) – Advanced Manufacturing Research Centre, Sheffield (High Value Manufacturing)**
  With the potential Pembroke Avenue site undeveloped at present, the connection with a High Value Manufacturing Catapult such as the Advanced Manufacturing Research Centre (AMRC) in Sheffield would provide a boost to the LaunchPad.

- **Haverhill Research Park – Connected Places**
  With Haverhill Research Park home to a variety of sectors, including bio science, advanced materials, software, clean technology, and engineering, we recommend a connection is formed with the newly formed 'Connected Places' Catapult.

How would connections be established?
Links between respective LaunchPad sites and Catapult Centres can be established in a multitude of ways, including:

- **Dedicated staff** from the respective Catapult Centre based at the LaunchPad site, providing support and advice on a permanent basis
- **Hot desking** for Catapult staff, essentially using the LaunchPad site as a satellite location
- **Networks**, both new and existing, focused on the relevant sector strengths

For more information on this recommendation, go to P. 146

11) MAXIMISE GROWTH CORRIDORS TO ATTRACT INWARD INVESTMENT FROM ACROSS THE UK AND GLOBE

Growth Corridors are developed in order to stimulate economic development. Cambridgeshire (and specifically Cambridge) is one of the most connected places in terms of infrastructure in the UK, with Growth Corridors providing access to London, Oxford, Ipswich, Norwich and the Midlands.

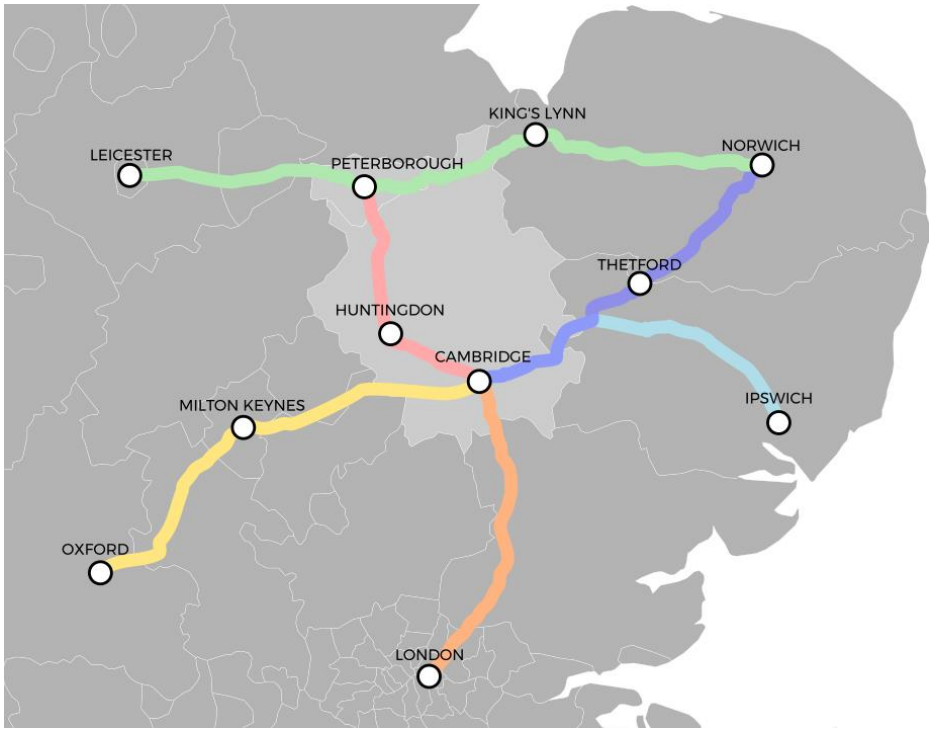


Figure 7 - Growth Corridors

The development of growth corridors aligns to multiple national strategies for the economic growth and increased productivity in the UK. The Industrial strategy puts a heavy emphasis on the importance of infrastructure and business environment on building productivity. By improving rail and road networks between Cambridgeshire and Peterborough's main cities and towns encourages increased travel and commute to the region.

This in turn boosts the development of supply chains in and around the region and collaboration opportunities with other cities in the East of England and further afield, with specialities that compliment the Advanced Manufacturing and Materials sector.

Implementation

A consistent brand and development plan for each corridor in the map above should be implemented. Further to this, key development sites should be earmarked along each corridor, aligning with the key geographical strengths and emerging technologies of the respective place.

The development of key growth corridors (as identified above) won't solely be the responsibility of any one given body – including the CPCA – and should instead take on a collaborative approach, encapsulating the sector as a whole (i.e. public sector and private sector), both within Cambridgeshire, and the surrounding counties that the corridors lay within.

For more information on this recommendation, go to P. 179

12) FACILITATE KNOWLEDGE TRANSFER BETWEEN ORGANISATIONS

Knowledge transfer between students, businesses, and academic institutions within the Advanced Manufacturing and Materials sector must be improved in order to ensure growth in the sector, both within Cambridgeshire and Peterborough, as well as the throughout the UK.

This will naturally be facilitated through a number of the previous recommendations within this report; mainly the implementation of make-it spaces, manufacturing networks, and technology groups.

A main challenge of UK culture is the inability to share ideas and thoughts. This has led to many industries and markets being siloed off from one another, preventing the opportunity for cross-sector innovation to be explored and for new markets and customers to be accessed.

Implementation

Innovate UK – the governmental innovation board – propose a 10-step process to encourage knowledge transfer:

1. Have an idea for a strategic innovation project
2. You need help to make it happen
3. Talk to a Knowledge Transfer Adviser
4. Discover how to access the UK's world-class knowledge base
5. Cost the project and apply for the grant
6. Recruit suitably trained graduates
7. Project progresses with support between partners
8. Transformation occurs
9. Strategic objectives are met
10. Knowledge and capability is embedded for long term beneficial change

The facilitation of knowledge transfer can be assisted through the development of a program similar to KEEP+ (keepplus.co.uk), with a specific focus on advanced manufacturing and materials. KEEP+ assist businesses in accessing expertise that they don't already possess, through the following means:

- Knowledge Exchange and Embed Partnerships (KEEPs)
- Research and Innovation Collaborations (RICs)
- Innovation Internships

This program could be developed in collaboration with universities in the surrounding area that have strengths within the manufacturing sector such as Cranfield or Loughborough.

For more information on this recommendation, go to P. 119

SPACE & CAPABILITY - DEVELOPING INCUBATION SPACES AND MAPPING TECHNOLOGICAL CAPABILITIES

13) UTILISE EXISTING INCUBATION SPACE

The Cambridgeshire and Peterborough region already boasts a wealth of commercial infrastructure, including industrial estates, business parks, technology parks, science parks, and campuses.

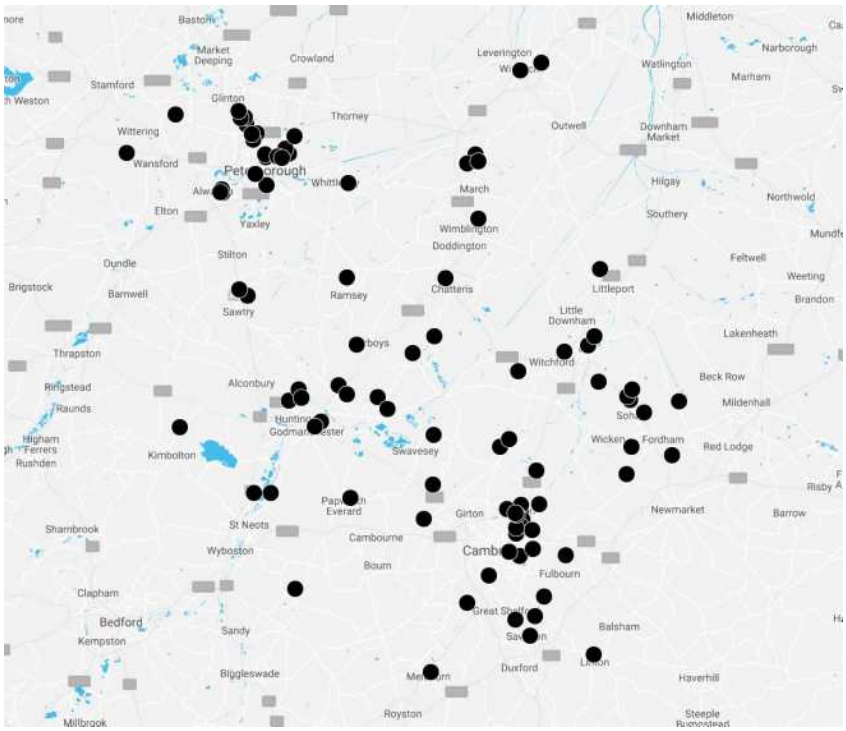


Figure 8 - Industrial Estates in Cambridgeshire and Peterborough

In order to further develop the region's Advanced Manufacturing and Materials sector, there should be a focus on growing this commercial infrastructure, so that the full potential can be met.

Key commercial sites such as industrial estates and business parks across the region must be identified and earmarked for development and investment.

Implementation

A tiered approach to developing existing sites should be implemented, with the goal not being to solely focus on building more science parks, but to instead grow industrial estates, business parks, technology parks, science parks, and campuses in line with their USP's and capabilities, in order to maximise their effectiveness.

The goal for all commercial sites - whether it be industrial estates, business parks, or science parks – should be to improve and reach their respective potentials. This point is valid for both privately and publicly owned assets.

For more information on this recommendation, go to P. 159

14) DEVELOP NEW GROW-ON SPACE WITH SPECIFIC SUPPORT PROGRAMS WITH CONDITIONS RELATING TO INDUSTRY 4.0 AND PRODUCTIVITY

Whilst some areas of Cambridgeshire and Peterborough aren't utilising existing infrastructure to their full capability, it is also recommended that new incubation space for businesses is developed in high-growth areas of the county.

Once such area that has been earmarked for development is the Red Brick Farm site. Red Brick Farm presents an investment and development opportunity to create a new employment area in a successful light industrial part of the city with a strong mechanical and engineering presence. The site is in a prime geographical location, only 45 minutes away from London by train, Cambridge only 40 miles away, and ports of Tilbury, Felixstowe and Hull just over 100 miles away. Red Brick Farm has been shortlisted for expansion by Innovation Corridor UK

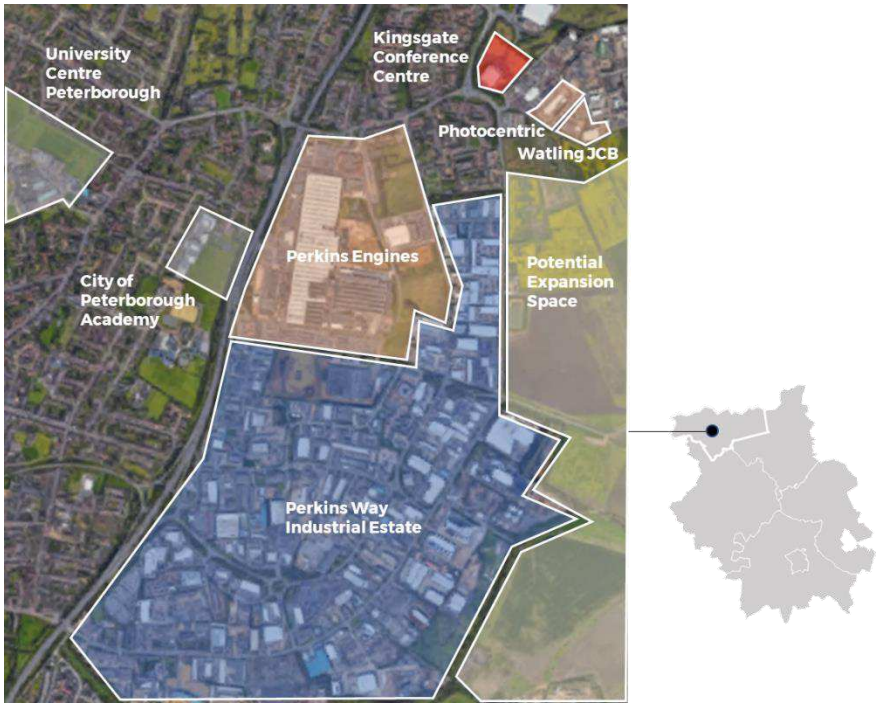


Figure 9 - Development of Red Brick Farm Site

Potential sites for development will benefit from the support and inclusion of multiple partners, including businesses and academia.

- **Academia** - Sites located near to academic institutes will benefit from gaining access to researchers and students, creating collaboration opportunities and supporting commercialisation of research
- **Incubators and Business Parks** - Businesses within incubators and business parks benefit from direct support of the centre owners. Identifying growth and collaboration opportunities
- **Keystone Businesses** - Inclusion of established industry leaders will allow neighbouring SMEs to be introduced and develop local supply chains
- **Space to Grow** - As businesses benefit from the increased opportunity of becoming involved with other tenants on site, more space will be required to facilitate growth.
- **Transport Links** - Cambridgeshire already benefits from being located close to major roads and ports, increasing the likelihood of businesses moving in.

Implementation

In addition to the existing incubation space for businesses across Cambridgeshire and Peterborough, we have also identified a number of potential sites for development, as per the map below:

For developing future sites, the below process has been outlined:

1) **Mapping** – define the owner of the site in question
2) **Define the Business Model** – dependent on the owner of the site in question (i.e. public sector or private), define the route forward as to ownership and operation of the site
3) **Sector Specialisation** – the surrounding infrastructure and businesses to the area of the site will affect the sector specialisation of the development site to focus on

We recommend that the whole private and public sector should look into the development of a program of funding and support that will aid businesses in relocation to the sites identified above, with specific conditions on them being focused on local economic growth, utilising and engaging the local skills supply chain (through collaboration with surrounding academic institutions), investment in new technologies, and improving productivity. There is also the need for funding and support specifically for the development of each site, through local enterprise zone implementation, finance for infrastructure improvements, and simplified, fast-tracked planning processes.

For more information on this recommendation, go to P. 159

SUPPORT – REVOLUTIONISING AND REVITALISING THE BUSINESS ENVIRONMENT

15) PROVIDE BUSINESS SUPPORT THROUGHOUT THE REGION'S KEY MAKE-IT CLUSTERS

To grow an advanced manufacturing and materials sector, there needs to be an innovation support network available in physical spaces throughout the county,

The physical support available at each site is important in its own right, and each site type has key strengths, but developing them to improve their innovation support capacity is vital for sector development.

Through a combination of consultation with industry leaders, and aligning with national strategies, we have defined five areas of support that businesses need, and this support should be made available throughout incubation spaces (from industrial estates to science parks) across the region (Fig. 10).

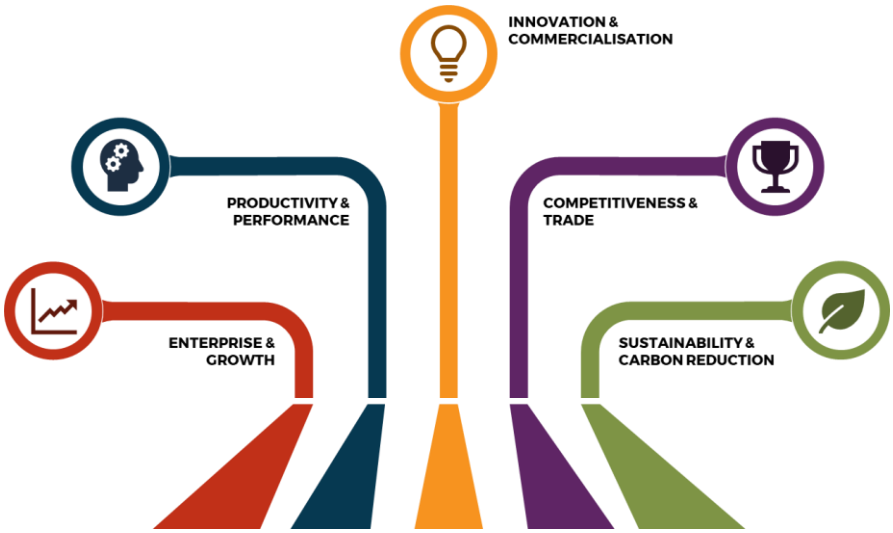


Figure 10 - The Journey of Journeys (Areas of Business Support)

The 'Journey of Journeys' provides a framework for delivering business support. Some organisations will be taken on each journey, whereas some may only need support in one or two areas.

- **Innovation & Commercialisation** - Helping improve our regions productivity by supporting individuals, businesses and clusters to become more innovative.
- **Competitiveness & Trade** - Building competitiveness of local businesses through focussing on our region's USPs.
- **Productivity & Performance** - Creating a framework to drive productivity growth and competitive businesses across the East of England.
- **Sustainability & Carbon Reduction** - Helping our regional clean growth by supporting individuals and businesses to become more sustainable.
- **Enterprise & Growth** - Bringing together our students, businesses, and experts to form inspiring entrepreneurial communities.

Implementation

In order to implement the business support framework set out above, business support should be provided in-house, across key incubation spaces in Cambridgeshire & Peterborough, delivered by a dedicated team.

In order to finance said business support, the public and private sector can look to access funding pots from organisations such as the UK Government or utilising remaining EU funding pots such as ERDF. These funding streams would align well to Priority Axis 1, 3 and 4.

Funding for business support programs would be able to cover activities related to each of the 5 business journeys defined within the 'Journey of Journeys', including the wages of facilitators, events, workshops and associated costs of relevant networks.

For more information on this recommendation, go to P. 191

16) INCUBATE IDEAS AND SUPPORT BUSINESSES TO STARTUP THROUGH SPECIFIC AMM INCUBATION AND ACCELERATION PROGRAMS

A healthy economy requires small businesses to grow and be sustainable, as when small businesses are healthy and flourishing, the community-at-large benefits and prospers too.

Cambridgeshire and Peterborough have a high concentration of start-ups and businesses in Greater Cambridge, yet other areas around it feel untouched by the economic success of the city of Cambridge. Cambridgeshire and Peterborough must engage in all of its districts in order to create inclusion and connectivity.

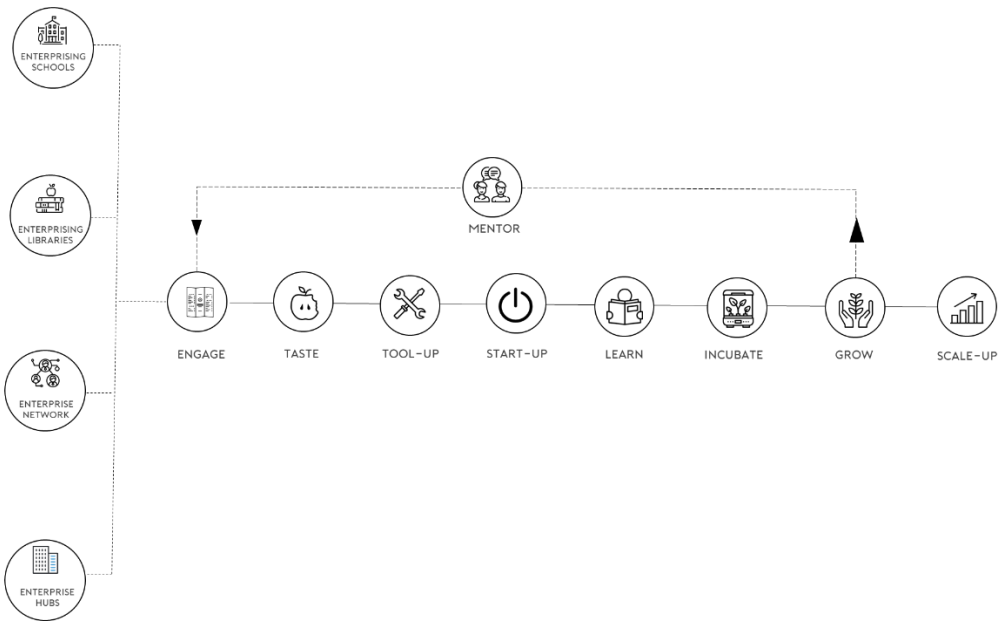


Figure 11 - The Enterprise Journey

Implementation

With nearly 50% of the Cambridgeshire population living in rural areas it is important to connect rural and urban communities to create a supporting, enterprising environment where business can thrive. To support this we suggest the AMM sector in the region look to:

- Developing **enterprise support groups** across the region to allow start-ups to connect with one another and share advice, supporting their businesses to grow and develop
- **Connecting schools and employers** to develop aspirations in students, and create a pipeline of skilled workers with the understanding of how real businesses function
- Connecting entrepreneurs with business ideas to local academic institutions to provide work experience for students and **accessible R&D for SME's**, leading to business growth, increased market awareness, and the development of new products, processes, and services
- **Developing relationships** between businesses by running informal meet-ups in and around the county, particularly providing support in rural areas
- Developing **market town incubators** throughout the region so that business have the necessary support outside of the main hubs (Peterborough and Cambridge)
- Facilitate **enterprise festivals** that are open to the wider community, with science and technology challenges for children, local business demonstrators, and skill workshops

For more information on this recommendation, go to P. 216

17) GROW EXISTING BUSINESSES THROUGH SCALE UP AND EXPANSION FUNDING AND SUPPORT JOURNEYS

Established Start-Ups and SMEs must face market imperfections and they usually operate in very competitive business environments. In order, to survive these businesses need to grow. They need to expand their customer list and their trading volume as well to adopt an agile strategy otherwise the competition will beat them, and market trends will leave them behind.

The challenges faced by start-ups during growth journey are grouped into three main categories: lack of financial capital (monetary funds, cashflow availability), human capital (employees, managers, advisors, board members), and social capital (connections, access and channels to markets and finance providers).

Support needs to be provided to help businesses within the sector to scale-up, and therefore contribute to the development of the sector.

Implementation

The key support to be provided under this recommendation is access to grant funding, not Angel or Venture. Most AMM businesses see big investment from sources which require them to sell within 3 – 8 years leading to a lot of businesses growing to a certain size and then being sold to national or international businesses.

We want businesses to be able to grow and stay within the region, through a regionally operated funding program which has specific conditions on the funding that they are promoting local economic growth and social impact.

New Anglia LEP have overseen a 'Growing Business Fund' in collaboration with Finance East and Suffolk County Council, in which grants between £25,000 and £500,000 are awarded to businesses looking to grow and create new jobs. A key criterion of the funding program is the necessity for the business to be based within the region, which is necessary for the economic development of the county. We recommend the implementation of a similar funding program that is made available to established businesses within Cambridgeshire and Peterborough that are looking in to expansion.

For more information on this recommendation, go to P. 216

18) INCREASE INNOVATION CAPACITY WITHIN THE MANUFACTURING SECTOR WITH SUPPORTED KNOWLEDGE TRANSFER AND FUNDING CALLS

Encouraging innovation and commercialisation is key to enhancing the productivity of our region and our nation as a whole; innovation currently accounts for 70% of the UK's long-term sustainable economic growth.

Figure 12 -The Innovation Journey

New ideas are needed, new approaches are needed, and new collaborations are needed. The UK can become the most innovative economy in the world and Cambridgeshire and Peterborough can be an engine to drive through, by empowering businesses to push innovation forward.

The Innovation Journey exactly addresses that need. Innovation is the creation of a viable new offering. It is important to find ways in which innovation can be fostered through a structured approach, as opposed to expecting innovation to happen naturally. It is entirely possible to generate innovation, if it is approached in the right way. The Innovation Journey provides a route to follow, tools to enabling innovative thinking and then approaches to take with ideas in order to create action.

Implementation

In order to implement this recommendation, we would recommend the AMM sector investigate the development of an innovation-led support program – similar to Breakthrough (Hethel Innovation) or EIRA (Eastern Academic Research Consortium) – that will foster innovation in manufacturing throughout Cambridgeshire.

For more information on this recommendation, go to P. 193

19) SUPPORT DEVELOPMENT OF PRODUCTIVE BUSINESSES WITH SUPPORT TO AUTOMATE AND DIGITISE BUSINESSES WITH INDUSTRY 4.0 TECHNOLOGIES

The Productivity Expedition follows five operational techniques and technologies which can increase productivity. When travelled upon and accessed consecutively, these technologies and practices cannot just increase the productivity of the business, but also accelerate innovation, creating more competitive businesses.

Figure 13 - The Productivity Journey

There are five areas, Lean, Agile, Digitise, Automate and Autonomy. By moving through each step in this order it is possible to move from a manual manufacturing plant, to a fully automated and intelligent factory operating at a much high level of efficiency.

This Journey is specifically designed to help businesses understand these steps, and eventually create ambassadors in each area. These experts can them become class leaders in their area and share their knowledge, now from direct experience, with others in the sector.

Implementation

We recommend the development of a program (from either public or private sector bodies) that has a focus on repurposing people for highly skilled positions, who may otherwise lose (or have lost) their jobs within manufacturing and engineering due to automation and technological advances within the sector.

This program could link in with IfM's 'Digital Manufacturing on a Shoestring' project, ensuring that Industry 4.0 is a key theme within manufacturing groups and technology groups, as per previous recommendations.

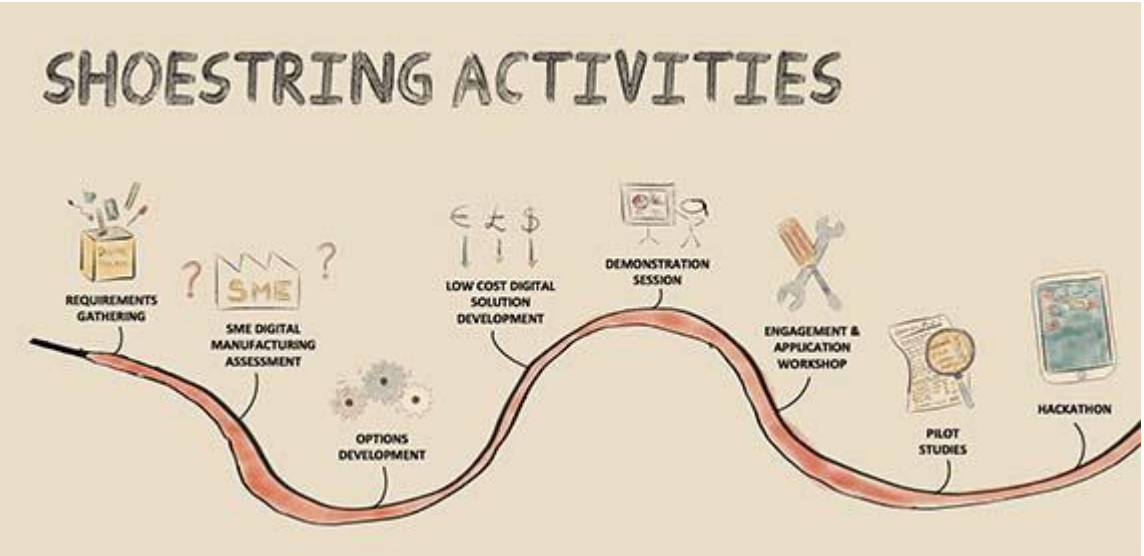


Figure 14 - Digital Manufacturing on a Shoestring Activities. Source: IfM

For more information on this recommendation, go to P. 203

20)SUPPORT SUSTAINABILITY IN BUSINESSES

The Sustainability Journey fills a need across the UK as a whole. As areas in the UK grow and improve they are going to produce more and more emissions and have an increased effect on the environment. This is an inevitable consequence of growth. The Sustainability Journey is designed to mitigate those side effects of growth by pushing businesses to grow in a sustainable way from the start. By making it part for the targets of growth, it becomes a manageable aspect. This Journey helps to fill the knowledge gap that many companies are facing.

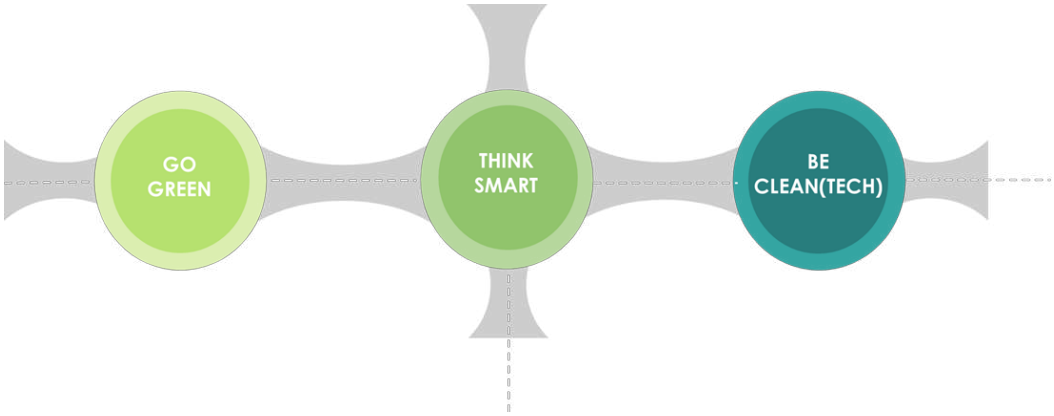


Figure 15 - The Sustainability Journey

Implementation

In order to support sustainability in businesses throughout the region, we recommend the development of a program similar to BEE Anglia (www.beeanglia.org), that would provide grants for businesses to invest in new, sustainable technologies.

Linking into Cambridge Cleantech and their programs would be another example of a way to utilise an existing platform, being able to market it to AMM businesses and making it accessible to smaller businesses as well.

For more information on this recommendation, go to P. 210

21) INCREASE THE COMPETITIVENESS OF BUSINESSES HELPING THEM ATTRACT INWARD INVESTMENT AND TRADE OPPORTUNITIES

The UK is the 8th most competitive country in the world and 19% of country's GDP comes from exports. However, there are still some significant barriers that prevent businesses to grow and compete overseas. These barriers are related to lack of skills, inability to adopt digital process, not having the right contacts in overseas markets, concern about payment risks or non-tariff barriers, limited global awareness of the UK's strengths and capabilities and finally, altitudinal barriers and market access issues.

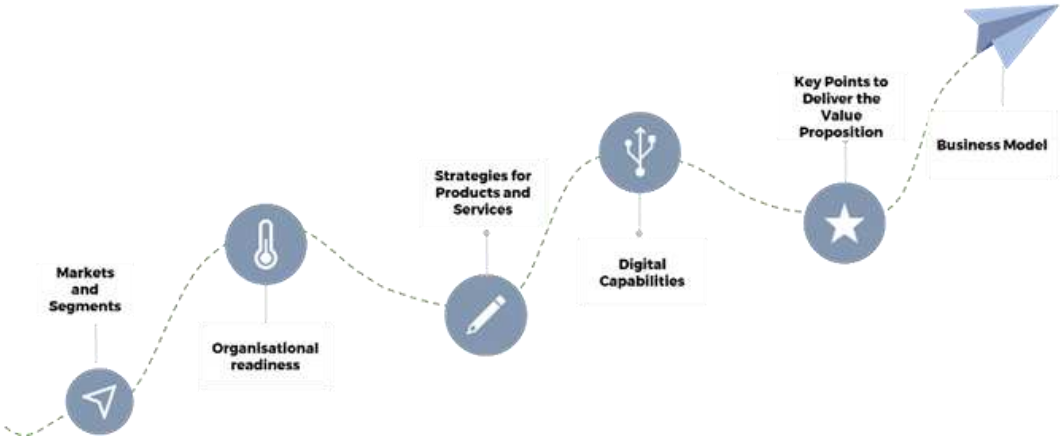


Figure 16 - Competitiveness Journey

The Competitiveness Expedition will benefit businesses but will require support from public bodies and government. The correct advice and guidance must be provided, and necessary funding for investment be made available.

Implementation

To deliver this recommendation, the development of an inward investment program – such as InvestEast (investeast.co.uk) could be implemented by the AMM sector.

InvestEast aim to provide a wide range of potentially high growth businesses with knowledge and the benefit of others' experience to enable them to access the most appropriate type of funding for their needs. By identifying strengths and weaknesses and optimising the investment proposal, they help those businesses to put forward a proposition to potential funders.

For more information on this recommendation, go to P. 199

SKILLS – CREATING A SKILLS SUPPLY CHAIN

22) PREPARE FOR THE FUTURE WORKFORCE; DEVELOPING INDUSTRY 4.0, PRODUCTIVITY, INNOVATION AND ENTREPRENEURIAL SKILLS

One of the most common challenges in the Advanced Manufacturing and Materials sector that is often cited is the skills gap issue and future supply chain of Industry 4.0 skills.

The data below (sourced from McKinsey) highlights what the estimated demand for skills will be within the sector by the year 2030, and therefore depicts the areas of focus for skills development for businesses to address.

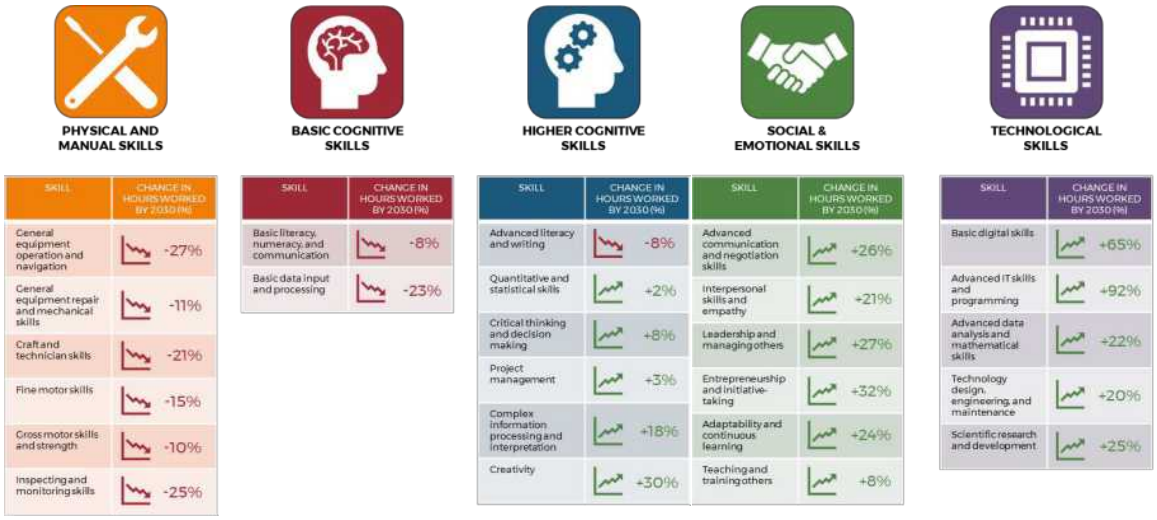


Figure 17 - Projected Requirements of Future Skills within Manufacturing

Implementation

To prepare for the need of future manufacturing skills, support must be provided in facilitating relationships between businesses and surrounding academic institutions.

2 options proposed for addressing this recommendation are:

- Skills are developed on-site in dedicated skills development centres, in collaboration with academic institutions
- Regional skills development centres are established throughout the region, financed by government funding, or private sector bodies

For more information on this recommendation, go to P. 238

23) GROW LOCAL LEADERS THAT WILL STAY WITHIN THE REGION TO ACCELERATE ECONOMIC GROWTH FOR THE BEST OF THE COMMUNITY

Effective governance and leadership are key to economic growth. Through our consultation activities, the need to grow local leaders has been defined as a key action to ensure both the growth and longevity of the advanced manufacturing and materials sector in Cambridgeshire and Peterborough.

We recommend that in-work programs to identify and develop potential leaders are established in order to address this issue. Blended learning models (of practical and theoretical experience) have been effective in developing leaders that stimulate innovation, drive change, and deliver results.

Figure 18 - Growing Local Leaders

Developing local leaders within manufacturing businesses will ensure there is clear, strategic direction on both a micro level (i.e. individual businesses, local manufacturing groups), and a macro level (region-wide sector network).

The benefits of this (on both micro and macro level) to be recognised are:

- Manage complexity and lead in uncertain times
- Achieve results in a resource constrained environment
- Bring teams with diverse views together.
- Move from developing people to developing future leaders – from managing talent to talent manager
- Improve people performance by developing resilience, confidence and mental agility in themselves and their teams

Implementation

The Cranfield Model utilises the concept of blended learning in order to ensure effective leaders are developed as a result of their program, with both practical and theoretical knowledge.

The diagram below outlines Cranfield's blended learning model, including best practice visits to businesses and leadership groups.

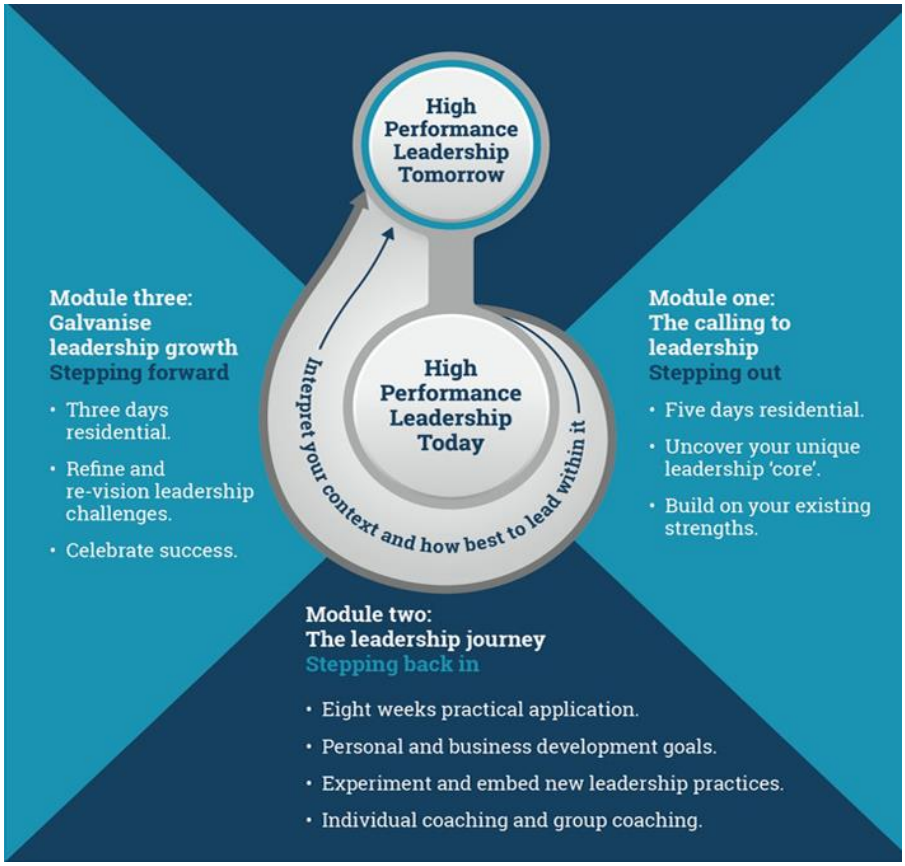


Figure 19 - Cranfield's Blended Learning Approach. Source: Cranfield University

For more information on this recommendation, go to P. 242

24) CREATE TECHNICAL, INDUSTRY FOCUSED UNIVERSITIES SUCH AS THE UNIVERSITY CENTRE PETERBOROUGH

The focus for University Centre Peterborough should be on being a technical university offering degree apprenticeships.

These degree apprenticeships should focus on cross-sector skills within technical Advanced Manufacturing and Materials degrees. This skills focus should be centred around innovation, productivity, and enterprise – aligning with our depicted business support journeys in previous sections.

Degree apprenticeships are primarily aimed at school leavers as an alternative route in to higher education, combining full-time work with part-time university study – whilst earning a salary, and not racking up student loans.

University Centre Peterborough can be a key asset in developing the skills supply chain, and future of the manufacturing within the region.

Implementation

Funding for degree apprenticeships is divided between the government and the industry employer.

In order to implement this change, University Centre Peterborough must be supported by the AMM sector in developing relationships with local manufacturing and engineering businesses offering apprentice placements.

Potential employers in Peterborough could include:

- Perkins – one of the world's leading providers of diesel and gas engines
- AB Agri – a global agritech business focused on sustainable agriculture and animal
- Flo-Mech – one of the leading providers of manufacturing equipment to the food and drinks industry
- Olympus Automation – supply market leading food processing and automation solutions
- Bradshaw – the largest UK manufacturer of industrial electrical vehicles

C ross cutting themes of the learning should focus on Industry 4.0, software engineering, lean and agile. A network of apprentices and employers should be set up such that they can share resource and learning, providing opportunities to see different work places, like those listed above.

For more information on this recommendation, go to P. 238

25) DELIVER INDUSTRY-LED APPRENTICESHIP QUALIFICATIONS IN IMET, FOCUSED ON THE FUTURE SECTORS

There is a need for curriculums to change in line with industry requirements. Therefore, we recommend that iMET deliver specific industry-led qualifications in areas such as composites, thus making progress towards addressing the skills issue in the manufacturing sector.

Industry-led courses have a strong practical element and typically include work placements with an industry employer, which could be with any number of surrounding businesses in the vicinity of iMET.

Implementation

A solution to delivering industry-led qualifications in iMET would be through the Manufacturing Technology Centre (MTC) – a HVM Catapult Centre based in Coventry, who offer their training services through a variety of courses and subjects. Working in collaboration with the Manufacturing Technology Centre would allow iMET to learn from their practices, and implement this within their own programs.

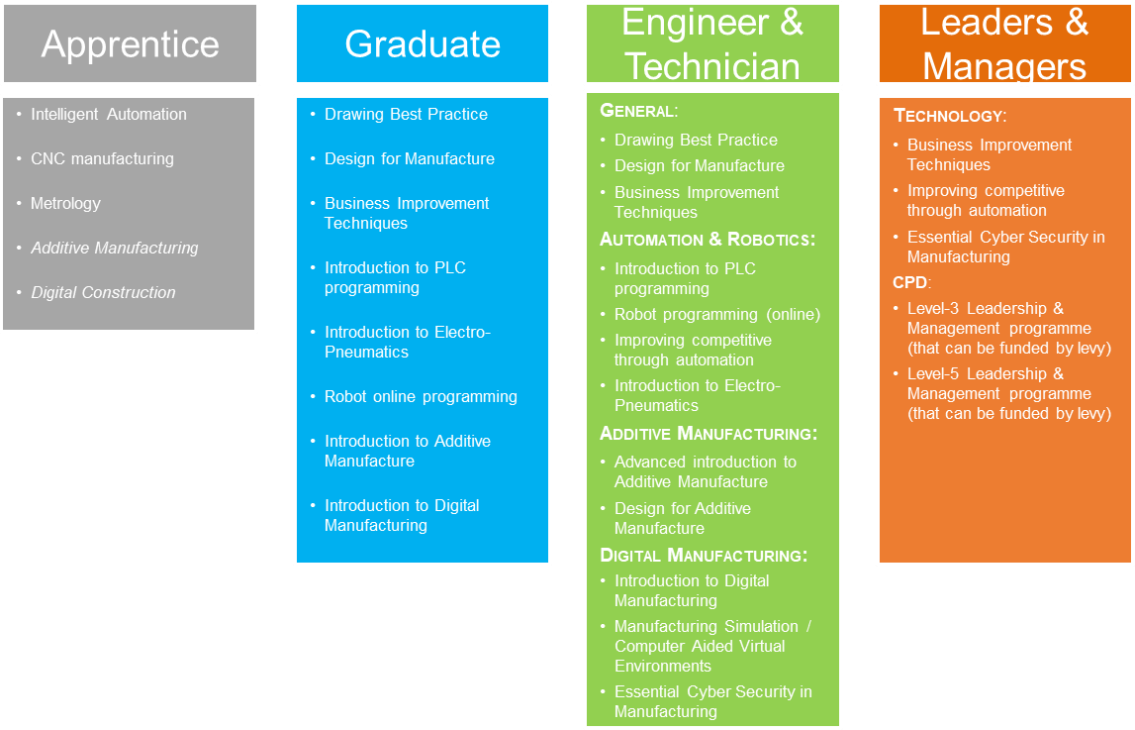


Figure 20 - MTC Training Courses

For more information on this recommendation, go to P. 235

26) MAP SKILLS/LEARNING PROVISION AND INFRASTRUCTURE TO IDENTIFY GAPS AND NEW OPPORTUNITIES

The mapping of skills and learning provision and infrastructure will highlight the areas around Cambridgeshire and Peterborough that need strengthening and capacity for provision needed for the future of the AMM sector.

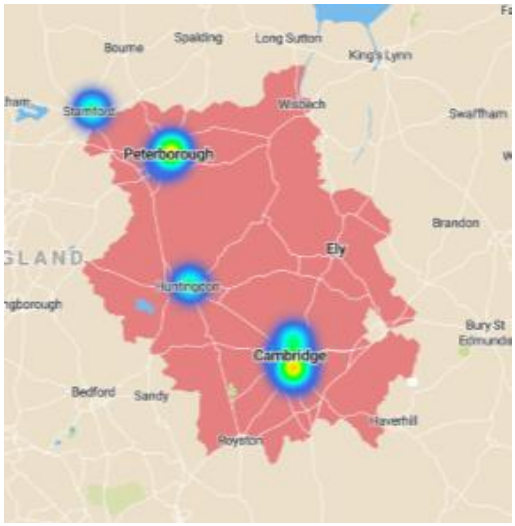


Figure 21 - Distribution of Colleges and Universities in Cambridgeshire and Peterborough

Implementation

As can be seen in the heatmap above, the distribution of academic institutions are mainly concentrated within the key hubs of the region; Cambridge and Peterborough.

In order to ensure the rest of the region has access to the skills and learning provision, we would recommend the delivery of a program involving a roaming STEM support team, that will support aspiring students, and other professionals looking to develop skills necessary to thrive within the sector and boost their employability. The roaming STEM program could deliver a wide range of activities including hackathons, STEM workshops, and STEM days for primary and secondary schools, delivered throughout the region.

A key learning can be gathered from the successful 'Primary Engineers' program, which provides teacher training and whole class projects as a means to address the gender imbalance in science and engineering. The 'Primary Engineers' program developed a 'STEM by Stealth' approach to education which enables children and pupils to engage with practical maths and science alongside creative problem solving and literacy. The AMM sector as a whole should make further efforts to embrace the Primary Engineers program to ensure that the future of the sector is both sustainable and bright.

For more information on this recommendation, go to P. 232

OVERVIEW

THE EAST OF ENGLAND – MANUFACTURING SUMMARY

Cambridgeshire is at the heart of the East of England's manufacturing sector; a sector which directly employs over 243,000 workers. Over the last 5 years the East of England's manufacturing sector has seen steady growth in which investment into academia by the government and internal investment into R&D by businesses, has seen the East of England become a greater presence in the national manufacturing environment.

With significant sector strengths in food & drink, with the likes of British Sugar, Adnams and Albert Bartlett, automotive, featuring Lotus Cars, Caterpillar and connections into Ford and Nissan supply chains and a collection of world leading research institutes, the East of England has capabilities in almost every sector.

Often overlooked as a manufacturing region, the East of England boasts many strengths which have seen the sector grow in the region over the last decade. The economic outlook for the regional sector can be seen in Figure 1.

Figure 1 - East of England Manufacturing Statistics

What is the outlook for the East of England Manufacturing Sector?

Manufacturing is one of the largest sectors in the East of England and accounts for approximately 11.3% of regional GVA (10.2% of UK Manufacturing GVA) Manufacturing is one of the largest industries in the region, corresponding to 11.3% of regional GVA in 2015 and 10.2% of UK's manufacturing GVA (UK Office of National Statistics[1])

Both the number of jobs within manufacturing (4.3%) and businesses themselves (1.9%) have increased steadily over recent years, with a good quality of living, access to research and low house prices allowing businesses to move to the East of England, and for new organisations to start up in the region. Today, 7.7% of the region's total workforce is employed by the sector, and this could be set to grow with increased opportunities in energy, the automotive sector, and a strong food and drink sector resistant to market change.

International opportunities for the East of England?

Currently, the East of England's manufacturing sector export 9.3% of the nation's total manufacturing output, slightly above that of the national average. These exports however rely heavily on European markets, with 60.2% of all exports being traded within the continent, 52.5% of those within the EU. Due to the uncertainty of Brexit, a weaker sterling has allowed UK exports to experience an increase in sales, with a rise of 1.5% from Q3 of 2017 to the same quarter of the following year[2].

Strong global demand for British goods have boosted exports, particularly those in transport and metal sectors, with transport equipment being a consistent source for export growth. The strong export performance within these sectors has offset weak domestic demand with UK sales decreasing towards the end of 2018.

[1] https://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedbalanceduk/1998to2017
[2] https://www.gov.uk/government/news/exports-continue-to-rise-across-the-uk

Regional Capabilities

The East of England has a wide array of sector strengths, with the two largest being food and drink, contributing to 16% of regional GVA, and transport equipment, and for 14.5%. The two primary sectors for the region have performed strongly over the previous year. Despite poor weather and an introduction of a sugar levy, the food and drink sector only declined slightly, and the future is forecasted to be strong with the market's resilience to demand fluctuations. Transport equipment, the second largest manufacturing sector within the region, saw a strong exporting performance and is forecast to continue in the same manner for years to follow.

The region also boasts strengths in the aerospace industry with a large collection of centres based across the region. In Stevenage, Hertfordshire, MBDA and Airbus Defence & Space are situated, creating a large proportion of the world's low earth orbit satellites. The region is also home to Cranfield University, which specialises in postgraduate engineering degrees, and also houses the Aerospace Technology Institute.

The automotive sector is another industry in which the East of England performs strongly, especially within design and engineering. Ford's European design engineering HQ is based at Dunton in Essex, Nissan host their Technical Centre Europe at Cranfield, and Lotus Cars and Lotus Engineering being situated just outside of Norwich. Cambridgeshire boasts a selection of automotive specialists, including Caterpillar Engines in Peterborough, and Ricardo and Cosworth both housing electrical system tech centres in Cambridge.

A strong science orientation within the University of Cambridge has allowed the development of a strong pharmaceutical sector to emerge, with the likes of industry leaders such as GlaxoSmithKline and AstraZeneca moving to the region. These organisations have utilised the research capabilities within the city to develop world-class strengths in health and life sciences, as well as technologies for medical equipment. Within the city both house research and production plants.

The world leading research being performed across sites such as Adastral Park, in Suffolk, and the Cambridge Cluster, have allowed the region to develop a significant ICT offering. Major microprocessor designers are situated in the region, with ARM Holdings being the world's largest manufacturer of microprocessors in the world, with their products being found in 95% of smart phones. Further tech innovators are based in the region, including Apple, Amazon, Huawei and Microsoft but to name a few.

The region has prioritised its strengths into four strategic areas: Health and Life Sciences, Agricultural Science and Technology, Information and Communications Technology and Advanced Materials & Manufacturing.

Productive Capabilities

Manufacturing within the East of England is considered to be the 2nd most productive within the UK, second only to the North West. These productive capabilities have allowed the sector to grow, creating more jobs and the ability to start more successful businesses. When measuring the region against others using a productivity index, the East of England possesses a rating of 105.3% of the UK average.

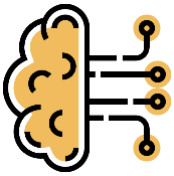
Research Strengths

As can be seen in Fig. 2, the East of England boasts impressive research capabilities. Housing the UK's best university in the University of Cambridge, alongside 8 other world leading research institutes, contributing to a much greater than average innovation index rating and subsequent spending on research and development.

Adastral Park, based in Suffolk is the global R&D centre for BT, developing research covering photonics and quantum technologies to deliver the next generation of telecommunications. Hundreds of SMEs are located within proximity at the Innovation Martlesham business park. There are significant research capabilities in sustainable construction at the Building Research Establishment in Hertfordshire, situated close to significant off-shore oil, gas and wind energy sources, providing effective maintenance and repair capabilities to the area. Both sites benefit from the world leading research and technology developed by The Welding Institute (TWI), which specialise in materials joining and engineering processes.

39.1%
INNOVATION INDEX RATING GREATER THAN UK AVERAGE

1ST
HIGHEST RANKING UNIVERSITY IN UK



8
WORLD CLASS RESEARCH INSTITUTES

63%
GREATER R&D EXPENDITURE THAN UK AVERAGE

Figure 2 - East of England Innovation Statistics

The region is home to a variety of world-class public research institutes, many of which situated within life sciences and could provide an accelerate route into biotechnology markets, such as biomaterials, biofuels and agritech. These include the National Institute for Biological Standards and Controls, John Innes Centre, MRC Laboratory of Molecular Biology, Babraham Bioscience Technologies Ltd, and Rothamsted Research as well as the Tyndall Centre for Climate Change Research and the British Antarctic Survey

The Cambridge area has developed a strong network of research capabilities and infrastructure, with a number of science parks, incubators and accelerators playing a pivotal role towards the Cambridge phenomena. So much so, that in 2014, one patent for every 1000 residents in Cambridge was granted, equalling five times the rates of other cities. Cambridge Science Park, St John's Innovation Centre and Norwich Research Park are just a few of these assets utilised to achieve such a feat.

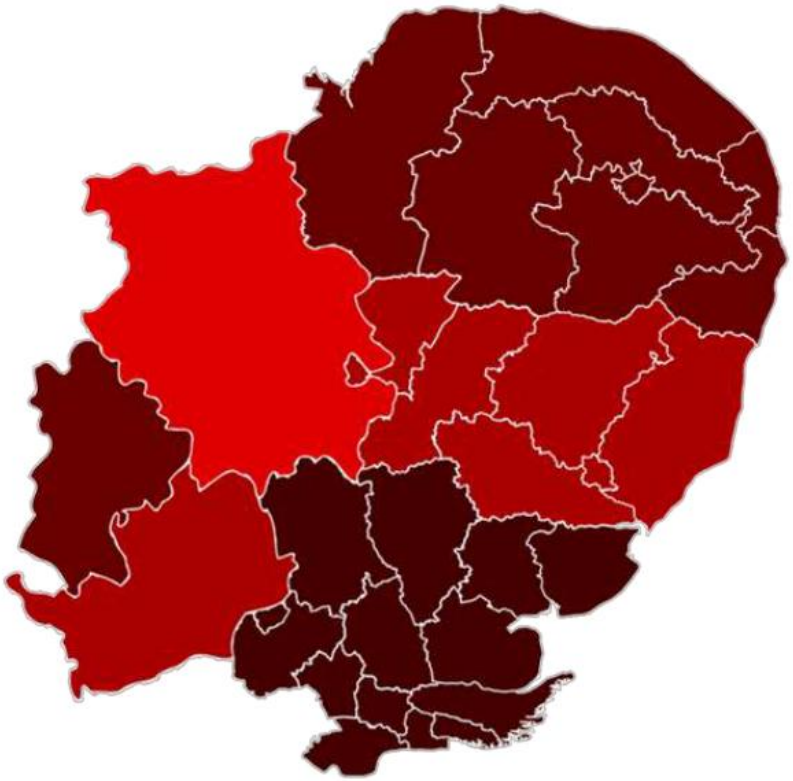
EAST OF ENGLAND MANUFACTURING

7.7%
OF REGION'S TOTAL WORKFORCE

14,040
BUSINESSES, UP 1.9% ON LAST YEAR

11.3%
OF REGIONAL GVA

52.5%
OF EXPORTS TO EU



2ND
MOST PRODUCTIVE REGION IN UK, ONLY TO NORTH WEST

39%
HIGHER LEVELS OF INNOVATION TO UK AVERAGE

1ST
HIGHEST RANKING UNIVERSITY IN THE UK

8
WORLD CLASS RESEARCH INSTITUTES

9.3%
OF UK EXPORTS, ABOVE REGIONAL AVERAGE

243,000
JOBS, UP 4.3% SINCE 2010

METHODOLOGY

CONSULTATION STRATEGY

Our development of the 'Consultation Strategy' has been created through the gathering of primary data.

In order to develop a greater level of understanding of the challenges, opportunities and business environment of organisations in the UK, Hethel Innovation has engaged with a combination of regional, national and international businesses. The overview diagram (Fig. 1) depicts how Hethel Innovation has generated findings and data to support the creation of a number of key recommendations that will develop the Advanced Manufacturing and Materials sector and provide relevant growth opportunities to businesses.

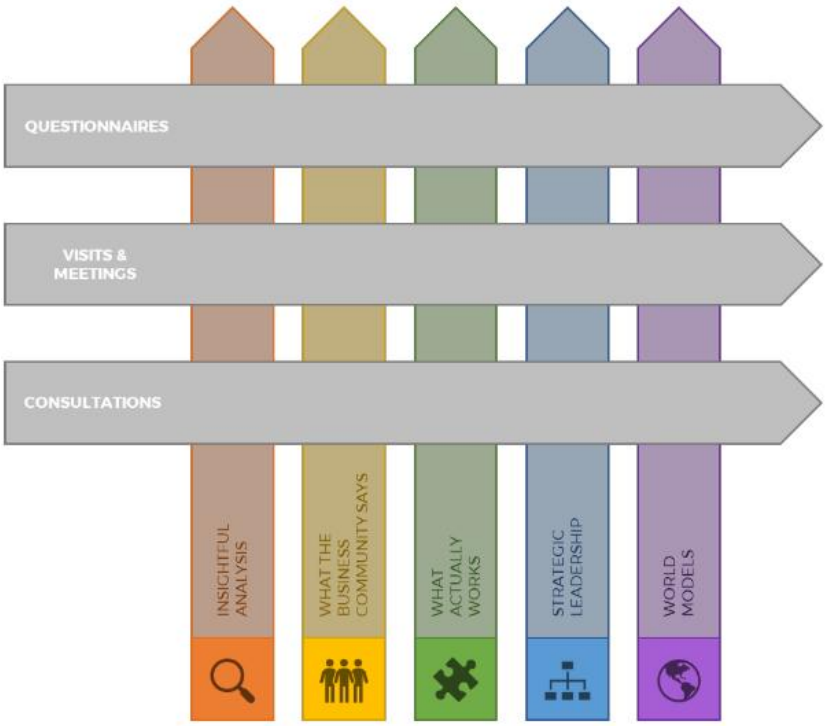


Figure 1 - Overview of the Consultation Strategy

QUESTIONNAIRES

Challenges, Opportunities, and the Business Environment

The purpose of the questionnaire distributed to organisations across the East of England, was to gauge what challenges and opportunities were currently being experienced and how they differ from sector to sector.

Without understanding the business environment of a variety of sectors, the outcomes of the key recommendations would be limited, providing only a small proportion of those engaged with to feel the benefits. As a result, the questionnaire was distributed to a number of businesses within the advanced manufacturing and materials sector, such as automation and composites, a number of cross sector organisations which play a supporting role in the development of the sector, such as digital tech and funding organisations, as well as network organisations which lobby for the needs of these businesses.

OPPORTUNITIES FOR THE REGION

"There are a number of emerging markets that the region could possess comparative advantages in, including microwave communications, quantitative imaging, printing technology and quantum technologies"

- John Molloy (National Physical Laboratory)

THE 'ACCIDENTAL MANAGER' PHENOMENA

The UK is considered to be suffering a leadership crisis, with four out of five managers within businesses lacking the sufficient training to be able to perform the role effectively.

Comments echoed by respondents to the questionnaire as well as by those in senior positions and government call for a greater availability to leadership training.

By engaging with cross-sector organisations, the recommendations generated will have the opportunity to benefit not only the Advanced Manufacturing and Materials sector, but a number of sectors which support its ability to access new markets.

What was asked?

Hethel Innovation's support networks allowed questionnaires to be completed by business leaders passionate about advancing the manufacturing, cleantech and biotech sectors. The questions asked allowed businesses to rank their challenges and opportunities (Fig. 2), as well as state how they interacted with cross-sector businesses, academia and the public sector (Fig. 3) to grow their business and mitigate risks.

Topic	Overview of Findings
Barriers to Growth and Productivity: • UK • Cambridgeshire & Peterborough • Businesses	• Skills • Red Tape, Regulations & Legislation • Ability to Embrace New Technology • Business Space (Offices & Workshops) • Physical Infrastructure • Economic Conditions • Accessible Grant and Funding Opportunities • Brexit • Access to Knowledge & Science • Finance • Supply Chains • Utilisation of Technological Solutions & Partners • Labour Immobility • Business Leadership • Connectivity (Transport & Broadband) • Collaboration Opportunities • Talent Retention

Figure 2 – Questionnaire: Ranking Challenges and Accessing Opportunities

It can be seen from Fig. 2 that there are multiple challenges and barriers to access opportunities, restricting businesses from growing and increasing productivity. These range from internal challenges, such as having sufficiently trained, knowledgeable and motivated business leaders, through to external challenges such as the immobility of labour or the uncertainty of an approaching Brexit.

UK Industrial Strategy

It was outlined by the UK Government that a review will be launched to understand what actions could be most effective in improving the productivity and growth of small and medium-sized businesses.

In order to generate these actions, it must first be realised what businesses themselves see as the main barriers to increase productivity; a sustainable way to grow the sector.

The second set of questions built upon the challenges of the business to understand how the business environment they are currently operating in either promotes or restricts the ability to overcome these challenges. The topics in focus, seen in Fig. 2 include the ability to engage with research and academia, the ability to access space, how easy it is to network, what business support is available and how finance and skills provision is being provided within the region.

Topic	Overview of Findings
Research and Academic Engagement	• Regularly engage with research within the region • Do engage but find difficulty in accessing preferred local partners • No links created • Research and academia have engaged with our business, but we do not have times or resources • We have connected in the past, and would like to again in the future
Availability of Space	• We have always found affordable and suitable space available • Space is available but is too expensive for our business • We were able to get start-up space but grow on opportunities are limited • We needed to move away from Cambridge to allow growth • The space available is not tailored to the need of the Manufacturing and Materials sector
Networking	• There are valuable networking opportunities available within our sector • The networking opportunities are good but do not suit the manufacturing sector • Outside of Cambridge, networking is limited • There is a lack of networking opportunities • I do not see the value in networking. Efforts should not be focused here
Business Support	• There needs to be more support on offer, specifically for AMM businesses • We have engaged with business support but didn't gain any value • We chose not to engage with the business support on offer • There is a focus on R&D but not growth • There is effective AMM business support on offer • There is a wealth of business support available in the region, accessible to all sectors
Finance	• Finance is available, focusing on startups • Finance is available focusing on business growth • Most finance is grant funding • Most finance is angel and venture capital • We would like to see more funding available for asset purchase • More funding needs to be available for productivity improvements • Funding must be available for manufacturing scale ups
Skills	• We have a good supply of leadership skills coming into the region • We can access the right skills to grow • We struggle to find technical skills • We can't retain our skilled workers in the region • There are not enough AMM leaders in the region

Figure 3 – Questionnaire: Defining the Business Environment

The findings of Fig. 3 show that certain businesses understand how to access assets to support the growth of the business, whereas others do not know what is out there. The recommendations created will therefore benefit businesses with a strong network of contacts to access, as well as those at the start of their business journey, not yet engaged with those to support growth.

Closing the questionnaire, an open question allowed businesses to directly suggest recommendations which would not only grow their business, but their surrounding business environment, A selection of answers can be seen in Fig. 4.

Topic	Overview of Findings
Recommendations to grow the sector	• More sector-specific networking available • More grow on space • More finance for equipment and productivity improvement • Manufacturing hubs surrounding Cambridge to scale up businesses • Tailored business support programmes • Export support programmes • Increased access to knowledge exchange • Develop businesses' understanding of productivity • Look ahead to ensure we have a suitably skilled future workforce • More opportunities to collaborate and share best practice • Look to emerging technologies and focus efforts on these comparative advantages

Figure 4 – Questionnaire: What recommendations do businesses have?

UK Industrial Strategy

Several of the comments gained through the questionnaire stated the significance of available space for businesses to grow.

This is echoed through the Industrial Strategy, where the UK Government has emphasised the importance of creating *"the best place to start and grow a business"*

NETWORKING CAN BE TOO GENERIC

"The networking in and around Cambridge can be too generic. If we are expected to travel over 30 minutes for networking, it must be worth our time.

We have found that the MAKE UK networking sessions are of most value to our business."

- Steve Hales (Huxley Bertrum)

CAMBRIDGE NEEDS SUPPLY CHAINS!

"Cambridge needs to be recognised for its manufacturing base. It is not science centric, there is much more.

More needs to be done to grow stronger supply chains within Cambridge rather than commercialise more science"

- David Cleevely

The questionnaire was designed to be a quick way for businesses to impact the future of their sector and to give real insight in to how they operate on a day-to-day basis. The results gained will be combined with the visits and meetings, consultation sessions and secondary research generated to create more impactful recommendations.

VISITS AND MEETINGS

Who did we engage with?

As stated in the previous section, Hethel Innovation engaged with advanced manufacturing and materials businesses, as well as organisations that help access future opportunities, including

funding partners and local support networks. Fig.5 shows the variety of organisations engaged with and extensively discussed with in person.

Name	Organisation	Description
John Molloy	National Physical Laboratory	Academia & Research
Tony West	University Centre Peterborough	Academia & Research
William Haire	East of England Agricultural Society	Academia & Research
Simone Gubbins	TWI	Academia & Research
Derek Jones	Babraham Science Park	Academia & Research
Steve Hales	Huxley Bertrum	Manufacturing & Engineering
Christopher Wilkinson	Marshalls	Manufacturing & Engineering
Paul Holt	Photocentric	Manufacturing & Engineering
David Cleeveley		Entrepreneur
Chris Woodward	Enterprise Europe Network (InnovateUK)	Funding
Tom Hennessey	Opportunity Peterborough	Thinktank
Gordan Round David Wells	St Neots – Masterplan	Special Interest Group
Stewart McTavish	IdeaSpace	Incubator
John Stenhouse	Cambridgeshire & Peterborough Combined Authority	Public Sector

Figure 5 – Visits & Meetings: A list of individuals engaged with

As can be seen in Fig. 5, a number of keystone organisations across Cambridgeshire and Peterborough were engaged with. This included academia and research, to understand what skills provision needs to be addressed, manufacturing and engineering leaders, to hear the needs of the private sector, as well as others including funding partners, space providers and the public sector.

What was asked?

The meetings and visits performed by Hethel Innovation were conducted in an open format, allowing individuals to discuss in-depth where they believed the challenges and opportunities to be. This allowed a wider range of responses to be generated and will allow for greater detailed recommendations.

As the meetings grew in number, it allowed Hethel Innovation to refer to previous discussions and investigate whether the sentiments of one manufacturing businesses aligned with another. Meetings with academia and research were conducted in the same manner.

CONSULTATIONS

How did they work?

The consultation sessions were an open invitation for individuals of all sectors to review the progress made by Hethel Innovation and identify any challenges and opportunities missed during the research. These sessions have been extremely significant for pointing out gaps which were not immediately identifiable.

Where were the meetings held?

Hethel Innovation has held three sessions to date, at the Institute for Manufacturing, in Cambridge, The Welding Institute, at Granta Park and at a Hethel Innovation-led conference in King's Lynn. These three sessions allowed a different demographic to be accessed and provided a greater range of recommendations to the existing work performed. NAAME's Evolution conference on February 20th at the College of West Anglia was coordinated specifically for manufacturing and engineering businesses, with the likes of Mitsubishi Electric, Rockwell Automation and Williams Refrigeration in attendance, and SMEs including Raptor Aerospace, Swift Aircraft and PathFindr providing their insight into the challenges and opportunities being faced approaching Industry4.0.

GROWTH DRIVERS

Through our consultation activities with a range of businesses and organisations, we were able to define the 'Growth Drivers' behind the development of a sector focused comparative advantage for Advanced Manufacturing and Materials in Cambridgeshire and Peterborough.

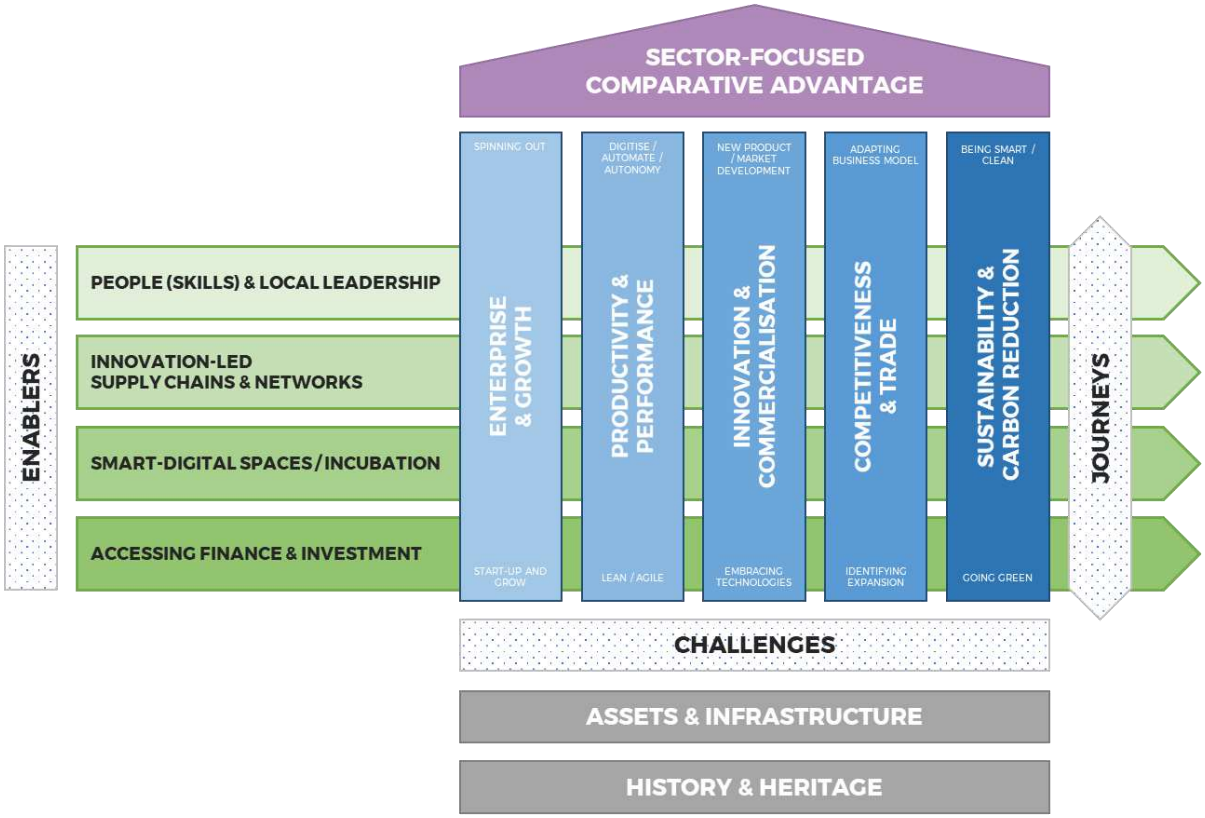


Figure 6 - Growth Drivers

ENABLERS

People (Skills) & Local Leadership

The first underlying enabler of sector growth is based around skills and leadership within the sector. Effective leadership in manufacturing organisations, as well staff with the right knowledge and skill set are necessary to grow the business and the overall sector.

The current skills gap within the manufacturing sector is often cited as one of the biggest challenges for businesses, and there is a need within the sector to address the demand for future skills within manufacturing.

Innovation-Led Supply Chains & Networks

Highly developed local supply chains and networks (including manufacturing groups) drive sector growth in the region.

Smart-Digital Spaces & Incubation

Businesses need sufficient space to grow and develop, whether it is on an industrial estate, a business park, or a science/technology park.

With Industry 4.0 approaching, manufacturing spaces are having to adapt in order to keep up with technologies surrounding this age's industrial production methods. Now, and into the future as Industry 4.0 unfolds, computers and machines are connected and communicate with each other to make decisions without human involvement. A combination of cyber-physical systems, the Internet of Things and the Internet of Systems make Industry 4.0 possible and the smart factory a reality.

Accessing Finance & Investment

In order for the manufacturing and engineering sector to grow, there must be sufficient investment and funding opportunities, especially for early stage businesses getting off the ground.

JOURNEYS

Innovation & Commercialisation

Embedding and implementing innovative new practices within the region's manufacturing and engineering businesses, leading to new products, processes, and services.

Competitiveness & Trade

Enhanced competitiveness (both on a business and regional scale) leads to greater export rates and therefore brings access to new markets.

Productivity & Performance

Increase productivity throughout the region's businesses through implementation and uptake of lean methodologies.

Sustainability & Carbon Reduction

Enhancing business sustainability through developing eco-friendly business practices, therefore reducing the carbon footprint of the manufacturing and engineering sector within the region.

Enterprise & Growth

Supporting the commercialisation and startup of ideas in to fully fledged businesses, throughout communities within the region.

CHALLENGES

Assets & Infrastructure

Maximising existing assets in the region is key to developing sector growth. Academic institutions, science parks, business parks, incubators and industrial estates are all key assets that enable this.

The development of growth corridors throughout Cambridgeshire will allow the growth of supply chains to the surrounding areas of the country.

History & Heritage

It is important to build upon the history and heritage of the region, in this instance, in relation to the engineering and manufacturing sector.

FORMING MAKE IT SPACES: MANUFACTURING INNOVATION DISTRICTS

The process below outlines how we develop Manufacturing Innovation Districts within the Cambridgeshire and Peterborough region.

The diagram shows how both businesses and students can be supported and engaged with in the development of Innovation Districts.

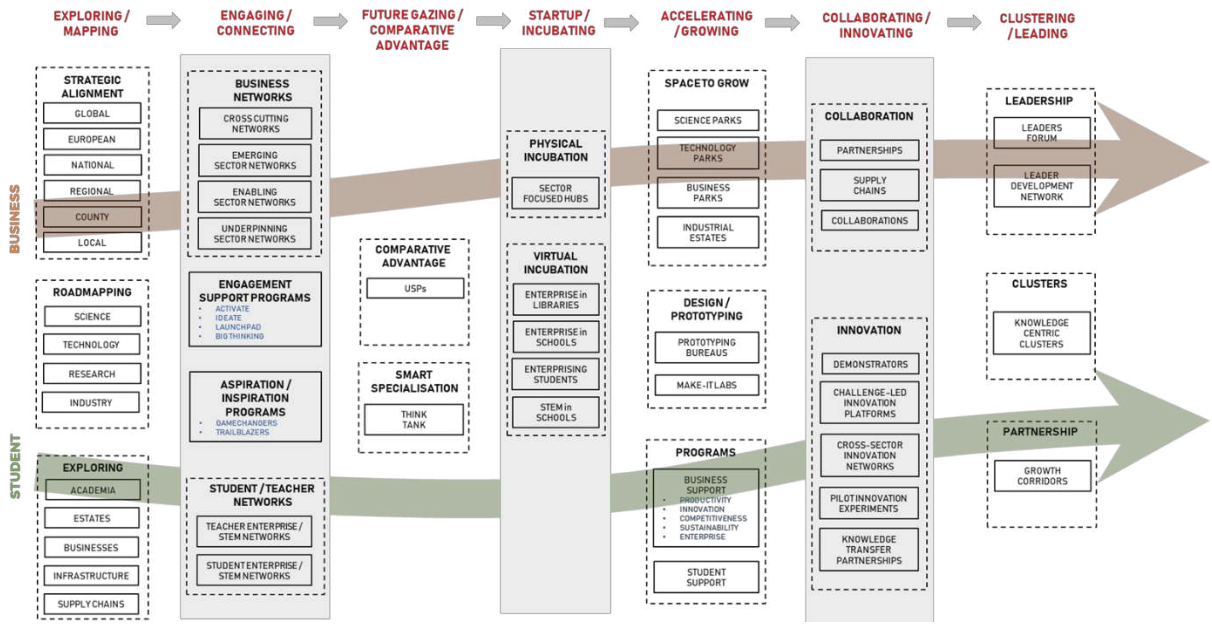


Figure 7 - Forming 'Make-It' Spaces: Manufacturing Innovation Districts

EXPLORING / MAPPING

Effective delivery of an Innovation District that connects opportunities and challenges to local solution providers requires an understanding of market conditions, the types of solutions available, and alignment to key strategies.

Geo-mapping of regional research and industrial assets, and concept mapping of technology trajectories and possible routes to innovation all build the understanding which is essential to any further support.

ENGAGING / CONNECTING

To engage current and future participants of regional innovation, opportunities such as sector networks and engagement support programs should be promoted by relevant agencies through existing business and research networks, and directly to those identified by prior mapping and exploring activities.

In regards to students, collaboration between academic institutions and businesses is necessary in the successful delivery of aspiration/inspiration programs, and student/teacher networks.

FUTURE GAZING / COMPARATIVE ADVANTAGE

In order to establish the comparative advantage of the innovation district, USPs of the region must be defined, in terms of business, lifestyle, infrastructure, and academia.

STARTUP / INCUBATING

Incubation of businesses at an early stage is crucial to their survival, and this can be done through physical or virtual means.

Physical incubation in sector-focused hubs and virtual incubation through student programs provide the support necessary to grow ideas and develop them in to businesses.

ACCELERATING / GROWING

Effecting the behavioural, organisational and systemic changes necessary for improving innovation needs interventions at all relevant levels, both top-down and bottom-up, that constantly seek to identify connections that could lead to collaborations or other sources of new ideas.

Hands-on approaches such commercialisation and lean start-up workshops deliver key theory to the initiators of new products and new businesses, while sector growth programmes build and support the entrepreneurial networks needed to successfully diffuse innovation.

Growth is also supported by the physical incubation of businesses, through industrial estates to science parks.

COLLABORATING / INNOVATING

Collaborations between disciplines, whether in the private or public sectors, are key starting points and test beds for new innovations. Professional communities in any sector of interest should be encouraged both en masse and individually to reach across boundaries.

Stakeholders can foster collaboration by establishing innovation platforms of all kinds (manual or automated) and ensuring that they reach critical user mass, to ensure value for participants and therefore sustainability of the activities in question.

CLUSTERING / LEADING

Key to securing the long-term success of any innovation district is the identification of leaders at all stages of the journey, whether in industry, research or stakeholder agencies, who can champion the principles of systemic innovation after any specific interventions have ended. Focused workshops and consultancy activities can identify and prepare leaders for this crucial role.

At the macro scale, advocacy and sector leadership can be instrumental in securing the conditions for industry cluster growth, while on the micro-scale continued innovation support that connects existing and new cluster participants is indispensable.

STRATEGY WORKSTREAMS

A combination of our consultation strategy, growth drivers, and innovation district process have ultimately defined the workstreams and themes of our Advanced Manufacturing & Materials Strategy, as depicted in the diagram below.

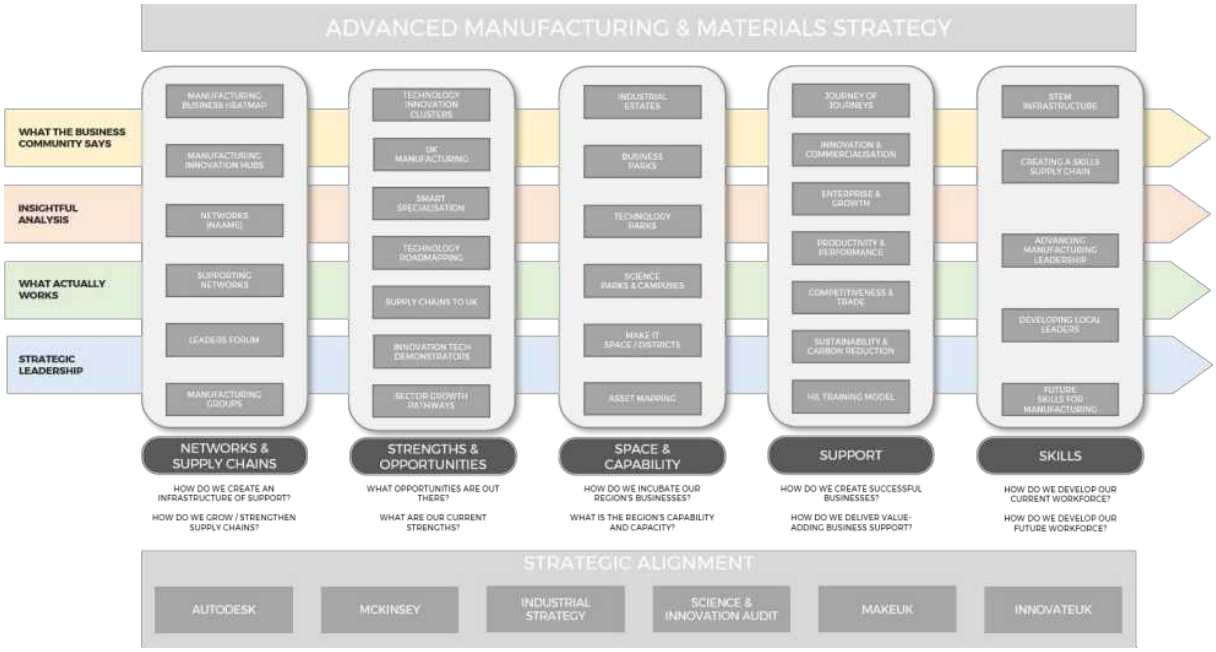


Figure 8 - Strategy Workstreams

As such, the strategy will be split in to 5 main sections which will explore our key recommendations for Cambridgeshire & Peterborough in regards to growing the Advanced Manufacturing & Materials sector. These are as follows:

- Networks & Supply Chains
- Strengths & Opportunities
- Space & Capability
- Support
- Skills

Each of these sections, and the recommendations that come from them have been aligned with a combination of strategies, including the UK Industrial Strategy and the East of England Science & Innovation Audit.

CONSULTATION MEETINGS REPORT

Hethel Innovation conducted meetings with keystone organisations across Cambridgeshire and Peterborough to learn of the challenges and opportunities being experienced today.

A range of organisations were approached to understand the differing views of individuals operating in the current business environment, and to learn how cross-sector organisations share the same challenges. The feedback gained from the organisations allowed an 'operating the ground floor' level of detail to be realised. A comprehensive list of all consulted parties can be found in Appendix 1.

All recommendations made by the respondents have been categorised using abbreviations, as seen in Fig. 1.

Skills **SK**	Infrastructure **INF**	Collaboration Opps **CO**
Finance & Investment **FIN**	Brexit **EU**	Leadership **LEAD**
Space to Grow **STG**	Knowledge Transfer **KT**	Network Support **NET**
New Technology **TECH**	Supply Chains **SC**	Incubation **INC**
New Markets **MAR**	Branding **BR**	Labour Immobility **LAB**

Figure 1 – Classification of Recommendations

Name & Organisation	Comments	Overview	Key Recommendations
John Molloy National Physical Laboratory	MAR TECH STG	**LEADERSHIP**	Develop a greater focus within education to deliver higher level skills and leadership training (**SK, LEAD)** Site branding and focus needs to be more open to Advanced Manufacturing and Materials businesses **(IF, STG)** Affordable business support and advice is needed for growth, horizon scanning and strategy **(NET)**
Chris Woodward Enterprise Europe Network	INF FIN NET	**NETWORKS**	Specific Brexit support programme and guidance is required **(EU)** A network is required to replace the space left by MAS **(NET)** More investment is needed in scale up space **(STG)**

Tom Hennessey Opportunity Peterborough	LEAD STG KTN	NETWORKS	Work must be done to show businesses the potential technology road maps that can connect research to businesses **(NET)** Tech parks needs to link into parent companies from overseas to invest in local operations **(FIN)** A support program is needed with a dedicated resource **(NET)**
Tony West University Centre Peterborough	SK LAB	SKILLS	Would be great for region to have a Cleantech or Advanced Manufacturing network **(NET)** There is a need to develop a USP for the Red Brick Farm, and develop its specialities **(TECH)** Support the development of the University Centre Peterborough and the creation of engineering degrees **(SK)**
William Haire East of England Agricultural Society	INF CO KT	NETWORKS	Support must be delivered through a designated network to match up farmers to researchers **(KT, NET)** People need educating about the opportunities within agriculture, and to not be seen as an old-fashioned mucky career **(SK)** Cultivation and the use of robotics is an EoE comparative advantage and must be maximised **(TECH)**
Steve Hales Huxley Bertram	INF SC SK	NETWORKS	Support must be delivered throughout businesses to increase productivity and involve the team **(NET)** A greater focus on the advancement and deployment of automation must be considered **(TECH)** Agile training should be available to businesses, so that they can be better equipped to adapt to changing conditions **(SK)**
Gordon Round & David Wells St Neots Masterplan	STG BR INF	SPACE TO GROW	An incubator would support new space in the region **(INC)** Regions outside of Cambridge would welcome startup space and grow on space to get the Cambridge feel **(STG)**

David Cleevely	NET STG CO	COLLABORATION	Map and develop Innovation Districts across the region **(STG, TECH, INC)** Create Manufacturing Groups, similar to those that helped launch the Cambridge Phenomenon **(NET)** Networking should start with a sector focus to get valuable connections and critical mass before expanding **(CO, NET)**
Paul Holt Photocentric	NET INF SK	SKILLS	There is a skills shortage for engineers, software engineers and scientists. Courses must be delivered in the region **(SK)** Export support must be provided to larger businesses **(NET)** Greater promotion of Peterborough **(NET)**
Simone Gubbins TWI	FIN CO SK	COLLABORATION	Focus for the region should be cleantech / clean growth, bringing together Cambridge and Peterborough **(CO, NET)** Incubation space must be available for spin outs from TWI **(INC)** More investment is needed within the branding of industrial estates so that solutions are clearer to cross-sector challenges **(STG)**
Derek Jones Babraham	INF LAB STG	NETWORKS	Map the expertise of the region **(NET)** Develop more campus sites, completely open and collaborative spaces **(STG)**
Stewart McTavish IdeaSpace	LEAD TECH INF	NETWORKS	Networks and local leaders must be connected **(NET)** Mapping work must be performed to identify what links to national hubs/research/specialisms can be accessed **(INF)** Develop the sites at Red Brick Farm, Chatteris, Chesterford, Alconbury and St Neots **(STG)**

John Stenhouse CPCA	STG INC TECH	**INCUBATION**	Develop new catapults in available space at Chatteris and Haverhill **(SK, TECH)** Support the development of Haverhill's incubator **(INC)** Strength relationships with external catapults to share best practice **(NET)**
Christopher Wilkin Marshalls	TECH CO BR	**NETWORKS**	Celebrate excellence through the creation of a national brand – like Chicago did **(NET, BR)** Develop networks to support lead management for building a brand around inward investment (**NET)** Support the integration of smart specialisation in outer towns and hubs to help with brand and investment **(BR, FIN)**
Steve Clarke CPCA	STG INC SK	**SPACE TO GROW**	Innovation districts would have launch pads within them. Make It spaces have specific park/special development **(STG, INC)** Industry 4.0 skills must be addressed and delivered, both at junior and adult level **(SK)** LIS must be built with a bottom -up approach (capturing the views of grassroots businesses), as opposed to top down approaches that other LIS's are implementing. **(NET)**
Jo Sainsbury iMET	SK MAR CO	**SKILLS**	There needs to be a focus on new skills developing cross sector innovation, productivity and enterprise **(SK)** There is a real opportunity for Cambridge's AME sector to drive innovation in the built environment sector **(MAR, TECH)** Make it spaces must include design and prototyping facilities **(STG, CO)**
Martin Lawrence Metalcraft	STG INF FIN	**SPACE TO GROW**	There must be a commitment from CPCA to provide future funding for further phases, allowing grow on space **(STG)** CPCA must invest in better infrastructure, notably in its power grid and roads **(INF)** A capital grant fund for commercialisation and business growth should be offered to support relocation **(FIN)**

Figure 2 – Recommendations of Keystone Organisations

What were the results?

Similar to those of the questionnaire and the consultation meetings held, the views of the organisations across Cambridgeshire and Peterborough differ greatly. Fig. 2 shows the breakdown of those engaged with to learn what their key recommendation was, alongside a number of small suggestions that should be actioned.

The cloud diagram in Fig. 3 shows a breakdown of the respondents' recommendations and their resulting category. The larger the size of the abbreviation (found in Fig. 1), the greater the number of times respondents answered that category. From the diagram it can be seen what matters most to organisations, and what support they believe is needed.

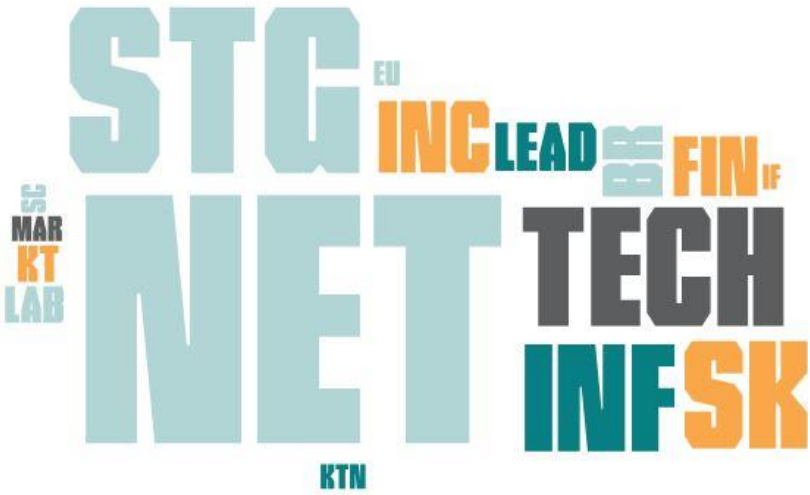


Figure 3 – Cloud Diagram of Organisation Recommendations

It can be seen from Fig. 3 that three recommendations stand out from the others:

Network: Establish a network championing the sector and providing businesses with the opportunity to share best practice and collectively grow.

Space to Grow: Identify new and existing sites for development, allowing organisations to grow sustainably and access greater opportunities.

New Technology: Accelerate the investment of new technology through strategies including business education, prototyping opportunities and best practice site visits.

The recommendations suggested by Hethel Innovation found later in the document align with those of the keystone organisations. Key findings from these meetings have emphasised the importance of developing a network within Cambridgeshire and Peterborough. It is evident that the work which has been performed in the past by organisations such as MAS (Manufacturing Advisory Service) and NMN (Nottinghamshire Manufacturing Network) have delivered great impact in different regions across the UK.

The recommendations made by the keystone organisations also suggest that there is limited space to grow businesses within Cambridgeshire and Peterborough, and that substantial investment is required to address this challenge. The limited space available for businesses to grow within the region could also play a detrimental part on the ability for businesses to expand into new markets and access new technology to support that expansion.

The third most discussed recommendation involved the ability to access new technology and for it to be applied within organisations. The challenges spoken by the organisations included a limited understanding of the available

technologies and how they can be used to improve businesses' productivity and develop new NPPS, funding available to access the new technology, and the knowledge of knowing what technology can be invested into in the future.

STRATEGIC ALIGNMENT

RECOMMENDATIONS ALIGNMENT TO UK INDUSTRIAL STRATEGY

Each of our recommendations within our Advanced Manufacturing & Materials sector growth strategy for Cambridgeshire and Peterborough have been developed in line with the UK Industrial Strategy, aligning to at least one of the five themes set out by the government in establishing a vision for a transformed economy:

- Ideas – the world's most innovative economy
- People – good jobs and greater earning power for all
- Infrastructure – a major upgrade to the UK's infrastructure
- Business Environment – the best place to start and grow a business
- Places – prosperous communities across the UK

Below outlines how each of our key recommendations align with these themes:

	IDEAS	PEOPLE	INFRASTRUCTURE	BUSINESS ENVIRONMENT	PLACES
BUILD A MANUFACTURING NETWORK ACROSS THE REGION TO CONNECT AND INFORM THE SECTOR	✔			✔	✔
DEVELOP MANUFACTURING GROUPS ACROSS CAMBRIDGESHIRE & PETERBOROUGH TO DRIVE PLACE-BASED GROWTH AND COLLABORATION	✔			✔	✔
FORM AND BRAND 'MAKE-IT SPACES' AS PLACES TO COMMERCIALISE PRODUCTS (DESIGN, PROTOTYPE, MANUFACTURE AND SCALEUP)	✔		✔	✔	✔
DEVELOP MAKE-IT CLUSTERS / DISTRICTS WITH KEY LAUNCHPAD SITES AND STRATEGIC SATELLITE LOCATIONS	✔			✔	✔
CREATE A CAPACITY UTILISATION PROGRAM AROUND 'MAKE IT' CLUSTERS TO MAXIMISE PRODUCTIVITY	✔	✔		✔	✔
DEVELOP SUPPLY CHAINS IN TO CAMBRIDGESHIRE AND ACROSS THE UK	✔			✔	✔
FORM TECHNOLOGY GROUPS FOCUSED ON EMERGING TECHNOLOGIES TO COLLECT CRITICAL MASS	✔			✔	✔
DEVELOP INNOVATION PLATFORMS TO DRIVE CROSS-SECTOR INNOVATION AROUND SHARED CHALLENGES	✔			✔	✔
PROVIDE BUSINESS SUPPORT THROUGHOUT THE REGION'S KEY MAKE-IT CLUSTERS	✔			✔	✔
INCUBATE IDEAS AND SUPPORT BUSINESSES TO STARTUP THROUGH SPECIFIC AMM INCUBATION AND ACCELERATION PROGRAMS	✔			✔	
GROW EXISTING BUSINESSES THROUGH SCALE UP AND EXPANSION FUNDING AND SUPPORT JOURNEYS	✔			✔	
INCREASE INNOVATION CAPACITY WITHIN THE MANUFACTURING SECTOR WITH SUPPORTED KNOWLEDGE TRANSFER AND FUNDING CALLS	✔			✔	
SUPPORT DEVELOPMENT OF PRODUCTIVE BUSINESSES WITH SUPPORT TO AUTOMATE AND DIGITISE BUSINESSES WITH INDUSTRY 4.0 TECHNOLOGIES	✔			✔	
SUPPORT SUSTAINABILITY IN BUSINESSES	✔			✔	
INCREASE THE COMPETITIVENESS OF BUSINESSES HELPING THEM ATTRACT INWARD INVESTMENT AND TRADE OPPORTUNITIES	✔			✔	
FACILITATE KNOWLEDGE TRANSFER BETWEEN ORGANISATIONS	✔	✔		✔	
PREPARE FOR THE FUTURE WORKFORCE; DEVELOPING INDUSTRY 4.0, PRODUCTIVITY, INNOVATION, AND ENTREPRENEURIAL SKILLS	✔	✔		✔	
GROW LOCAL LEADERS THAT WILL STAY WITHIN THE REGION TO ACCELERATE ECONOMIC GROWTH FOR THE BEST OF THE COMMUNITY	✔	✔		✔	✔
CREATE TECHNICAL, INDUSTRY-FOCUSED UNIVERSITIES SUCH AS THE UNIVERSITY OF PETERBOROUGH	✔	✔			
DELIVER INDUSTRY-LED APPRENTICESHIP QUALIFICATIONS IN IMET, FOCUSED ON THE FUTURE SECTORS	✔	✔		✔	
MAP SKILLS/LEARNING PROVISION AND INFRASTRUCTURE TO IDENTIFY GAPS AND NEW OPPORTUNITIES			✔	✔	✔
DEVELOP SMART SPECIALISATION PROGRAMS WITHIN CAMBRIDGE, PETERBOROUGH AND FENLAND TO IDENTIFY THEIR INDIVIDUAL STRENGTHS	✔			✔	✔
DEVELOP LINKS IN TO CATAPULTS AND OTHER SIGNIFICANT HUBS / CITIES WITHIN LAUNCHPAD SITES	✔		✔	✔	✔
MAXIMISE GROWTH CORRIDORS TO ATTRACT INWARD INVESTMENT FROM ACROSS THE UK AND GLOBE			✔	✔	✔
UTILISE EXISTING INCUBATION SPACE			✔	✔	✔
DEVELOP NEW GROW-ON SPACE WITH SPECIFIC SUPPORT PROGRAMS WITH CONDITIONS RELATING TO INDUSTRY 4.0 AND PRODUCTIVITY			✔	✔	✔

IDEAS

The UK Industrial Strategy highlights how our countries ability to innovate is one of our key historic strengths. The same statement can be applied to the Cambridgeshire and Peterborough region.

Cambridge in particular boasts the highest amount of patent applications (per 100,000 of population) in the UK, highlighting its strengths in innovation. In comparison, Peterborough is ranked 18th for the same measure. Although this is in by no means disastrous – and it is in fact in the top 30% of UK cities for amount of patent applications – it does highlight that there is much room for improvement in regards to supporting ideas and fostering innovation.

Our recommendations that align with the UK Industrial Strategy's 'Ideas' pillar, and will enable the support of innovation are as follows:

- **BUILD A MANUFACTURING NETWORK ACROSS THE REGION TO CONNECT AND INFORM THE SECTOR**
    - By setting up a network you a providing a way for AMM companies across the region to interact encouraging collaboration, commercialisation and challenge-led innovation

- **DEVELOP MANUFACTURING GROUPS ACROSS CAMBRIDGESHIRE & PETERBOROUGH TO DRIVE PLACE BASED GROWTH AND COLLABORATION**
    - Developing smaller, local manufacturing groups allows the sharing of best practice and a consortium-style communication where challenges and opportunities can be discussed in a non-competitive environment

- **FORM AND BRAND 'MAKE-IT' SPACES AS PLACES TO COMMERCIALISE PRODUCTS (DESIGN, PROTOTYPE, MANUFACTURE AND SCALE UP)**
    - By making technologies and machinery that is underutilised in a business available for others to use in down time you are increasing productivity, collaboration and the chance of NPPS' to market

- **DEVELOP MAKE-IT CLUSTERS / DISTRICTS WITH KEY LAUNCHPAD SITES AND STRATEGIC SATELLITE LOCATIONS**
    - A hub consisting of a combination of manufacturing groups, incubation space, academic institutes, industrial estates and science parks is a pool of innovative thinking through collaboration and emerging technologies

- **CREATE A CAPACITY UTILISATION PROGRAM AROUND 'MAKE-IT' CLUSTERS TO MAXIMISE PRODUCTIVITY**
    - An online, challenge-led platform to inform the use of technologies and machines within these make it clusters ensures that the region's commercialisation capacity is being maximised

- **DEVELOP SUPPLY CHAINS IN TO CAMBRIDGESHIRE AND ACROSS THE UK**
    - As supply chains are developed it will pull products and knowledge across the region from Cambridge and the wider UK encouraging the formation of connections, collaboration and commercialisation of new products

- **FORM TECHNOLOGY GROUPS FOCUSED ON EMERGING TECHNOLOGIES TO COLLECT CRITICAL MASS**
    - Becoming early adopters of emerging technology allows the region to take advantage of technologies that aren't widespread yet and therefore create innovate products and services based on these before others get the chance

- **DEVELOP INNOVATION PLATFORMS TO DRIVE CROSS-SECTOR INNOVATION AROUND SHARED CHALLENGES**
    - Challenge-led innovation platforms with expertise brought in from academia, users and investors as well as businesses creates an innovative environment that can take a solution rom idea to product

- **PROVIDE BUSINESS SUPPORT THROUGHOUT THE REGION'S KEY MAKE-IT CLUSTERS**
    - Playing to the key strengths of each physical space you are able to tailor business support to each region. The Journey of Journeys uses five areas of business support, one being innovation and commercialisation, to develop the sector as a whole

- **INCUBATE IDEAS AND SUPPORT BUSINESSES TO START-UP THROUGH SPECIFIC AMM INCUBATION AND ACCELERATION PROGRAMS**
    - Cambridge already has a high concentration of start-ups; however, this lacks in other areas of the greater region. With ample space to host, and through providing business support, the fostering of starts ups across the region could bring greater productivity and commercialisation of products with it

- **GROW EXISTING BUSINESSES THROUGH SCALE UP AND EXPANSION FUNDING AND SUPPORT JOURNEYS**

- Supporting start-ups and SMEs through an enterprise journey combats the pressures faced by small companies such as lack of financial, human and social capital. This allows them to grow steadily, contributing to the innovation community already present in the region

- **INCREASE INNOVATION CAPACITY WITHIN THE MANUFACTURING SECTOR WITH SUPPORTED KNOWLEDGE TRANSFER AND FUNDING CALLS**
  - In order to contribute to the long term, sustainable, economic growth of the region new ideas, approaches and collaborations are needed. This can be achieved by supporting businesses through the innovation journey and encouraging collaboration and competitiveness

- **SUPPORT DEVELOPMENT OF PRODUCTIVE BUSINESSES WITH SUPPORT TO AUTOMATE AND DIGITISE BUSINESSES WITH INDUSTRY 4.0 TECHNOLOGIES**
  - Productivity directly correlated with innovation and economic growth. By taking businesses on the productivity journey you can both educate individual businesses but also create ambassadors for each stage of the journey to further educate their fellow AMM companies in the region

- **SUPPORT SUSTAINABILITY IN BUSINESSES**
  - As areas in the region improve and grow emissions will grow with them. By supporting businesses to think innovatively about keeping their business sustainable you are contributing to a greener UK and can encourage businesses to share best sustainable practice

- **INCREASE THE COMPETITIVENESS OF BUSINESSES HELPING THEM ATTRACT INWARD INVESTMENT AND TRADE OPPORTUNITIES**
  - By preparing and encouraging businesses for export and trade you are actively contributing to an increase in GDP

- **FACILITATE KNOWLEDGE TRANSFER BETWEEN ORGANISATIONS**
  - As previously stated, creating AMM communities that include students, academics and businesses is essential to improve growth within the sector. Academic institutions often have access to the latest research and technologies and so enhanced communications between these and businesses is an obvious step for innovation and growth

- **PREPARE FOR THE FUTURE WORKFORCE; DEVELOPING INDUSTRY 4.0, PRODUCTIVITY, INNOVATION, AND ENTREPRENEURIAL SKILLS**
  - One of the most commonly cited issue in the AMM sector is the skills gap issue. By ensuring today's workforce, and the future workforce, are trained in skills such as digital, design and technological will mean the industry grows exponentially rather than stunting due to graduates lacking desperately needed skills

- **GROW LOCAL LEADERS THAT WILL STAY WITHIN THE REGION TO ACCELERATE ECONOMIC GROWTH FOR THE BEST OF THE COMMUNITY**
  - In work programmes to identify and grow local leaders will establish ambassadors in the area who can champion technologies, technique and share best practice

- **CREATE TECHNICAL, INDUSTRY FOCUSED UNIVERSITIES SUCH AS THE UNIVERSITY CENTRE PETERBOROUGH**
  - By creating a technically focused university centre you are ensuring the graduates are developed in real-world skills and have experience before entering the world of work as full competent members of staff, contributing to overall productivity and innovation in their chosen businesses

- **DELIVER INDUSTRY-LED APPRENTICESHIP QUALIFICATIONS IN IMET, FOCUSED ON THE FUTURE SECTORS**
  - Industry-led courses with a strong practical element ensure those who partake are fully skilled with placements enabling them to contribute to the sector when ready to start employment

- **DEVELOP SMART SPECIALISATION PROGRAMS WITHIN CAMBRIDGE, PETERBOROUGH AND FENLAND TO IDENTIFY THEIR INDIVIDUAL STRENGTHS**
  - By replicating the smart specialisation programmes currently available in Cambridge and surrounding areas in the north of the region you are able to provide skills training contributing to businesses productivity and growth across the whole area

- **DEVELOP LINKS IN TO CATAPULTS AND OTHER SIGNIFICANT HUBS / CITIES WITHIN LAUNCHPAD SITES**
  - Cambridgeshire and Peterborough are in close proximity to at least five Catapult centres that support businesses to innovate and commercialise products. By linking up to these networks businesses in the region can benefit from this support and community aspect

PEOPLE

The second key theme that the UK Industrial Strategy is developed around concerns people, and in particular improving the employment and earning power of the country's citizens. As a country (and in the manufacturing sector as well), we are currently facing challenges surrounding the skills and talent of the labour force.

Within Cambridgeshire and Peterborough, the challenge is no different. An often cited challenge of employers within the advanced manufacturing and materials sector is the skills gap. The difference between the cities of Cambridge and Peterborough in relation to skills is stark.

Cambridge is noted 2nd in the country for percentage of the working age population with a qualification at NVQ4 or above (58.1%) compared to Peterborough, who rank 59th in the country (25.6%). Obviously, Cambridge has a rich heritage of education, and boast one of the best universities in the world, which would (at least in part) explain the gap between the 2 cities in question. Additionally, the average weekly earnings between the two cities again differ significantly, with Peterborough ranked 51st in the country, compared to Cambridge, who lie 4th in the UK.

In line with the UK Industrial Strategy, we have identified skills as a key component in developing sector growth of Advanced Manufacturing & Materials within the region. As such, the following recommendations we have proposed align with the 'People' pillar of the UK Industrial Strategy, and will have an impact on the local economy:

- **CREATE A CAPACITY UTILISATION PROGRAM AROUND 'MAKE-IT' CLUSTERS TO MAXIMISE PRODUCTIVITY**
    - The creation of a utilisation programme concerning machinery and technologies available in the region means people will be able to develop skills on this equipment that would not be readily available at their own firm

- **FACILITATE KNOWLEDGE TRANSFER BETWEEN ORGANISATIONS**
    - By developing relationships between academic institutions and businesses you are actively encouraging the theoretic learning of staff and the practical learning of students and academics. This contributes to a well-rounded society

- **PREPARE FOR THE FUTURE WORKFORCE; DEVELOPING INDUSTRY 4.0, PRODUCTIVITY, INNOVATION, AND ENTREPRENEURIAL SKILLS**
    - It has been highlighted in research by McKinsey that the use of physical, manual and basic cognitive skills is declining whereas higher cognitive, social, emotional and technological skills usage is on the rise. In order to keep up with this demand we should be provisioning the right kind of training to the future workforce

- **GROW LOCAL LEADERS THAT WILL STAY WITHIN THE REGION TO ACCELERATE ECONOMIC GROWTH FOR THE BEST OF THE COMMUNITY**
    - By developing programmes to identify and develop potential leaders you are ensuring that the next generation of management is established and correctly skilled as well as creating ambassadors to pass the knowledge down the chain to the rest of staff

- **CREATE TECHNICAL, INDUSTRY-FOCUSED UNIVERSITIES SUCH AS THE UNIVERSITY OF PETERBOROUGH**
    - Pivoting the focus of the University Centre Peterborough creates graduates with real-world experience and prepares them with the skills they will need when they enter the workplace

- **DELIVER INDUSTRY-LED APPRENTICESHIP QUALIFICATIONS IN IMET, FOCUSED ON THE FUTURE SECTORS**
    - By upgrading iMET's syllabus to include specific industry-led qualifications you are developing sorely needed skills in the AMM industry and students are applying them in a real-world scenario

INFRASTRUCTURE

"A major upgrade to the UK's infrastructure" is the third key theme of the UK Industrial Strategy that we have aligned our recommendations to, particularly focused on improving people's lives where they work.

Having modern and accessible infrastructure is cited as a key driver for growth, according to the UK Government, and this applies to the growth of the manufacturing sector as well, in regards to developing growth corridors, incubation space for businesses, digital capabilities, and housing for growing employment areas.

Our key recommendations that align with the UK Industrial Strategy's 'Infrastructure' pillar are:

- **FORM AND BRAND 'MAKE-IT' SPACES AS PLACES TO COMMERCIALISE PRODUCTS (DESIGN, PROTOTYPE, MANUFACTURE AND SCALE UP)**
    - Make It Spaces that provide modern technologies and capabilities to AMM businesses will significantly improve the workplace and promote growth

- **MAP SKILLS/LEARNING PROVISION AND INFRASTRUCTURE TO IDENTIFY GAPS AND NEW OPPORTUNITIES**
    - The mapping of skills and learning provision and infrastructure will highlight the areas around Cambridgeshire and Peterborough that need strengthening and capacity for provision needed for the future of the AMM sector

- **DEVELOP LINKS IN TO CATAPULTS AND OTHER SIGNIFICANT HUBS / CITIES WITHIN LAUNCHPAD SITES**
    - By strengthening relationships to surrounding catapults around Cambridgeshire, the region's AMM community will benefit significantly and strengthen the knowledge transfer between businesses in the region

- **MAXIMISE GROWTH CORRIDORS TO ATTRACT INWARD INVESTMENT FROM ACROSS THE UK AND GLOBE**
    - The physical development of Growth Corridors (i.e. dualling the A47) would allow improved and simplified access between Cambridgeshire and surrounding areas

- **UTILISE EXISTING INCUBATION SPACE**
    - Existing infrastructure across the region to its full capacity, ensuring the incubation of AMM businesses through Cambridgeshire and Peterborough

- **DEVELOP NEW GROW-ON SPACE WITH SPECIFIC SUPPORT PROGRAMS WITH CONDITIONS RELATING TO INDUSTRY 4.0 AND PRODUCTIVITY**
    - Development of new incubation space should provide modern facilities that will support the growth of AMM businesses

BUSINESS ENVIRONMENT

The overall aim under this pillar of the UK Industrial Strategy is for the UK to be the best place to start and grow a business. At the moment, the UK is considered to be one of the best countries in the world to do business in, due to our competitive tax rates, and welcoming nature to disruptive start-ups and ideas.

We believe that the majority of our recommendations specifically align with the 'Business Environment' pillar of the UK Industrial Strategy, including:

- **BUILD A MANUFACTURING NETWORK ACROSS THE REGION TO CONNECT AND INFORM THE SECTOR**
    - The development of a region-wide manufacturing network would facilitate the overcoming of shared challenges and opportunities within the sector

- **DEVELOP MANUFACTURING GROUPS ACROSS CAMBRIDGESHIRE & PETERBOROUGH TO DRIVE PLACE BASED GROWTH AND COLLABORATION**
    - The development of a manufacturing groups within key market towns across the region provides a platform for local businesses to gain insights in to best practices

- **FORM AND BRAND 'MAKE-IT' SPACES AS PLACES TO COMMERCIALISE PRODUCTS (DESIGN, PROTOTYPE, MANUFACTURE AND SCALE UP)**
    - 'Make-It' Spaces would support smaller organisations by providing them with the necessary environment and tools to grow their business

- **DEVELOP MAKE-IT CLUSTERS / DISTRICTS WITH KEY LAUNCHPAD SITES AND STRATEGIC SATELLITE LOCATIONS**
    - 'Make-It' clusters and districts would again support smaller organisations, and facilitate the establishment of relationships with leaders within the sector

- **CREATE A CAPACITY UTILISATION PROGRAM AROUND 'MAKE-IT' CLUSTERS TO MAXIMISE PRODUCTIVITY**
    - The Make-It Capacity Utilisation Program would provide a platform for growing businesses and startups to be competitive

- **DEVELOP SUPPLY CHAINS IN TO CAMBRIDGESHIRE AND ACROSS THE UK**
    - Developed diverse supply chains in and around Cambridgeshire would simplify routes to market for the region's manufacturing businesses

- **FORM TECHNOLOGY GROUPS FOCUSED ON EMERGING TECHNOLOGIES TO COLLECT CRITICAL MASS**
    - The formation of technology groups across the region provides a platform for local businesses to gain insights in to best practices surrounding emerging technologies

- **DEVELOP INNOVATION PLATFORMS TO DRIVE CROSS-SECTOR INNOVATION AROUND SHARED CHALLENGES**

- Innovation platforms can aid the development of a new product, process or service, and subsequently enhance the likelihood of commercialisation

- **PROVIDE BUSINESS SUPPORT THROUGHOUT THE REGION'S KEY MAKE-IT CLUSTERS**
  - On-site business support to growing businesses in industrial estates through to science parks would enhance the survival and longevity of the sector's businesses

- **INCUBATE IDEAS AND SUPPORT BUSINESSES TO STARTUP THROUGH SPECIFIC AMM INCUBATION AND ACCELERATION PROGRAMS**
  - Providing specific, tailored support to early-stage businesses to ensure that ideas survive and develop

- **GROW EXISTING BUSINESSES THROUGH SCALE UP AND EXPANSION FUNDING AND SUPPORT JOURNEYS**
  - Supporting the growth of high-potential businesses through enterprise-led business support

- **INCREASE INNOVATION CAPACITY WITHIN THE MANUFACTURING SECTOR WITH SUPPORTED KNOWLEDGE TRANSFER AND FUNDING CALLS**
  - Networks, manufacturing groups, innovation platforms etc. will support the facilitation of innovation within the manufacturing and materials sector

- **SUPPORT DEVELOPMENT OF PRODUCTIVE BUSINESSES WITH SUPPORT TO AUTOMATE AND DIGITISE BUSINESSES WITH INDUSTRY 4.0 TECHNOLOGIES**
  - Increasing collaboration, building skills, and delivery of productivity-focused business support will drive productivity within the sector's businesses

- **SUPPORT SUSTAINABILITY IN BUSINESSES**
  - A focus on sustainability within manufacturing and materials businesses

- **INCREASE THE COMPETITIVENESS OF BUSINESSES HELPING THEM ATTRACT INWARD INVESTMENT AND TRADE OPPORTUNITIES**
  - Specific support to drive competitiveness and exporting in manufacturing

- **FACILITATE KNOWLEDGE TRANSFER BETWEEN ORGANISATIONS**
  - Knowledge transfer facilitated through the use of innovation platforms, networks, manufacturing groups, technology groups, and make-it clusters between businesses, public sector bodies, and academic institutions

- **PREPARE FOR THE FUTURE WORKFORCE; DEVELOPING INDUSTRY 4.0, PRODUCTIVITY, INNOVATION, AND ENTREPRENEURIAL SKILLS**
  - Addressing the skills issue in manufacturing will ensure the competitiveness of the UK's (and Cambridgeshire's) advanced manufacturing and materials sector

- **GROW LOCAL LEADERS THAT WILL STAY WITHIN THE REGION TO ACCELERATE ECONOMIC GROWTH FOR THE BEST OF THE COMMUNITY**
  - Local leaders in manufacturing would help provide strategic direction and vision for the advanced manufacturing and materials sector in Cambridgeshire and Peterborough

- **DELIVER INDUSTRY-LED APPRENTICESHIP QUALIFICATIONS IN IMET, FOCUSED ON THE FUTURE SECTORS**
  - Delivering degree apprenticeships would provide students with real-world experience within the sector

- **MAP SKILLS/LEARNING PROVISION AND INFRASTRUCTURE TO IDENTIFY GAPS AND NEW OPPORTUNITIES**
  - Instilling STEM and links between businesses and academic institutions

- **DEVELOP SMART SPECIALISATION PROGRAMS WITHIN CAMBRIDGE, PETERBOROUGH AND FENLAND TO IDENTIFY THEIR INDIVIDUAL STRENGTHS**
  - Mapping assets, capabilities, challenges and opportunities within Peterborough and Fenland

- **DEVELOP LINKS IN TO CATAPULTS AND OTHER SIGNIFICANT HUBS / CITIES WITHIN LAUNCHPAD SITES**
  - Establishing links with Catapult Centres across the country will help to establish the region's business environment

- **MAXIMISE GROWTH CORRIDORS TO ATTRACT INWARD INVESTMENT FROM ACROSS THE UK AND GLOBE**
  - Growth corridors are a key asset in the business environment, and the development of Cambridgeshire's corridors are important in establishing competitiveness of the sector in the region

- **UTILISE EXISTING INCUBATION SPACE**
    - Linking to the recommendation to provide business support throughout physical incubation spaces in Cambridgeshire

- **DEVELOP NEW GROW-ON SPACE WITH SPECIFIC SUPPORT PROGRAMS WITH CONDITIONS RELATING TO INDUSTRY 4.0 AND PRODUCTIVITY**
    - Linking to the recommendation to provide business support throughout physical incubation spaces in Cambridgeshire

PLACES

The final pillar of the UK Industrial Strategy is based around the aim of having prosperous communities throughout the country, and maximising our cities comparative advantages. The Industrial Strategy recognises that economic growth is based around places, and strong local economies have key attributes including a skilled labour force, good infrastructure and connections, rich innovation ecosystems, academia, and land for commercial and residential property.

Our recommendations for the Advanced Manufacturing and Materials Growth Strategy that align with the 'Places' them of the Industrial Strategy are as follows:

- **BUILD A MANUFACTURING NETWORK ACROSS THE REGION TO CONNECT AND INFORM THE SECTOR**
    - The development of a region-wide AMM network would result in the showcasing of the region's comparative advantage within the sector

- **DEVELOP MANUFACTURING GROUPS ACROSS CAMBRIDGESHIRE & PETERBOROUGH TO DRIVE PLACE BASED GROWTH AND COLLABORATION**
    - Manufacturing Groups across the region will highlight the USP's and strengths in manufacturing within the individual districts of the region i.e. Fenland, Huntingdonshire etc.

- **FORM AND BRAND 'MAKE-IT' SPACES AS PLACES TO COMMERCIALISE PRODUCTS (DESIGN, PROTOTYPE, MANUFACTURE AND SCALE UP)**
    - The formation of 'make-it' spaces in commercial areas around the region will allow machinery/technologies to be utilised by a wider range of businesses in the area, therefore strengthening the sector

- **DEVELOP MAKE-IT CLUSTERS / DISTRICTS WITH KEY LAUNCHPAD SITES AND STRATEGIC SATELLITE LOCATIONS**
    - The development of make-it clusters/districts will again highlight the strengths and capabilities that individual towns and districts have to offer, collectively enhancing the comparative advantage for the region as a whole

- **CREATE A CAPACITY UTILISATION PROGRAM AROUND 'MAKE-IT' CLUSTERS TO MAXIMISE PRODUCTIVITY**
    - The capacity utilisation program will ensure that all manufacturing businesses in Cambridgeshire and Peterborough have access to the tools and infrastructure they need in order to be successful and ultimately grow their business

- **DEVELOP SUPPLY CHAINS IN TO CAMBRIDGESHIRE AND ACROSS THE UK**
    - Strengthening of supply chains within the region builds a comparative advantage for the sector

- **FORM TECHNOLOGY GROUPS FOCUSED ON EMERGING TECHNOLOGIES TO COLLECT CRITICAL MASS**
    - In addition to creating a platform for the sharing of best practice between AMM companies across the region, technology groups would also act as a demonstrator for the sector strengths and highlight what the region is at the forefront of

- **DEVELOP INNOVATION PLATFORMS TO DRIVE CROSS-SECTOR INNOVATION AROUND SHARED CHALLENGES**
    - Innovation platforms bringing together world-class academia, researchers, and businesses will ensure the development of new products, processes and services to address regional, national, and global challenges

- **PROVIDE BUSINESS SUPPORT THROUGHOUT THE REGION'S KEY MAKE-IT CLUSTERS**
    - Support throughout business parks, industrial estates and incubators will strengthen what the region has to offer and will ensure it is an attractive place to base your business

- **GROW LOCAL LEADERS THAT WILL STAY WITHIN THE REGION TO ACCELERATE ECONOMIC GROWTH FOR THE BEST OF THE COMMUNITY**
    - The development of local leaders will provide a clear vision for AMM in Cambridgeshire and Peterborough, ensuring that the region's comparative advantages are maximised and continue to grow

- **MAP SKILLS/LEARNING PROVISION AND INFRASTRUCTURE TO IDENTIFY GAPS AND NEW OPPORTUNITIES**
    - The mapping of skills and learning provision and infrastructure will highlight the areas around Cambridgeshire and Peterborough that need strengthening and capacity for provision needed for the future of the AMM sector

- **DEVELOP SMART SPECIALISATION PROGRAMS WITHIN CAMBRIDGE, PETERBOROUGH AND FENLAND TO IDENTIFY THEIR INDIVIDUAL STRENGTHS**
    - By replicating the smart specialisation programmes currently available in Cambridge and surrounding areas in the north of the region you are able to provide skills training contributing to businesses productivity and growth across the whole area

- **DEVELOP LINKS IN TO CATAPULTS AND OTHER SIGNIFICANT HUBS / CITIES WITHIN LAUNCHPAD SITES**
    - By strengthening relationships to surrounding catapults around Cambridgeshire, the region's AMM community will benefit significantly and strengthen the knowledge transfer between businesses in the region

- **MAXIMISE GROWTH CORRIDORS TO ATTRACT INWARD INVESTMENT FROM ACROSS THE UK AND GLOBE**
    - Growth corridors are a key enabler of economic growth, and the development of those around Cambridgeshire and Peterborough will lead to enhanced connectivity to other regions of the UK, and therefore developing communities and specific strengths with each identified

- **UTILISE EXISTING INCUBATION SPACE**
    - Maximising the capacity and capability of existing infrastructure within the region will provide an attractive place for businesses to incubate and grow in

- **DEVELOP NEW GROW-ON SPACE WITH SPECIFIC SUPPORT PROGRAMS WITH CONDITIONS RELATING TO INDUSTRY 4.0 AND PRODUCTIVITY**
    - The development of new incubation space throughout the region (such as sector-focused incubators) will develop clusters, providing comparative advantage within the sectors

STRATEGIC ALIGNMENT

UK INDUSTRIAL STRATEGY

The UK Industrial strategy was first announced in 2017 as an initiative to boost productivity in the UK by encouraging businesses to grow, develop skills and increase the earning power of those working in the UK. This is all to be achieved through a series of sector deals, each with details of investment in skills, industries and infrastructure. Split into two main parts the Industrial Strategy focuses on the Grand Challenges that, if supported, will propel the UK economy to the forefront of those fields and the five foundations of productivity. Each section lists the challenges being faced in the UK currently, goals for the future and how the government are planning on supporting UK industry to achieve these. By aligning our key recommendations to these we believe that it will improve the overall economic growth of Cambridgeshire and Peterborough's Advanced Manufacturing and Materials sector.

THE GRAND CHALLENGES:

The UK Industrial Strategy has identified four Grand Challenges, focused on global trends, that should be focused on to push the UK to the forefront of these industries. These Grand Challenges are:

- Artificial Intelligence (AI) and data
- Ageing society
- Clean growth
- Future of mobility

All four of these challenges have a strong affiliation to the AMM sector both in the sense of development of solutions or the use of technology. AI and big data are transforming the manufacturing sector with the continuation of the fourth industrial revolution and there will be no solutions to any of the four Grand Challenges without innovation from the AMM sector. Each challenge has at least one mission statement that has been developed alongside it to have a measurable unit of success. The AMM sector across the UK should have an integral role in these:

- AI and Data: Use data, AI and innovation to transform the prevention, early diagnosis and treatment of disease by 2030
- Ageing society: Ensure that people can enjoy at least 5 extra, healthy, independent years of life by 2035
- Clean growth: At least half the energy use of new buildings by 2030
- Clean growth: Establish the world's first net-zero carbon industrial cluster by 2040 and at least one low-carbon cluster by 2030
- Future of mobility: Put the UK at the forefront of the design and manufacturing of zero emission vehicles with all new cars and vans effectively zero emission by 2040

The importance of aligning any strategy for the Cambridgeshire and Peterborough area to the UK Industrial Strategy is tremendous. Not only because the solving of these Grand Challenges is important to the growth of the UK economy and quality of life, but also because the UK government are allocating funding streams available to businesses who are willing to work towards these Grand Challenges. By aligning with these you are able to encourage the AMM businesses in the area to apply their skills to particular, important challenges and potentially secure funding allowing individuals and businesses to improve their work, develop their skill base and contribute to a more productive economy in the area.

THE FIVE FOUNDATIONS FOR A TRANSFORMED ECONOMY:

In 2016 the Office for National Statistics revealed data that proved the UK's productivity slump. With the UK at the bottom of the league tables for productivity when compared to its G7 counterparts, percentage growth in manufacturing falling by a fifth and the average British worker producing 16% less than others in the G7 economic group the UK Industrial Strategy white paper outlined the 5 foundations for productivity and their ambition statements. These are:

- **Ideas:** The world's most innovative economy
- **People:** Good jobs and greater earning power for all
- **Infrastructure:** A major upgrade to the UK's infrastructure
- **Business Environment:** The best place to start and grow a business
- **Places:** Prosperous communities across the UK

Though the recommendations listed in this strategy all align to the overall goal of working towards solving the Grand Challenges, it is most important that they align with the five foundations of productivity to ensure the growth of a prosperous and productive AMM sector in Cambridge and Peterborough.

Ideas:

In the Industrial strategy white paper, the government pointed out the need to invest more in research and development to ensure the continuation and improvement of Britain's innovative economy. Cambridge is one of the most innovative cities in the whole of the UK with 316 patents per 100,000 people, the highest ratio in the UK according to research by the MPA Group. This put Cambridge at three times as many patent filings as the second closest city in 2017. Our recommendation of the creation and branding of Make-It clusters aims to align to this goal of creating a more innovative economy. These Make-It labs are flexible spaces that allow the transformation of innovation from start-up commercialisation. With flexible, rented lab, office and workshop space you are creating the opportunity for those who may not have the funded to rent out their own building to create and grow their businesses, and by extension the economy. The overall goal being to create innovative products that allow the business to move out and scale up. The key recommendation of preparing for the future workforce and developing skills also ties into the Ideas foundation. Without allowing and encouraging current and future employees of the AMM sector to develop skills that will allow them to work a fourth industrial revolution environment you cannot expect to grow a more innovative economy. Feeding into the development of skills and investment in innovation during the fourth industrial revolution is the creation of digital clusters and communities. As stated previously, the addition of digital technologies such as AI is become more significant in AMM sectors. By creating digital clusters, you are allowing the easy access to technologies and skill development to employees in the sector. Collaboration is key to innovation so by creating clusters of like-minded individuals you are encouraging partnerships of businesses in the region.

People:

Although the UK employment rate is at an all-time high the UK government have identified the insufficient attention given to education in the STEM subjects (Science, Technology, Engineering and Mathematics) in the past. Currently the STEM skills gap costs UK industry £1.5 billion per year, according to findings from STEM Learning in 2018. Cambridgeshire and Peterborough contain the top UK University to offer STEM subjects according to employers and this should be taken advantage of. The Industrial Strategy also focuses on the development of skills in those already employed in order to ensure that as the economy adapts to include more technology in traditional employment, staff can continue their skills development to keep up. Recommendations, including the creation of Make It clusters and preparing the future workforce through the development of key skills programmes, align to this growth in STEM skills across Cambridge and Peterborough. But, in order to develop the region's skill set, it is first important to carry out the recommendation of mapping the region's skills / learning provision and infrastructure. By attaining the knowledge of what skills provisioning you have and where they are, it is then possible to start improving and promoting these to those in education and the already employed.

Infrastructure:

The UK Industrial Strategy white paper disclosed that in order to support improvements in productivity there must be a major improvement with intercity travel and road networks. In 2017 Cambridge was voted one of the worst cities to travel from and within in a survey by the ESP Group. There is a need to improve both road and rail connections from Cambridgeshire and Peterborough into adjacent counties as well as between towns within the region. There are huge opportunities in doing so including the recommendations of the development of supply chains and the creation of digital communities/growth corridors. The Cambridge Norwich Technology Corridor, Cambridge-Milton Keynes – Oxford Arc and the Cambridge London Corridor all supply plentiful opportunity for collaboration and connection across the East of England for businesses in the advanced engineering and manufacturing sector. By adhering to the recommendations of utilising existing and building new incubation space in these areas you are further encouraging connectivity, as well as giving businesses the opportunity to start and scale up in the region. Another point that should be mentioned is that infrastructure doesn't just mean roads and rail, it also includes digital connectivity. The UK government are proposing the Britain should live on the digital frontier and that by providing full-fibre broad band and 5G connectivity we can boost the economy's productivity. Cambridgeshire and Peterborough have strong 4G signals in the cities and towns but poor in rural areas where there is more likely to be space for businesses to grow. Taking advantage of these spaces and providing 4G, or even 5G, networks may help to encourage the formation of AMM clusters, as in recommended in this strategy.

Business Environment:

According to the UK Industrial Strategy a new business starts in Britain every 75 seconds and we are home to five of the top 10 fastest-growing businesses in Europe. However, the UK's managers are, on average, less proficient than others in Europe so the challenge here is how to spread our best practice, as well as continuing to support the start-up and scale up of our smaller companies. The Industrial Strategy white paper has revealed the government's intention of doing this by driving collaboration, building skills and ensuring everyone has the

opportunity of high paid work. We believe that recommendation the recommendation of grow local leaders through work programmes, aligns to the prospect of sharing best practice among the managers in Cambridgeshire and Peterborough's AMM sector. This also encourages the collaboration of leaders and developing supply chains. We have also included the recommendations of developing a network and manufacturing groups here as the development of a region-wide network and more local manufacturing groups encourages the share of best practice, contributing to the region's productivity. The recommendations of growing current businesses and encouraging start-ups both contribute to the idea of the UK being the place to be for a business. By putting in place the structures and funding to allow businesses to start and scale up it creates a business environment with a reputation that will encourage more people from across the UK, and even internationally, to start or move their AMM business to the Cambridgeshire and Peterborough region.

Places:

The UK has greater disparities in regional productivity than any other European country. This is seen in Cambridgeshire and Peterborough with the prosperous city of Cambridge, compared to Peterborough which in 2016 was named in the top 30 poorest cities of the UK. It is important to address this disparity and aim to develop a strong local ecosystem providing skilled jobs and opportunities across the region, rather than just in the university city of Cambridge. By utilising current incubation space and building new incubators, as well as a digital community and Make-It clusters (all recommendations in this strategy) across the region, specifically in the north you can encourage the levelling of productivity across the board.

AUTODESK: THE MANUFACTURING MANIFESTO

The Autodesk Manufacturing Manifesto ('Enabling the art of the impossible- How Britain can lead the 4th industrial revolution') was developed in partnership with industry in positive response to, and to compliment, the Industrial Strategy white paper and the Made Smarter Review. It focuses on the benefits of digitisation in the manufacturing industry, the impact it can make and how it can be achieved. Where the UK Industrial strategy does not focus on any particular sector, the Autodesk Manifesto takes the principle of digitisation and applies it solely to the engineering and manufacturing sector, this is why we chose to use this manifesto our strategy to.

THE CORE PRINCIPLES:

The Autodesk Manifesto suggests two core principles in order to develop a sustainable strategy for UK manufacturing. These are:

- Thinking beyond productivity
- Embracing design and manufacturing as a single, connected discipline

Thinking Beyond Productivity:

The Autodesk Manifesto suggests that isolating the goal of increasing productivity sends the wrong message. The message that higher volume, lower cost mass production and automation are the only routes of economic growth. Here they suggest instead that the market is moving towards smarter, personalised products and the engineering and manufacturing companies should be preparing for that transition by collaboration and hybrid techniques. This is where our recommendations align. The development of a manufacturing network across the region allows for updates on potential jobs and collaborations to get as far a reach as possible; where manufacturing groups and Make-It clusters allow the sharing of best practice and space to create these personalise products for clients. This balances the focus between productivity with new opportunities and value. By collaboration it is possible to make the process of creating a product much smoother, contributing to overall economic growth in a bigger way than just individual productivity.

Reports by Hennik Research shows that of the 62% of manufacturers planning to undertake the move to 'Industry 4.0' only 23% were actively doing something about it. Through the formation of manufacturing groups and a network Cambridgeshire and Peterborough Combines Authority would be able to encourage greater uptake of digital technologies in the AMM sector through the encouragement of others in the region who have already done so.

Embracing Design and Manufacturing as a Single, Connected Discipline:

"The engineers of tomorrow will create digital threads that seamlessly connect how products are designed, made and sold, and there will be no separate design and manufacturing thinking'. This passage, from the Autodesk

Manifesto aligns to our several recommendations in our strategy. Assessing the areas capability for digital space and the creation of digital clusters brings together those from the advanced manufacturing and engineering sectors with those in the creative sectors; particularly those with skills in artificial intelligence, virtual and augmented reality. This coming together of digital creatives and advance manufacturers allows cross-sector collaboration to propel the engineering and manufacturing sector into the fourth industrial revolution. In the 2017 Tech Nation report it was stated that the city of Cambridge was joint third of cities with the most digital tech companies, with an average of 335 start-ups each year in the sector and is home to Europe's largest technology cluster with 1,500 businesses. By monopolising on this opportunity, building digital space for advanced manufacturers and engineers and encouraging the partnership of the two disciplines, not just in Cambridge city but across the region, will see the development of new productive business, products and services.

THE RECOMMENDATIONS:

Breaking these core principles down further, the Autodesk Manifesto suggests four key recommendations that would support them and benefit both the manufacturing and the design sectors by bringing them together and driving collaboration between the two:

- Developing home grown leadership
- Enabling full spectrum innovation
- Simplifying the skills issue
- Connecting everyone

Developing Home Grown Leadership:

The Autodesk Manifesto states that the UK needs new design and manufacturing role models for both current industry professionals and to encourage those still in education to pursue careers in STEM subjects like engineering and manufacturing. They also say that though the £406 million investment from government to address the national shortage in STEM skills is a first step, there also needs to be intervention from industry leaders. This is where recommendations seven and eight from this strategy align to the Autodesk Manifesto. By preparing for the future workforce and developing skills in both current employees and those still in education we can prepare then for the fourth industrial revolution and the inclusion of digital and design into the advanced engineering and manufacturing sector. This can be underpinned by growing local leaders, identifying digital champions already present in the Cambridgeshire and Peterborough Combined Authority area who could be utilised within manufacturing groups to share best practice or even set up training.

Enabling Full Spectrum Innovation

Autodesk suggest, in their manifesto, that there is too much focus on early stage research and development and that there needs to be a balance between R&D all the way through to commercialisation of innovative products. This is why our recommendation to grow existing businesses in the Cambridgeshire and Peterborough area, is important. It is always good to encourage start-ups and provide them with adequate funding and support but whilst we are transitioning into the digital age of the advanced manufacturing and engineering era it is important to also support and grow those businesses already existing to ensure they are not left behind. The recommendations to grow a manufacturing network comprising of smaller, local groups are integral to this, by providing networks and manufacturing groups it enables the support of these current manufacturing businesses in the region.

They also mention that despite the funding focused on start-ups and new innovations, SMEs are struggling to engage with current business support organisations, and many want to see a balance of practical business support and long-term R&D. They also say that SMEs are unlikely to be aware of the Tax Credit Scheme as it is poorly utilised by these small to medium businesses. This is something to consider when taking into account the recommendation of supporting start-ups.

Simplifying the Skills Issue:

As stated in the UK Industrial Strategy, employers need staff who are equipped with STEM and digital skills to take them into Industry 4.0. This is especially true in engineering and manufacturing businesses. The Autodesk Manifesto agrees that it is important to be encouraging our students to pursue STEM jobs but also admits that the current workforce in the sector was training to solve 'yesterday's problems'. Autodesk say that Britain much equip its workforce with a broader range of skills including design thinking, digital skills, social platforms and coding. Using the recommendation to map skills provisioning and technology road mapping the Cambridge and Peterborough Combined Authority would be able to map the learning provisions already available in the region, allowing them to promote those already existing and developing new skills arrangements where there are identified gaps.

Connecting Everyone:

Where the Industrial strategy describes plans for both traditional and digital infrastructure, the Autodesk Manifesto focuses sole on digital infrastructure stating that this is what leads to innovation, productivity and economic reward. Our strategy agrees and recommendations align with this notion. The digital capability and capacity, both of space and high-speed internet, should be assessed within the Cambridge and Peterborough area to ensure that companies are getting the highest quality connection possible to encourage collaboration, innovation and the adoption of digital technologies that rely on such a connection.

THE GREAT REMAKE: MANUFACTURING FOR MODERN TIMES

McKinsey's The Great Remake, though not a strategy, was brought out in 2017 as a piece on the current state of manufacturing and engineering. It sets out to challenge, intrigue and support those in the sector by embracing new standards and technologies by building on the foundational elements that are present in many of Cambridgeshire and Peterborough's AMM businesses today and have been since Toyota and Ford developed their legendary technologies and ways of working. Viewing this piece of work as a national strategy works well, there are pieces on how to improve productivity whilst still staying true to the fundamentals as well as leadership, network optimisation and the workforce of the future which compliment the recommendations set out in this strategy well. The Great Remake is split into three sections:

- Modern Times
- Modern Vision
- Modern Practices

Each focus on a different part of the journey to advance manufacturing and engineering and Industry 4.0.

Modern Times:

In this first stage, The Great Remake explores the changing landscape of manufacturing across sectors. The need to understand demand — and how, where, and when to produce —has become even more critical. As digital capabilities become more attainable and understandable, the adoption of these technologies will drive levels of competitiveness and enable faster and more agile production systems. Recommendations eleven and twelve, assessing digital capabilities and creating digital clusters, will assist in the adoption of innovative technologies leading to innovative products and services. This is key to increasing productivity through both competitiveness and collaboration. In order to make the most of the new digital technologies available for integration into manufacturing and engineering companies it is important to ensure those going in to work, and those already in work, are prepared with the skills they need to operate and utilise them. The recommendation of mapping the skills and learning provisions already available in the region is key to this; you can ensure the right people are being taught the right things. However, the basics of operational excellence will remain the foundation of an organisation's transformation and journey into the future.

Modern Vision:

In this next stage, The Great Remake dives deep into specific topics that they think are important for companies to consider. Some are technical concepts, such as advanced manufacturing, network optimisation, and advanced analytics, while others focus on crucial mind-sets and behaviours, such as leadership and the workforce of the future. Our recommendations of developing a manufacturing network, manufacturing groups and growing local leaders echo these topics. By having talented adopters in leadership positions and giving them access to other businesses in the region through networks and regular groups you are ensuring that digital knowledge is being passed down the chain and not secluded to a few visionaries. They also delve into the fact that for organisations to remain competitive, they must think about the value chain from beginning to end, through all aspects of production. Our recommendation of developing supply chains both throughout the region and further afield in this strategy reflects this as it serves a purpose both by keeping supply chains British, lowering costs, and encouraging collaboration throughout.

Modern Practices:

With all the concepts and theory for leaders to think about, it is often daunting to think about the actions necessary to make change happen. Trying to make everything happen at once can often lead to failure, while going too slow wastes an impossible-to-replace competitive advantage. In this stage, The Great Remake addresses some of the tactical steps needed to steer an organisation on the right path forward. We suggest this in order to ensure AMM businesses are to grow and become more productive, innovative and competitive. This can be

achieved through the combination of multiple recommendations in this strategy but specifically the recommendation of preparing for the future workforce and developing skills. It is important to balance focus between the current generation of AMM staff, as well as giving suitable training, such as the new T Levels, to those still in education pursuing a career in this sector.

INNOVATE UK: DELIVERY PLAN 2017-2018

In December 2017 Innovate UK released their delivery plan for the next year. Innovate UK is the portion of the UK government who provide funding to develop new products, processes and services. They are the group who oversee the Industrial Strategy Challenge Fund. The strategy is split into four focus sectors:

- Emerging and Enabling Technologies
- Health and Life Sciences
- Infrastructure Systems
- Manufacturing and Materials

The AMM sector will play a role in the development and continuation of all four of these sectors both in the supply and usage of the products that will be used in the future of these areas. However, here we are going to focus on Innovate UK's five-point plan, five goals that support their sector-based approach.

1. Turn scientific excellence into economic impact and deliver results through innovation, in collaboration with the research community and government

By following through on the recommendations in the strategy such as the creation and branding of Make It clusters and the formation of technology groups and innovation platforms across the region of Cambridge and Peterborough you can be sure of aligning to Innovate UK's five-point plan. The formation of these groups and clusters encourage the early adoption of technologies, as with as the creation of new ones that can be commercialised. Cambridge city also boasts the best STEM university in the country that can be used as a point of collaboration for businesses across the region in order to commercialise research that may otherwise stay within the university or in research papers.

2. Accelerate UK economic growth by nurturing high-growth potential SMEs in key market sectors, helping them become high-growth, mid-sized companies with strong productivity and export success

The second point in Innovate UK's plan aligns strongly to our recommendations of giving tailored support to SMEs, especially those starting up or scaling up. By providing training in productivity, innovation, sustainability, competitiveness and innovation you can safeguard smaller company's success rates, creating mid-size AMM businesses and clusters throughout Cambridgeshire and Peterborough. In order to establish export success, it is also important to follow the recommendation of creating solid supply chains throughout the region and into the wider UK.

3. Build innovation excellence through the UK, investing locally in areas of strength

Establishing Cambridgeshire and Peterborough as an area of strength in the AMM sector could open the possibility of funding through streams such as the Industrial Challenge fund. But to first do this it is important to fulfil the recommendations given in this strategy. By building a region-wide AMM cluster through manufacturing groups, a network and Make It clusters providing support, innovation and technology platforms you can establish this area in the East of England as a local area of strength. Therefore, bringing in funding and encouraging AMM businesses to start or scale up in the area. This will contribute to competitiveness and collaboration in the area, bringing in an overall growth in economic value, something that is especially important in the north of the region.

4. Develop Catapult centres within the UK's national innovation network to provide access to cutting edge technologies, encourage inward investment and enable technical advances in existing businesses

Innovate UK have seven well establish Catapult centres with three more in development across the UK currently. Though there are none in Cambridgeshire and Peterborough itself there are several within the London and Milton Keynes area, connected by the Cambridge – London – Milton Keynes Arc. These are:

- Future Cities, London

- Cell and Gene Therapy, London and Stevenage
- Digital, London
- Transport Systems, Milton Keynes

We have recommended in this strategy that spatial and site development should be focused on the areas that link to Catapults and growth corridors, when considering this it is important to bear in mind where specialities lie in the areas that are connected to the region already, such as this Arc containing four Catapult centres already. By aligning to these specialities within the AMM sector you are increasing your chance of collaboration with these centres and therefore, potential innovation and funding.

5. Find new ways to ensure the businesses we work with get the right kind of funding at the right time and help public money work harder

The final point of Innovate UK's five-point plan focuses on getting the right kind of funding to businesses in the UK at the right time. This recommendations in this strategy aligns to this by suggesting smart specialisation, specifically in the north of the region and the Fenlands and creating inward investment opportunities and programmes by bringing together industry and lifestyle. The benefits of inward investment are huge, including employment opportunities, diversification of local economies, improved R&D and productivity. Inward investment provides an opportunity for economic growth.

MAKE UK: HOW 4IR WILL TRANSFORMM MANUFACTURING PRODUCTIVITY

In 2018 the Manufacturer's organisation, MAKE UK, produced a strategy on the fourth industrial revolution (4IR) and how it will affect productivity in the manufacturing sector. They describe 4I as being all about connectivity using the industrial Internet of Things, Big Data and secure digital infrastructure to support it all. They have split the process of transforming a company to adopt 4IR technologies, the percentages indicate the number of companies currently at each stage with the research was conducted:

- Pre-conception (30%)- Doing nothing on 4IR
- Conception (27%)- Deciding how 4IR could be implemented
- Evolution (39%)- Current business practice optimised with technology
- Revolution (4%)- Changing how value is derived within the business

MAKE UK state that the transition to 4IR technology is so important due to the fact that it will reshape and transform processes, allowing an increase in productivity. 44% of firms surveyed agrees that productivity would be better if they were innovative in their use of technology. Common barriers identified in the adoption of 4IR technologies include lack of finance to invest, not understanding how the technologies could help and lack of skills within the business for implementation. This is where the key recommendations in this strategy for Cambridgeshire and Peterborough's AMM align. The development of digital clusters, technology road mapping and the formation of technology groups focused on emerging technologies will support the adoption of 4IR technologies, combatting the issue of companies not knowing how these technologies could benefit them. The identification of local leaders and early adopters in the area would also allow the combines authority to put in place key skill supply chains, using those who are already aware of 4IR technology benefits in the AMM sector to be put in contact with those who are yet to learn. The recommendation of promoting University Centre Peterborough as providing courses with a technical focus through apprenticeship degrees would also be beneficial; both for the student to learn and also for the companies working with them as students may be able to bring in knowledge on these new technologies that businesses may not be aware of yet.

EAST OF ENGLAND SCIENCE AND INNOVATION AUDIT

The East of England Science Innovation Audit (SIA) was produced in 2017 alongside other SIA's for other regions across the UK to both showcase the region's science capabilities and demonstrate the area that we could develop further and improve on. The white paper was written in collaboration with the four local LEP's (New Anglia, Greater Cambridge Greater Peterborough, Hertfordshire and South East) as well as representatives from Stevenage Bioscience Catalyst, Rothamstead Research, BT Technology and TWI ltd. The SIA focuses on four sectors, representative of the strengths we hold in the region, these are:

- Life Sciences
- Agri-tech
- Advanced Materials and Manufacturing
- ICT

In the East of England SIA summary, two overarching challenges were identified and then examined rigorously by the steering committee. These were collaboration and commercialisation. These were them translated into the four main gaps in view to the East of England's future evolution, not just it's current form. These are:

- Unlocking Investment in the process of convergence
- Providing skills- particularly relating to data
- Enabling co-location and clustering
- Increasing connectivity

Using these four gaps with the particular view of the Advanced Manufacturing and Materials sector in the Cambridgeshire and Peterborough region we have aligned our recommendations to correlate with these gaps.

Unlocking investment in the process of convergence:

When it comes to commercialisation, investment is key. The city of Cambridge is lucky enough to attract a wide range of private and public investment, especially in early stage research and development. The main gap identified in this SIA was the fact that technologies such as those that deal with Big Data, machine learning and connected medical devices do not necessarily generate intellectual property in a way that can be protected, due to the connective and collaborative nature. This creates uncertainty and risk, especially in investors who may have limited knowledge of these technologies and are sector specialists. By adhering to our recommendations of creating an AMM network and digital clusters, in combination with skills training, you may be able to close the skills gap, not just in AMM staff but also in individuals or public bodies involved in the funding of these technologies. This tactic of involving everyone along the commercialisation process also increases the chances of new start-ups and scale ups moving to the area, if investment is available you are more likely to attract those who need it.

Providing skills- particularly relating to data:

The skills shortage is something that is mentioned often in the East of England SIA, across all four focus sectors but is especially important in the AMM sector. One consultee from the AMM theme was quoted as saying "What are the most valuable skills going forward? Software skills, data management skills, automation skills, robotics, AI, machine learning." The SIA states that without sufficient people who are educated in computer sciences innovation will falter and productivity will continue to stall. This is why aligning our strategic recommendations to this is important. By closing the skills gap by providing tailored support, manufacturing groups to share best practice, growing local leaders to provide examples to other businesses in the area and establishing the University Centre Peterborough as a provider of skills-based degrees you can ensure that Cambridge and Peterborough stay ahead of the skills curve and can provide highly skills graduates and staff to the AMM sector.

Enabling co-location and clustering:

The East of England SIA identified the benefit to innovation capacity from co-location and clustering. They state that the traditional 'silo' way of working should be broken down in order for knowledge to be generated and shared to create an open innovation environment They also identify that physical clustering of businesses and research is not always available, something that is particularly true in and around Cambridge, where space is limited and at a premium. This strategy aligns with the recommendation of both physical and digital clustering by the development of networks, physical clustering (such as the Make It and digital clusters) and the establishment of growth corridors in and around the area. These clusters encourage both innovation and collaboration and when combined with the establishment of investors in the area will result in the commercialisation of AMM products from the Cambridgeshire and Peterborough region.

Increasing Connectivity:

As in the majority of strategies that we have analysed in order to create a well-rounded AMM strategy for Cambridgeshire and Peterborough the notion of a better-connected world, both in terms of physical and digital infrastructure, appears again in the SIA. This white paper focuses on the development of Big Data and how the amount of data being generated needs to be captured, stored analysed and used and our digital infrastructure will have to reflect this. This strategy for AMM in Cambridgeshire and Peterborough aligns with this section by recommending the formation of digital clusters and provisioning training from sector leaders in the involvement of these technologies in AMM businesses, from start and scale ups to established businesses in the area. The formation of growth corridors in and around the area will contribute to the physical connectivity of the area to surrounding cities and it is important the digital infrastructure is kept in a good condition to allow the collaboration of businesses and academic/research institutes along these routes.

WORLD MODELS

REPLICATING WORLD MODELS TO DRIVE IMPACT

The UK is the world's eighth largest manufacturer, according to MAKE UK, having previously been positioned the largest for the 19th and most of the 20th century. Revolutionary manufacturing models deployed around the world have allowed international competitors to grow at an increased rate and become increasingly competitive on the world stage.

Cambridgeshire and Peterborough are positioned well to benefit from the knowledge infrastructure that exists and can allow a smoother transition when replicating leading world models.

GERMANY: COMPETING THROUGH QUALITY

What has happened?

German manufacturing has grown consistently from the turn of the decade and is now positioned as the fourth largest manufacturing nation in the world, and the largest in Europe. Renowned for its high-quality manufacturing capabilities, Germany has a proven track record of strategic investment in education and research and development, allowing the nation to compete on quality, rather than cost.

Built upon a strong foundation of its successful automotive sector, featuring the likes of Audi, Mercedes Benz and BMW, its OEMs have been able to position themselves based on quality, innovation and performance.

Following the Mittelstand mindset, mid-sized German businesses position themselves as a leader in their markets, regardless of the niche they target. Recent investment in the fundamentals of manufacturing have allowed Germany to sustain its position of high-quality market leaders, but with other nations beginning to invest in high value manufacturing capabilities and research, conditions could change quickly.

What are the key fundamentals of German manufacturing?

The success of Germany's manufacturing sector has been built upon four fundamental components:

1. **Understanding Labour:** Employees seek responsibility and empowering opportunities. Provide upskilling wherever relevant in the organisation.

2. **Research Raw Materials:** Develop a strong supply chain built upon the foundations of high-quality raw materials which will not cause issues

3. **Capital Investment in Equipment:** The process is only as effective as the equipment being used. Quality output is driven from robust processes.

4. **Strong Government Support:** Allow manufacturers a clear path to the government, providing businesses with a voice for change and support

How has Germany driven growth in its manufacturing sector?

Germany's manufacturing sector is expected to continue its position as a market leader of high-quality goods, rather than compete on price. This has been achieved through the combination of three key unique institutions.

- **Mittelstand:** Developing the niche of Germany's middle-sized businesses
- **Fraunhofer-Gesellscahft:** Linking research to industry
- **Dual VET:** Vocational training for young workers

Mittelstand: The engine room of the German economy

The Mittelstand is defined as a business with less than 500 employees and a turnover less than €50million It represents over 99% of all German businesses and is responsible for the employment of over 60% of the labour workforce. Through its ability to develop a niche with a focus on high quality, Mittelstand businesses have been able to contribute to 68% of the country's exports.

The Mittelstand allows SMEs to develop the ability to find a niche and focus its performance to drive it to become a market leader, encourage the longevity of the business and access funding whenever available:

1. **Find a speciality, and work to become the world leader of it:** Sennheiser, a German sound equipment company founded in 1945 has focused all its efforts to create the highest quality products in the market.

2. **Develop family ties, keep relatives input close in decision-making:** Family members allow a different perspective of the business

3. **Retain a family atmosphere across the organisation:** Labour turnover is less than 3% per year in Germany, with approximately 3 out of 4 workers feeling their ideas are valued.

4. **Develop the skills of the worker:** The Mittelstand encourages apprenticeships and develop through work opportunities.

5. **Success doesn't come easy:** Maintain the focus of the business and do not feel the pressure of selling a stake to raise finances

6. **Look for funding at all times:** German Mittelstand businesses always seek funding to develop its niche and competitive capabilities, and possess some of the lowest debt ratios in the world,

Fraunhofer-Gesellschaft: Linking research to industry

The Fraunhofer-Gesellschaft, or Research Institute, builds on the successes of the Mittelstand and provides opportunities for industry to access leading research across Germany. This bridges the divide, experienced in other countries, of researchers having a market-ready project but no relevant contact to work with; creating immediate business applications for projects. The Research Institutes look to access businesses within a tradition of manufacturing particular goods and provide R&D support to keep the industry at the cutting edge.

The Fraunhofer-Gesellschaft has been designed to perform the following:

1. **Research Institutes**: Set up research institutes across the country to provide hubs which facilitate the connection of research to industry.

2. **Practical Applications:** Develop the translation of scientific findings into practical applications, bringing together applied research and industrial best practice

SUPPORT FOR MIDDLE-SIZED BUSINESSES

"When you look at a lot of government policy, it's aimed at SMEs or larger corporates. These mid-sized companies don't tend to get the support that they need."

- Stuart Lisle (BDO)

3. **Facilities for Research:** Establish spaces for work on scientific papers and to allow the research of its utilisation in industry.

4. **Collaboration:** Creating connections between research organisations, bringing together leading minds to contribute to joint projects.

5. **Professional Development:** Promote the training and development of technical and scientific fields through the creation and facilitation of training and development facilitates; accelerating the implementation of projects, such as teaching courses, workshops and seminars, to spread the knowledge of innovative professional methods.

Dual VET: Vocational training for young workers

The Dual VET is a vocational training system which includes both a traditional school education system alongside on-the-job training on an apprenticeship of the student's choice, for a period of two to three and a half years, this allows a continuous stream of highly qualified talent to enter the job market and contribute to the growth of productivity. Standardised training programmes offered through the Dual VET are constantly updated with applications of the new technology to ensure easy integration in to the labour market. Deployment of the Dual VET in Germany has multiple responsible parties:

- **Federal Government:** Responsible for designing the content of the training for occupations. The basic principles of the content is agreed upon by multiple parties including industry.

- **Provincial Government:** Regional governments plot the courses to be offered to the businesses, taking into consideration skills shortages for different areas.

- **Industry:** Industry has the option to submit training development programmes or suggest the inclusion of new technologies in existing courses through support of worker unions.

- **Chambers of Commerce:** The Chambers of Commerce issue the certificates to successful candidates. This recognises the skilled worker and is recognised nationwide. The Chamber is also responsible for the creation of a training board and governs the development of vocational training courses.

- **Training Companies:** Training is primarily delivered by designated in-company team members. These employees attend regular refresher sessions and work closely with training companies to be updated of the latest development of the course.

- **Vocational Schools:** The vocational schools allow trainees to attend part-time and develop theoretical and practical knowledge related to their occupation. The students also attend general subjects including economics, social studies and foreign languages.

- **Trainees:** The trainees are placed within the dual VET system for 2 – 3.5 years in Germany, 2 – 4 in Austria, and benefits trainees through the development of personal and social skills, learn in a motivated environment, acquire labour-market ready training and receive a certificate recognised across the country as a sign of a high skilled individual.

MOROCCO: REPOSITIONING AFRICA'S MANUFACTURING HUB

What has happened?

Moroccan manufacturing has grown significantly over recent years, fuelled by a strong performing agritech and textiles sector. Morocco enjoys a strong geographic location, stable political environment and positive economic initiatives, which has allowed the nation to be considered outperformers in North Africa. Heavily reliant on Europe for external investment and trade, Morocco experienced a crash the previous decade, causing the nation to look to diversify its exports towards high valued manufacturing, and away from its agriculture and services.

What are the fundamentals of Moroccan manufacturing?

Morocco have been able to reposition themselves as a manufacturing hub of Africa. This has been achieved through increase focus on:

1. **Investment:** Moroccan manufacturers have begun investing in and out of Africa, to reduce its reliance of the European market, spreading the risk of domestic trading.

2. **Leverage Geography:** Morocco is in a prime geographical location, and with a strong infrastructure alongside, can attract in foreign manufacturers looking to access Africa.

3. **Strengthen Capabilities:** Provide the tools and capabilities needed for domestic manufacturers to scale up and become competitive on a continental and global scale,

4. **Embrace Industry 4.0:** Invest in capabilities and technologies to adapt to the operational changes in manufacturing.

How has Morocco driven growth in its manufacturing sector

Morocco's manufacturing sector has grown consistently following the turn of the decade, with value-added output having increased by 5.1& between 2010 and 2016. This has been supported by several large European manufacturers including Bombardier and Renault setting up operations in the country to take advantage of its low labour cost, proximity to African and European markets, and government's industrial policy. The industry has experienced growth partially due to the transition to higher valued manufacturing and the development of skilled workers in automotive and aerospace markets replacing the low value-added agriculture sector.

The Moroccan government has played a key part in developing its manufacturing sector, including the deployment of:

- **The Industrial Acceleration Plan 2014-2020:** Introduction of targeted sectoral strategies.
- **Pacte National pour L'Emergence Industrielle (PNEI):** The development of six key export industries.

Industrial Acceleration Plan

The Industrial Acceleration Plan followed on from the 2009 National Pact for Industrial Emergence, which created upwards of 110,000 industrial jobs between 2008-2011, an increase of 22% in the sector's exports and a clear development of infrastructure and establishment of global industry leaders in the nation; increasing foreign direct investment by an annual average rate of 23%.

1. **Industrial ecosystems for a more integrated industry:** Establishing industrial ecosystems with a mission of creating new relationships between large organisations and SMEs. The ecosystem is designed to optimise the social and economic benefits of procurement contracts through industrial compensation which represents 20% of the national GDP. The strategy also allows the creation of a self-entrepreneur status, a modified tax section which supports business development and access to unique funding opportunities.

2. **Support tools adapted to the industrial base:** Improving the competitiveness of SMEs through providing appropriate support for businesses' needs. A significant investment fund of 20billlion dirhams, approximately £1.6bn, was allocated to allow the industrial sector to modernise and embrace Industry 4.0. 1000 hectares of land was made available for industrial parks to make use of a surplus of unemployed workers.

3. **Stronger international positioning:** Efforts are to be increased in sectors with a high export potential with the aim of improving competitiveness in the industries. The strategy also aims to promote foreign investment by establishing a culture of 'deal-making' to allow foreign businesses and workers access to the international market.

Pacte National pour L'Emergence Industrielle (PNEI):

The PNEI was a set of strategies designed to increase the competitiveness of six key export industries, including aerospace, automotive, agritech, offshore energy, textiles and pharmaceuticals. The programme combines a top-down and bottom-up approach, combining state support with the acceleration of competitive markets. New sector groups were established to drive the sectors, and new collaborations were established between Morocco and the EU, including Anglia Ruskin University.

BRAZIL: REVIVING A MANUFACTURING POWERHOUSE

What has happened?

The 9th largest manufacturer in the world, Brazil is the largest manufacturing nation in South America and has recently begun its recovery following a lengthy recession, repositioning it as a major manufacturing hub for the continent. Against surrounding uncertain economic conditions in South America, Brazil is expected to continue growing under the backing of foreign investment and upskilling of the significant labour force.

Brazil is positioned well to grow its manufacturing sector in the near future, with access to raw materials and a significant labour force underpinning its competitive capabilities, including automotive, aerospace and aviation. A recent focus on talent and educating the workforce to embrace Industry 4.0 technologies will see South America's largest manufacturing nation grow further and look more appealing to foreign investors. Investment in Brazil's work environment will ease the ability trade internationally, sought after by both importers and exporters, and new regulations will reduce the risk of trading with the nation.

What are the fundamentals of Brazilian manufacturing?

Brazil have been able to recover from a recession to re-establish themselves as the largest manufacturers in South America, this has been achieved due to:

1. **A future-ready workforce:** Developing world class training capabilities to create a well-trained and labour market-ready workforce.

2. **Preparing for Industry 4.0:** Increasing the awareness of the benefit of Industry 4.0 and providing opportunities for implementation of cutting-edge technology.

3. **Structural Commitment:** All parts of the Brazilian economy have a part to play, from the government through to SMEs in contributing to the success of the sector; voicing their needs and desires at all levels

How has Brazil driven growth in its manufacturing sector?

Brazil has been able to recover from a lengthy recession through increasing domestic demand, maximising foreign investment and increasing the number of initiatives available to industry. Two initiatives which have accelerated Brazil's recovery include the Strategic Map of Industry 2013-22, which seeks to transform Brazil into a highly competitive, sustainable economy by 2022, and the BNDES (Brazilian Development Bank) launching a studying of "The Internet of Things: An Action Plan for Brazil". Creating a set of priorities to develop the IoT within the country and to implement by 2022.

Strategic Map of Industry 2013-2022

Launched by the Brazil National Confederation of Industry (CNI), the Strategic Map of Industry defines the initiatives and programmes which will support the development of Brazil, transforming it into a highly competitive sustainable economy by 2022. The strategic map, developed with support from 500 industry and governmental leaders, is structured around 4 key metrics:

1. **Improving the education system:** Improve the quality of basic education, expand the supply of technical and vocational education and training and improve its quality and to expand the supply of engineering graduates from industrial technology programmes offered by universities.

2. **Creating favourable trading conditions:** Developing the macroeconomic environment through the stimulation of long-term public planning, contributions to the improvement of the exchange rate and increase investment in infrastructure.
3. **Influence supply conditions:** Identifying bottlenecks within public policies and entrepreneurial actions, notably taxation, financing, infrastructure and labour relations, and finding solutions.

4. **Market Development:** Increase Brazil's share in the global production of goods, through facilitation of export programmes, improve foreign trade laws, develop studies into global supply chains and create new incentives for regional development.

Internet of Things: An Action Plan for Brazil

Outlined by the Brazilian government in 2017, the IoT Action Plan for Brazil set out over 70 initiatives to develop the country's digital capabilities within manufacturing, featuring targeted incentives in innovation, regulatory environment, connectivity and human capital.

The proposal focuses on environments mapped as a priority including health, smart cities and particularly industry, encouraging cross-sector innovation to increase the digital capabilities of the surrounding sectors.

The Brazilian Development Bank (BNDES) acts as an inducer and supporter of the initiatives and will also review and improve the innovation support provided to businesses through funding support.

The IoT action plan has placed significant interests on the country's agriculture sector as it aims to create 'Tropical Farms 4.0' which increases productivity and the quality of Brazilian rural production, through utilisation of data to accurately monitor the living assets (crops).

An innovation network dedicated to the action plan is to be deployed so that large companies, start-ups and research institutes can gather greater amounts of data and contribute to research projects more effectively.

CANADA: OVERCOMING THE DECLINE IN NORTH AMERICA

What has happened?

Canada is the 10th largest economy in the world and follows a mixed economy system like that of the US, with a market-oriented system. Canada's manufacturing contribution to GDP has declined steadily since 2000, with only 10% of GVA being created in the sector.

A comparative strength in R&D, similar to that of Cambridgeshire and Peterborough, can allow Canada to take advantage of the upcoming Industry 4.0 revolution. This transformation into Industry 4.0 will change the nature of Canadian manufacturing and as a result, Canada's government have taken action.

What are the fundamentals of Canadian manufacturing?

Canada's manufacturing sector is in a good position to benefit from Industry 4.0, and the fundamentals complement its future direction.

1. **Championing adoption of Industry 4.0:** Development of productivity and innovation through investment of Industry 4.0 in SMEs, driving growth through supply chains

2. **Strengthening leadership:** Enhancing the countries competitive capabilities through the development of leadership and an ability to innovate and diversify.

3. **Developing the future workforce:** Supported by strong policies to encourage investment and innovation, the development of the young workforce to be future-ready.

How has Canada driven growth in its manufacturing sector?

Following the economic crash of 2008 Canada reacted by deploying new initiatives which would drive the country to embrace Industry 4.0 and to maximise the capabilities it possesses in research and development. These initiatives fuelled investment into innovation and the availability of R&D tax credits, alongside the creation of road mapping to double the value-added manufacturing, processing, technology and services sectors by 2030.

Innovation Canada: A Call to Action

The Innovation Canada action plan was devised by the Canadian government in 2010 following the economic crash to futureproof the nation's manufacturing sector. It was split into six recommendations to accelerate innovation:

1. **Creation of Industrial Research and Innovation Council:** More than 60 innovation support programmes existed across Canada, creating a complicated application system which overwhelmed businesses. Streamlining applications through a designated portal and providing a support service would support businesses find the appropriate funding bid for their needs.

2. **Simplification of Tax Credit System:** The Scientific Research and Experimental Develop (SR&ED) programme was overcomplicated, with small businesses hiring a consultant just to apply, discouraging many businesses from applying for funding. The tax credits were transformed to be based solely on labour costs, easing the process.

3. **Making business innovation a core objective of procurement:** Canadian government realigned its procurement process to maximise home-grown innovation, originally transforming purchasing power into domestic innovation.

4. **Transforming National Research Councils into a series of large collaborative centres:** Originally, centres were created to house research and development with the only engagement with businesses were the spinouts being created. These NRCs were transformed to bring together industry, universities and the public sector.

5. **Support businesses accessing risk capital through a central bank:** Previously, innovative Canadian businesses relied on foreign investment to bridge the gap of high-risk spending. To support domestic businesses the Business Development Bank of Canada was created to support late-stage risk capital/growth equity funds.

6. **Establish a voice for innovation:** Coordinating innovation across the economy was spread across several cabinets. Shifting to a single advisory committee allows cross sector innovation to occur.

Industrie 2030

Created by the Canadian Manufacturers & Exporters (CME), Industrie 2030 was a set of objectives creating a roadmap to double value-added manufacturing, processing, technology and services in Canada by 2030. Underpinned by four key objectives, it sets to reinvigorate Canadian manufacturing:

1. **Retain and attract investment & expand capacity:** Manufacturing capacity decreased significantly, and existing facilities are almost full. Investment in space, from domestic or international sources is required to allow manufacturing businesses to invest in new manufacturing capabilities.

2. **Manufacture more products and technologies in Canada:** Canada has a strong research base, and an extensive history of commercialising innovative products. The process must be accelerated through linking research to industry.

3. **Accelerate adoption of new technologies and processes:** To overcome a lower manufacturing capacity, new technologies must be adopted by industry. They create new opportunities for manufacturers and can allow access to new markets and opportunities.

4. **Sell more to customers in Canada and around the world:** Branding must be integrated into Canadian-made products to allow domestic and international customers to recognise their origin of manufacture, and to benefit from the beneficial reputation the country possesses.

THE FOUR TIGERS: RAPID DEVELOPMENT

What has happened?

The Four Tigers are known as the economies of Hong Kong, Singapore, South Korea and Taiwan. These four nations experienced incredible growth and underwent rapid industrialisation. The high growth rates, which have been around 7% a year, have allowed the four Asian nations to become high-income economies benefitting from targeted competitive advantages.

Whereas Hong Kong and Singapore became world-leading financial service providers, South Korea and Taiwan have positioned themselves as world leaders in the manufacturing of electronic component devices. The models used by the nations have begun to be replicated in developing countries.

What are the fundamentals of The Four Tiger's manufacturing?

The Four Tiger nations have invested heavily in its economy to allow the countries to reach new opportunities and establish comparative advantages:

1. **Investment in infrastructure**: The governments and authorities of the four nations invested heavily in infrastructure, including ports, to develop excellent export logistics; creating a great investment opportunity for overseas businesses.

2. **Industrialisation**: Local governments pushed industrialisation and focusing on local market strengths and high potential export markets. As income rose, so too did the launching of new businesses and allowed expansion beyond industrialisation to become high value manufacturing leaders.

3. **Developing and maintain the educated population**: The skills developed by The Four Tiger nations was built upon cultural conditions of respecting superiors and recognising achievements; allowing high staff retention.

4. **Government financial support**: Low-interest rates for bank loans allowed businesses of all sizes and industries to access funding to grow the business and become more competitive in domestic and global markets.

How have the nations driven growth in the manufacturing sector?

A significant push to industrialise their developing economies allowed rapid expansion into new markets. Combined with a strong geographical location, the four nations were able to export high valued goods effectively.

Hong Kong: Heavy investment in infrastructure allowed new roads, schools and hospitals to be built, revolutionising the education, transport and healthcare systems. This allowed a high skilled workforce to be developed, maintaining good health, and having the opportunity to travel to reach greater job opportunities.

Taiwan: A shift from low valued manufacturing jobs to high value markets meant that wages increased, and so too did Taiwan's strategy. Investment in Industry4.0 technologies to enter new markets have allowed the Taiwanese economy to compete in the highly competitive electronics market.

Singapore: The government have encouraged rapid growth through eliminating regulation and incentivizing development. There is a 'no red-tape' policy in place with large incentives for startups looking to launch in the country.

South Korea: South Korea has developed its innovative tech industry through integrating SMEs into global leading supply chains to collaborate and test new disruptive technologies before circulation into the global market.

RECOMMENDATIONS

Through analysis of multiple world models, it can be seen that the government and local authorities have a large part to play in the development of the manufacturing sector. With a focus on top-down strategies coordinated by national governments, it is important to look at how a bottom up approach can be launched, with the two strategies meeting half way:

1. **Develop regional equivalents of The Fraunhofer-Gesellschaft:** Research institutes which facilitate collaborations between industry and researchers. Cambridge has great strengths in research, and through increasing focuses on the collaboration with industry, commercialisation of research can be accelerated; allowing businesses to become more competitive in high-value global markets.

2. **Invest in grow-on-space:** Morocco's manufacturing sector has benefitted from low-cost grow on space, allowing existing businesses to grow and increase capacity, as well as creating space for foreign businesses to enter the African market. Cambridge could replicate this, providing space for domestic businesses to grow, and international businesses move to access the high-value economy.

3. **Development of Innovation network:** Brazil's manufacturing sector has begun to shift to a high-value economy. With support of a dedicated innovation network, businesses are receiving support to embrace Industry 4.0 technologies. Cambridge's science and research capabilities provide a strong foundation to build a network upon which can connect sectors and increase the value generated through the

manufacturing sector. Canada's recent strategies have also seen a shift to a designated innovation network to support integration of industry 4.0 technologies.

4. **Investment in infrastructure:** The Four Tigers have been able to shift to high value manufacturing and maintain growth through establishing a strong network of roads, education and health centres. Investment in infrastructure will allow the region to export more effectively and become more competitive on the global market.

NETWORKS & SUPPLY CHAINS

MANUFACTURING BUSINESS HEATMAP

Cambridgeshire and Peterborough have a significant manufacturing and engineering sector, which can be overlooked due to its significant strength in science and research. Hethel Innovation has performed mapping across the region to identify clusters of innovative and competitive manufacturing businesses which could drive the development of the sector.

Figure 1 shows the heatmap of manufacturing businesses within the region and highlights the clusters which will accelerate the development of localised supply chains and growth of the sector.

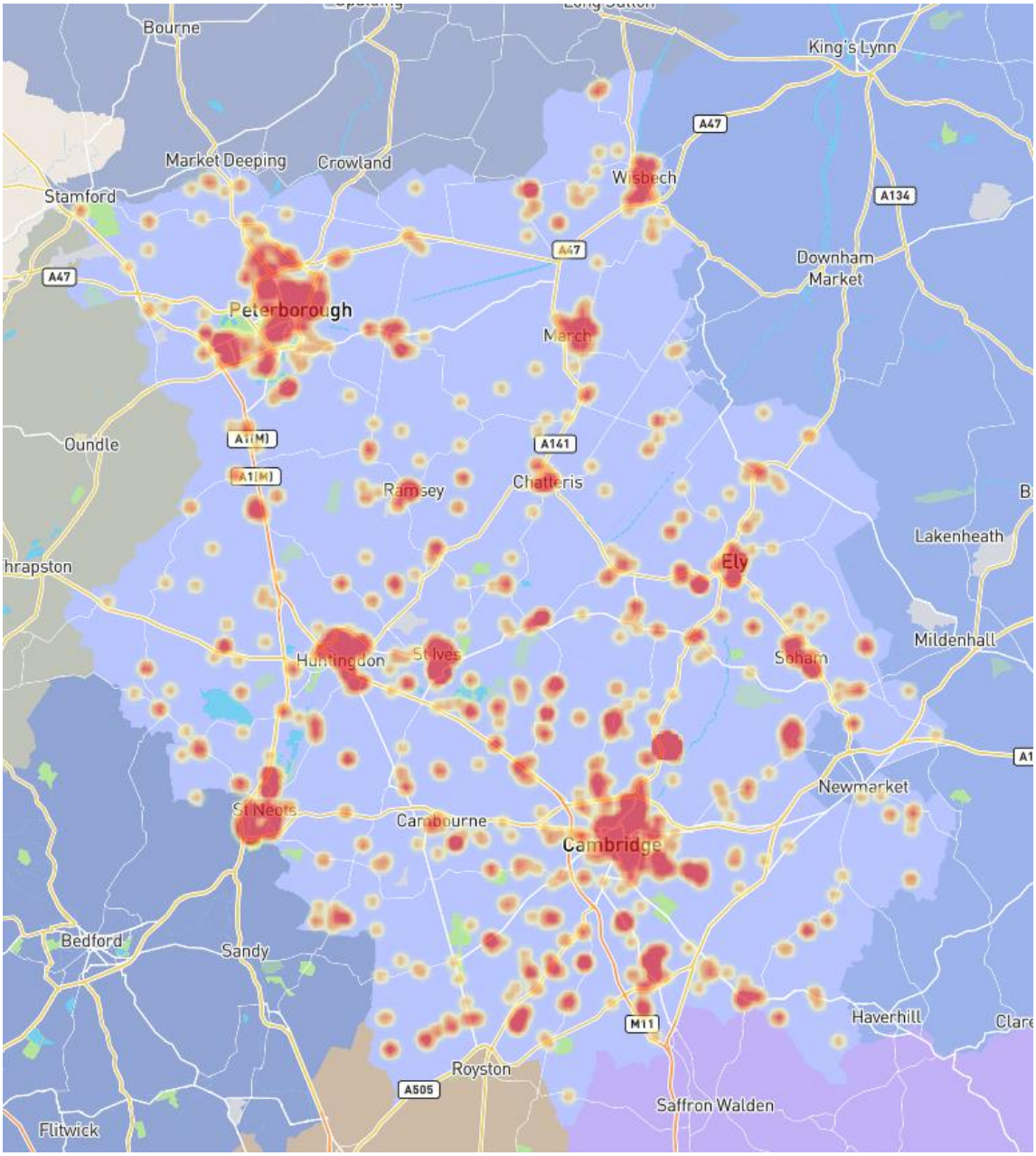


Figure 1 – Cambridgeshire and Peterborough Manufacturing Heatmap

IDENTIFYING HUBS OF MANUFACTURING & ENGINEERING

As Figure 1 shows, Cambridgeshire and Peterborough has many clusters of manufacturing and engineering businesses which can benefit from the science and research capabilities of the region, as well as being well positioned geographically to connect with other parts of the UK, including Norfolk and Suffolk's significant strengths in energy, and the Midland's Engine's automotive capabilities,

There are approximately 2,659 manufacturing businesses in the region, with the majority, unsurprisingly, located around Cambridge and Peterborough. The following locations have been identified as areas for increased focus when accelerating economic development:

ST NEOTS

Already home to a Manufacturing Group, St Neots benefits from a good road infrastructure connecting it to Cambridge's strong research capabilities, as well as the Satellite Application Catapult in Harwell, the Transport Systems Catapult in Milton Keynes and the Cell and Gene Therapy Catapult in Stevenage. Situated close to research capabilities will allow businesses such as the Kier Group, Cambridge Precision and Bailey Morris to benefit from accelerating the development of new products, processes and services.

With several industrial estates positioned within St Neots, there is a great opportunity to connect these SMEs to research capabilities and advance the sector. Efforts should be concentrated on linking these businesses to research and developing local areas of excellence in sectors relevant to the neighbouring catapult.

HUNTINGDON & ST IVES

Situated equally between both Cambridge and Peterborough, a high number of manufacturing businesses located in Huntingdon and St Ives have increased access to both the scientific and research capabilities of Cambridge, and significant manufacturing strengths of Peterborough.

With high value manufacturers including Encocam, Videojet and SIS Digital located within the area, there is a great opportunity to connect in with the Milton Keynes and Stevenage catapults and grow the region.

Significant industrial estates and parks including Telford Way, Stukeley Meadows and Ermine Business Park will allow the development of local supply chains and engage directly with the Huntingdon Regional College. There is currently no network positioned within the area to support the manufacturing and engineering businesses within the region, increasing the need for a recognised champion and lobbyist for the sector.

CAMBRIDGE

Possessing a number of high value manufacturers, leading in industries such as pharmaceuticals, robotics and electronics, the Cambridge Phenomenon has already proven to be an effective method of developing high value sectors. With significant strengths in research supporting the development of the sector, the region is continuously welcoming new businesses and, in turn, developing local supply chains.

With an established research and education infrastructure, which includes the University of Cambridge, the College of West Anglia Cambridge Campus, and TWI, there is a great opportunity to develop a localised skills supply chain; inspiring young engineers at college, to enrolling on a degree apprenticeship, to mastering specific skills at TWI.

To further develop Cambridge's manufacturing sector, efforts must be concentrated on the development of recognised industrial estates, which will provide SMEs with the opportunity to engage with the neighbouring research and development capabilities.

EMBRACING THE MANUFACTURING SECTOR

"Cambridgeshire and Peterborough have not embraced all leagues of their manufacturing sector, and attention must be put upon smaller businesses in need of support"

- Chris Woodward (Enterprise Europe Network)

Cambridge's research and science capabilities must be exploited and delivered across the region.

By developing lesser realised areas of manufacturing excellence, connections and collaborations can be created, inspiring future generations of business leaders, well equipped to deal with Industry 4.0

Recognition and development of a Fenland Corridor would allow increased investment into the region and accelerate the creation of localised supply chains; benefitting the local economy.

PETERBOROUGH

Situated in both established markets such as food and drink and automotive, and emerging markets including 3D printing, Peterborough possesses the largest concentration of manufacturing and engineering businesses within Cambridgeshire and Peterborough. Home to businesses such as Perkins Engines, British Sugar and Photocentric, the town is positioned well to grow and develop its manufacturing sector, creating opportunities to develop cross-sector innovation opportunities.

Peterborough is positioned well to replicate the Cambridge Phenomenon, and with a core underlying manufacturing sector, could benefit greatly from an increased focus in research and development. With the University Centre Peterborough having been established in 2009, the region is beginning to increase its effort in providing upskilling and education opportunities to its inhabitants.

The region is home to a recognised support network, in the form of Opportunity Peterborough, and allows businesses of all sizes to access support to grow.

WISBECH, MARCH & CHATTERIS: THE FENLAND CORRIDOR

Containing some of the lowest land prices in Cambridgeshire and Peterborough there are significant opportunities to expand the manufacturing sector, developing more spaces to grow businesses, as well as providing incubation opportunities for start-ups.

With Chatteris realised as a potential expansion site to develop a technology park, the A141 could play a pivotal role in connecting the park to neighbouring manufacturing hubs such as March, Wisbech and Huntingdon. With industrial estates such as Century Way, Honeysome Road and Mount Pleasant Road, there is a high concentration of manufacturing businesses to contribute to the collective growth of the region.

Positioned close to the College of West Anglia, Wisbech campus, the Fenland corridor would have direct access to the emerging generation of engineers seeking employment in a fast-developing local economy.

MANUFACTURING NETWORKS

Networks are a great tool for bringing businesses together to share best practice and encourage innovation and knowledge transfer.

Growth of individual sectors is best supported through the creation of knowledge-intensive sector networks that are open to supporting not only intra-sector innovation but cross-sector collaborative innovation.

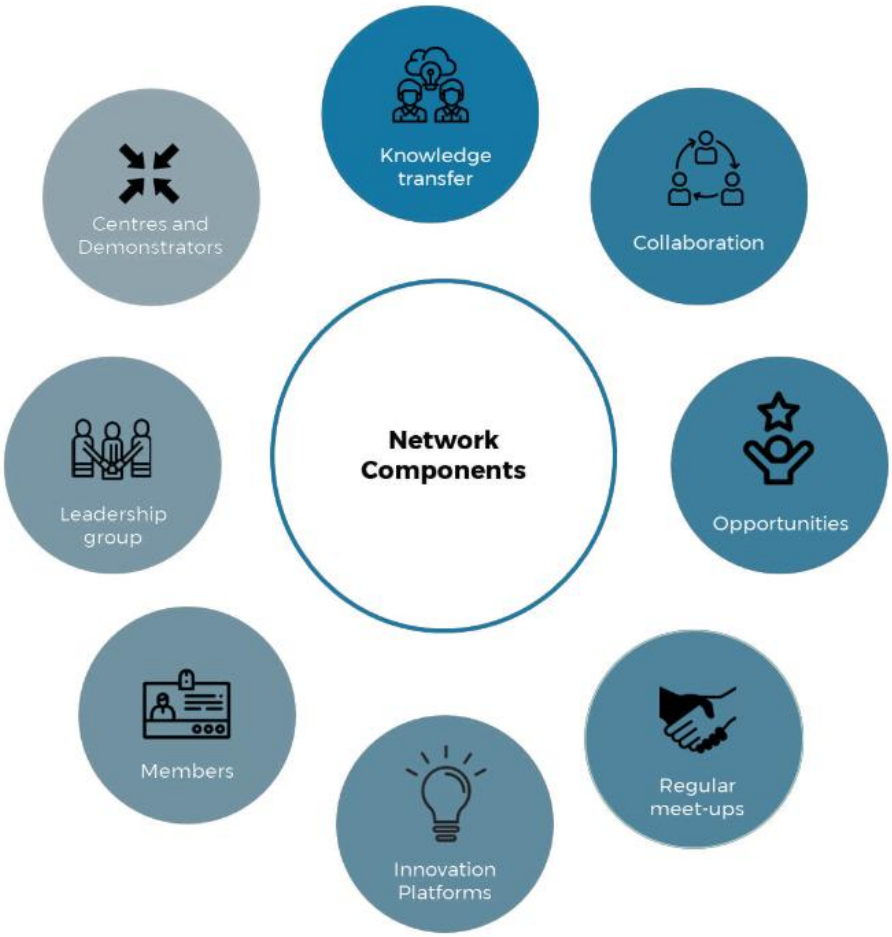


Figure 1 - Components of a Successful Network

Figure 1 shows the individual components of a network. These components work effectively as a standalone feature but can also be combine to great effect. Networks can be multinational and large in size, for example the Enterprise Europe Network provides support to access funding in over 60 countries, or small and local, such as the Nottingham Manufacturing Network which supports what the name suggests.

NORTH-EAST PRODUCTIVITY ALLIANCE (NEPA)

- Established in 2004
- Includes manufacturing businesses, public agencies and academic experts
- Delivers bespoke Lean manufacturing training across the North East of England
- Created £20m of productivity savings
- Supported 376 businesses
- Created 200 jobs
- Safeguarded over 3,000 jobs

COMPONENT: KNOWLEDGE TRANSFER

WHAT IS A KNOWLEDGE TRANSFER?

Knowledge Transfers have become an extremely powerful tool in recent times. As research and development becomes ever more detailed and performed in greater quantities by academia, it can often be difficult for industry to keep up and apply the knowledge without sacrificing time away from the business. The purpose of a network is to create those connections and encourage the sharing of the knowledge and best practice, not only to advance the research carried out by academia, but to allow industry to create competitive advantages within their markets.

WHAT IS THE CHALLENGE?

Before embarking on a Knowledge Transfer project, the parties involved must know what is being explored and what the desired outcomes are to achieve. Without this original information, the purpose and delivery of the transfer is limited. Where Networks can support this is to act as an external voice and supporter to shape the delivery of the project, facilitate meetings between parties and map/list minutes of the interactions. Opportunities can often be overlooked when focusing on one aspect of a project, having a network coordinator support on the project can present a wider scope of opportunities to explore.

A main challenge of UK culture is the inability to share ideas and thoughts. This has led to many industries and markets being siloed off from one another, preventing the opportunity for cross-sector innovation to be explored and for new markets and customers to be accessed. When targeting new markets and customers it can often be a difficult task to understand the challenges being experienced by those markets, and how the new idea can overcome them; this is when a Knowledge Transfer would benefit all. However, if one is not positioned in the market, how is one to know who to talk to? This is where a network would support the project and introduce the partners.

The role of a network is to establish strong relationships with key figureheads in academic and industrial positions to be able to easily identify the most suitable partner and accelerate the Knowledge Transfer process.

Morgan Motors & University of Birmingham

Morgan Motors is a family run manufacturer, specialising in the design manufacture and distribution of traditional cars. The firm realised a need to accelerate NPD.

An introduction to the University of Birmingham allowed for a Knowledge Transfer Partnership to begin, and such was the success of the first, that two more followed.

The benefits to Morgan Motors included an extension to its portfolio, an ability to prepare and manage vehicle testing and design errors in manufacture being addressed.

Knowledge Transfer is not limited to being between industry and academia and can often feature two figures in industry. The Knowledge Transfer between industry follows a different structure and is often considered much less structured but features more interaction and meetings. The challenges being overcome during knowledge transfer between industry prioritises best practice and how to maximise the effectiveness of the business.

The role of a network when supporting two industry figures wanting to engage in a Knowledge Transfer project is to define the scope of a project, the challenges, ideal solutions and future actions. Once defined, the network can begin identifying the relevant partner to involve and being the transformation process, as suggested by Innovate UK in their Knowledge Transfer Partnership process.

KNOWLEDGE TRANSFER PARTNERSHIPS (INNOVATEUK)

Innovate UK, the governmental innovation board follows a 10 step process to encourage knowledge transfer:

1. Have an idea for a strategic innovation project
2. You need help to make it happen
3. Talk to a Knowledge Transfer Adviser
4. Discover how to access the UK's world-class knowledge base
5. Cost the project and apply for the grant
6. Recruit suitably trained graduates
7. Project progresses with support between partners
8. Transformation occurs
9. Strategic objectives are met
10. Knowledge and capability is embedded for long term beneficial

COMPONENT: COLLABORATION

WHAT IS A COLLABORATION?

Collaborations play the same role as Knowledge Transfer projects but focus on different outcomes. Whereas a KT project wants to develop existing capabilities, a collaboration often targets something completely new to the business.

WHAT IS THE CHALLENGE?

Similar to Knowledge Transfer projects, it can be difficult for industry to understand what the next steps are when accessing a desired outcome, or even who to work with. Networks act as a powerful mediator when accessing new information and can save great amounts of time in accessing resources.

There are a number of barriers for industry when wanting to enter new markets and access new opportunities. These can include the likes of available finance, startup costs, marketing costs, competitor strategies, and without sufficient information the actions taken, or not taken, can be damaging. When working alongside a network research can be delivered to industry to mitigate the risks of entering a collaboration and accessing new opportunities.

HOW TO DEVELOP A COLLABORATION?

To generate an effective collaboration strategy, a number of steps must be actioned:

- **Identify your assets:** Through analysis of the business model, it could identify assets which could support the facilitation of collaboration, and the desired outcomes set by both businesses.
- **Inspire your team:** For collaborations to be successful, both teams of the organisations must understand the value of the partnership, and what is required from them. When implementing projects within businesses there must be support throughout the organisation, from top to bottom, for imoact to be achieved.
- **Interact with companies:** Before revealing the desired project and what outcomes are to be achieved, businesses must begin to identify potential partners. The role of a network would benefit the interested party and provide access to a large number of relevant businesses suitable for the project.
- **Ignite your business:** Through the identification of co-projects, both internally and externally, relationships will be created in the immediate eco-system and new projects will be created because of it.

COMPONENT: OPPORTUNITIES

HOW TO ACCESS OPPORTUNITIES?

Opportunities can be created through many different sources. The scope of opportunities can be very small or very large, and it is the role of a network to see those opportunities and present them to industry, academia or the public sector to be explored further.

The purpose of the network is to build a strong contact list in which the sharing of information is encouraged, and opportunities are easily transparent across the members.

Networks can accelerate the ability for industry to access opportunities through forming digital platforms. These platforms allow information to be posted online and easily accessed by members. Platforms such as Ideascape are being used in a variety of sectors, from tourism in Cardiff, to location tracking across the world at any time and allow comments and suggestions to advance the scope of the opportunity.

COMPONENT: REGULAR MEET-UPS

HOW TO CONDUCT REGULAR MEET-UPS?

One of the many roles of a network is to facilitate meetings between industry, academia and the public sector. These meetings provide a great chance to share best practice, explore new opportunities and suggest ways to overcome existing challenges.

A common complaint of networking sessions is meeting with individuals who will not add any value to the business and cannot play any part alongside it. Through the facilitation of a manufacturing-specific network, only organisations with a manufacturing and engineering orientation will be invited, providing greater opportunities to meet with relevant organisations and individuals.

Greater Norwich Manufacturing Group

Set up by NAAME in 2016, the Greater Norwich Manufacturing Group draws on the rich experiences of local sector businesses in order to enhance regional productivity and development opportunities. The group currently has over 40 members, including over 30 Manufacturing businesses from across the Greater Norwich Region.

These meetups are help on a quarterly basis at a manufacturing or engineering businesses' site and features a tour of the premises. These meetup sessions create opportunities for businesses to learn through best practice and for the host to learn from suggestions from participants.

As the group has grown, special meetups have allowed digital businesses in the exciting Norwich tech area to attend and discuss the possibilities of Industry 4.0.

Meetup groups can play a considerable role in shaping the future of manufacturing.

It is common to experience manufacturing meet-up groups championing skills within the region, and these groups allow these advocates to develop a strategy to take to the necessary party.

HOW TO ORGANISE A MEET-UP GROUP?

When organising a new meet-up group it must be considered whether the group is required. Many networking groups finish before they begin due to a lack of demand from attendees. To begin and coordinate continuous meetup groups, the following must be considered:

- **What is the purpose**: If the group has no purpose and no desired outcomes, then this will be reflected onto guests, as they leave through lack of direction. Previous manufacturing meet-up groups have focused the attention onto skills, industry4.0 and accessing exporting opportunities.

- **Who is invited**: A comment which was aired during the consultation suggested that *"Cambridge networking is too generic, so travelling over 30 mins must be beneficial'*. Businesses expect to meet interesting people and advance their organisation, meeting those who do not add value is wasteful. A manufacturing network will be able to track the attendees of a meet-up before it happens and manage the session accordingly. This can be performed through the extensive contact lists in which they possess.

- **What is the demand:** A group with no demand, is no group at all. Attendees must find value in groups and must realise the need. Networks are positioned uniquely in the sense that engagements with industry and academia can increase the demand for a group to be created or an opportunity to be realised.

COMPONENT: INNOVATION PLATFORMS

WHAT IS AN INNOVATION PLATFORM?

An Innovation Platform is the bringing together of industry, academia and the public sector to solve a problem. The individuals involved within an Innovation Platform often represent organisations of different backgrounds and interests. For example, in a food packaging problem, platforms could feature food growers, food processors, automated machine manufacturers, logistics firms and supermarkets.

Innovation platforms can be used to explore strategies that can boost productivity, manage natural resources, improve value chains, and adapt to climate change. Some innovation platforms focus on single issues; others deal with multiple topics.

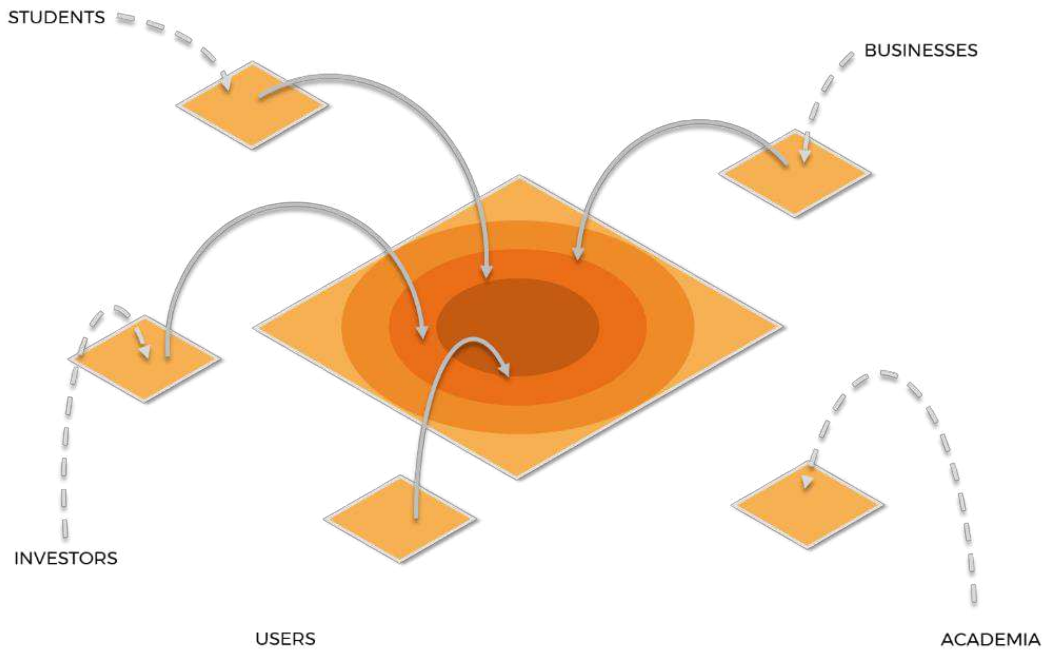


Figure 2 – Structure of an Innovation Platform

HOW CAN A NETWORK SUPPORT INNOVATION PLATFORMS?

Networks can play a pivotal role in the formation, performance and closure of an innovation platform. The first contribution networks can make within an Innovation Platform is to identify members for involvement that will be able to input ideas and further progress. Networks engage with businesses on a frequent basis and can identify whether an invitee would cause the group to develop or to falter.

Networks can act as a neutral facilitator and ensure that meetings stay on track and not lose its focus. The parties invited to the platform will likely be subject matter experts and possess the technical skills and experience to advance the platform. The role of the network is to simply facilitate that growth and maintain momentum. Businesses are often very busy, with the UK workers suggested to work the most hours in a week in the EU, therefore the networks would take the time to organise meeting locations, write up minutes and signpost the future steps of the platform.

Following the completion of an Innovation Platform, networks provide an opportunity for free exposure and marketing of a potential new product, process or service, further increasing the likelihood of commercialisation. Once a problem has been solved by the parties within the Innovation Platform, it can be assumed project closed, however, the network has the opportunity to identify new pathways to sustain the group further and access new markets and customers, creating greater riches for those involved.

Recommendation

Develop innovation platforms to drive cross-sector innovation around shared challenges

COMPONENT: MEMBERS

WHY DEVELOP A MEMBER OFFERING?

Manufacturing networks, unless funded through an external party, must generate a source of income to be able to function. Memberships are a common way that support networks can afford to deliver their services. Memberships not only provide networks with a revenue source to survive, but they also allow the networks to shape themselves and outline what services are provided.

Memberships allow networks to build a database of contacts for future use and when shaping new initiatives and projects. It allows strategies to be created and allows a landscape of the immediate manufacturing region to be identified. This information can then be used to create new innovation platforms, new training programmes, new manufacturing groups and new online content.

WHY SHOULD BUSINESSES BECOME MEMBERS?

Memberships, for businesses, represent an opportunity to join a club of likeminded ambitious manufacturing organisations looking to access new opportunities, markets and customers. They can act as a chance to meet with businesses not yet engaged with and yet to trade with.

Networks deliver exclusive events, training and workshops to businesses. By enrolling team members on such occasions, it will allow new skills to be developed through discussions with other businesses and learn through best practice; which would otherwise not have been experienced.

COMPONENT: LEADERSHIP GROUP:

WHY DEVELOP A LEADERSHIP GROUP?

A Leadership Group possesses a variety of benefits for organisations, both with those inside the network and even those outside. The Leadership Group brings together manufacturing advocates with experience and subject expertise to discuss how to shape the future of the regional manufacturing environment.

The Leadership Group acts as a continuous learning opportunity for a manufacturing network to better understand the regional working environment and to better understand what must be delivered for businesses to grow. With representation from a small number of academia and public body figures, it will allow the wider region to develop an understanding of the challenges manufacturing businesses are experiencing and allow the aligning of strategies to support the sector's development.

Leadership is a challenge which has been recognised by Hethel Innovation's consultation strategy. During meetings with keystone organisations, a lack of business leaders driving the sector was a common challenge voiced. Stewart McTavish of IdeaSpace suggested: "*Leaders must be able to see opportunities locally to stay and fall in love with region*". All leaders within a network must be local and must champion the sector the continually drive it forward.

COMPONENT: CENTRES & DEMONSTRATORS

WHAT ARE CENTRES AND DEMONSTRATORS?

Centres and Demonstrators are recognised businesses and organisations of excellence that can provide support to SMEs and researchers to allow access to new opportunities. These opportunities can include providing SMEs with the chance to trial the latest technology and review investment. There are opportunities for the centre and

demonstrator site owners too, as seen in Fig. 3, and these can include chances to collaborate with SMEs on projects and integrate into supply chains.

Identification of Centres and Demonstrators through a manufacturing network will open new opportunities to businesses in the region, both the large businesses championing the demonstrator capabilities, and the SMEs accessing the capabilities.

HOW WILL BUSINESSES BENEFIT?

Fig. 3 shows the benefits that can be experienced through usage of a centre and demonstrator.

Large Businesses	Small Businesses
• Access to ambitious SMEs to integrate into established supply chains • Opportunity to headhunt from smaller businesses • Opportunity to coordinate research projects with academia • Ability to enter new markets through collaborations • Increased selling opportunities through visits	• Access to latest technologies otherwise unattainable financially • Opportunity to work alongside industry leaders and gain access to cutting-edge information • Opportunity to be integrated into industry leader supply chain • Opportunity to upskill staff with latest technology in preparation of investment • Opportunity to prototype and test new products

HOW CAN NETWORKS BENEFIT FROM CENTRES AND DEMONSTRATORS?

For centres and demonstrators to be of real value to businesses and academia, networks must be positioned to facilitate connections and visits to the sites. The extensive contact list utilised by the networks will also allow sector specific workshop sessions to be held on-site alongside emerging technologies, maximising the benefits.

Centres and Demonstrators can also act as a way for networks to deliver internal training session to its members, as well as deliver meet-up groups and conferences in an environment which displays the focus and purpose of the meeting.

Recommendation

Build a manufacturing network across the region to connect and inform the sector

MANUFACTURING GROUPS

Networks possess the ability to create meet-up groups to bring together businesses, share best practice and accelerate the development of the sector.

The groups, otherwise known as Manufacturing Groups, provide manufacturers and engineers with the opportunity to meet likeminded ambitious individuals seeking to advance their organisation and access new opportunities.

The demand for Manufacturing Groups is already evident within Norfolk and Suffolk, with 7 currently in operation. Cambridge and Peterborough's manufacturing sector have spoken out about a need for targeted networking opportunities which only bring together manufacturers; these groups fulfil this need.

Manufacturing Groups are to be established by a manufacturing network, bringing together the businesses, confirming a host location and beginning the series of meetings. Then, they are passed onto economic development officer at the local council to continue the development, with the manufacturing network supporting when and where required.

DEVELOPING MANUFACTURING GROUPS

WHAT IS A MANUFACTURING GROUP?

A Manufacturing Group is a meet-up group set up in areas across the region which bring together the manufacturing and engineering sector to network, learn through best practice and discuss new opportunities with likeminded ambitious businesses.

Manufacturing Groups are delivered by manufacturers, for manufacturers and feature a rotating host organisation who open their doors to the local manufacturing community and provide a tour of their premises. These tours allow businesses to discover how others are operating in the region and provide opportunities to ask questions relating to the manufacturing environment they are witnessing. Manufacturing Groups work best when situated on industrial estates and house a large quantity of manufacturing and engineering businesses. When hosted on an industrial estate, a greater turnout is achieved due to the shorter travel time for a large proportion of the attendees, being only around the corner from their establishment.

The groups provide opportunities for local supply chains to be established, support for local initiatives to be voiced, as well as being updated with local opportunities and events others should be made aware of. The East of England has a reputation for being a strong supportive community, and these groups reiterate that fact, with collaboration and support being two key themes of the groups.

HOW DO YOU LAUNCH A MANUFACTURING GROUP?

Manufacturing Groups have been setup across Norfolk and Suffolk, and can follow the strategy below:

1. **Map the Area:** Perform mapping across Cambridgeshire and Peterborough to identify regions with high concentrations of manufacturing and engineering businesses. Look for industrial estates, or SMEs situated around industry leaders. Create a database of the businesses.

2. **Assess Demand:** Following the identification of an area featuring a large concentration of manufacturing businesses, assess the demand of those businesses to network and engage locally. Certain businesses do not see the value of networking locally due to national and international supply chains; SMEs tend to have strong engagement, however. Cold calling and distributing brochures are an effective way of accessing businesses.

CORNWALL MANUFACTURING GROUP

- Founded in 2012
- Contains 35 paying invite-only members
- Annual membership costs up to £800
- Sectors include agricultural machinery to medical equipment
- Support local academia to develop new training programmes
- Deliver yearly Cornwall Manufacturers Awards
- Coordinate quarterly meetup groups

Manufacturing Groups provide the perfect opportunity for academia to meet with local businesses and discuss the skills shortage in their area.

A demand for new courses could be realised, challenging the skills gap being experienced in the region.

3a. **Find a Host:** Many businesses can be hesitant when first told other organisations can look around their factory, with many fearing competitors finding out about their competitive advantages. The attendance list is to be reviewed by the designated support network alongside the host organisation to ensure no competitors attend.

3b. **Organise a Discussion:** If businesses are reluctant to host a Manufacturing Group, coordinate a roundtable discussion with interested organisations to educate them of the format, function and benefits of the Manufacturing Group. Work alongside a local educational establishment, incubator or accelerator to act as a neutral host location. At the meeting agree on the purpose of the group, the goals, and the agenda for future sessions.

4. **Confirm the Agenda:** Working alongside the confirmed host business, agree on a relevant topic to be discussed at the meetup. The topic can be something personal to the host, such as skills or certain technologies, or can be generic, like exports. When the topic is confirmed, have the network look for relevant speakers that could provide a 10-minute presentation on their experiences to encourage discussion within the group.

5. **Market the Event:** Manufacturing Groups are a good way for the services sector to access high-valued businesses, therefore it is important not to immediately them into the pilot sessions. Using the mapping created at step 1, send out invites to manufacturing and engineering businesses within the area. This can be done utilising emails, phone calls or personal handwritten mail. Invite the local economic development officer to the event to begin the handover to the public sector. Ensure that invites are not sent to competitors and discuss with the group host.

6. **Coordinate the Session:** Pilot sessions of Manufacturing Groups can create a low turnout of businesses depending on the level of mapping performed at the beginning of the group formation process. Groups that work well tend to bring together approximately 30 individuals representing the manufacturing sector. Supporting the host organisation, the manufacturing network will welcome guests and allocate them to the correct area, ensuring the host has time to network and meet guests. When and where required, the manufacturing network will support the running of the session, at the request of the host.

7. **Continue Group Delivery:** Following the end of the first meeting, hold an open discussion where the next session of the manufacturing group can be performed. These occur every 3 months, or can be within a shorter period of time, depending on the demand of the attendees. At this point the manufacturing network will hand over the responsibility of the group to the local economic development officer to continue the running of the group. Should the ec-dev officer fail to continue the group, the network will repossess the group and continue its delivery until a future date.

PLYMOUTH MANUFACTURING GROUP

- Supported by 59 Members
- Creators of £1.6bn Collective Turnover
- Employing 12,000-13,000 workers
- Contributing to £759m GVA
- Rotating chairman – Previous have included directors of Kawasaki Machinery UK & Pipex px
- Contains constitution; reviewed regularly
- Membership costs up to £590p.a.
- Plymouth is highest manufacturing employment city in UK south of Midlands

WHAT HAPPENS AT A MANUFACTURING GROUP?

WHO IS INVITED TO A MANUFACTURING GROUP?

Manufacturing Groups require the collective efforts of multiple sectors, not just manufacturers, including academia, the public sector and funding partners. Other industries to invite, include:

Researchers & Academia: Establish new collaborative research opportunities between industry and researchers, accelerating innovation. Discover new apprenticeship and worker development opportunities.

Public Sector: Raise awareness for local initiatives and businesses in need of support

Keystone Institutes: Develop unique skill sets and raise awareness of innovative technologies available to use for prototyping and gain access to large supply chains.

Funding Providers: Discover new funding pots available for businesses and provide opportunities to improve bid writing skills.

Cross Sector Organisations: Invite members of the digital tech and creative sectors to support the integration to Industry 4.0 and access cross-sector innovation opportunities.

THE ACTIVITIES OF A MANUFACTURING GROUP

Manufacturing Groups can be as structured or as informal as desired by the host of the session. All Manufacturing Groups however must provide organisations with a tour of the premises and an opportunity to open a forum to attendees to discuss best practice and their challenges and opportunities within the business environment.

Fig. 1 shows the range of activities that can be delivered within Manufacturing Groups, with the tables below giving a short summary of those activities.

Figure 1- Components of a Manufacturing Group

Topic	Activity	Description
Space & Incubation	Space to Grow	Discover new opportunities to expand the business within the region. Learn of new construction projects and redevelopment of existing space.
	Sharing of Assets	Connect with other organisations to share the use of assets, including workers, machinery and land.
	Tenancy Opportunities	Meet with incubator and business park directors to learn of the low-cost opportunities available to businesses in the region.
	Access to Public Sector & Funding	Engage with the public sector to learn of support available to find new space, and the funding sector to learn how to write a bid to fund expansion.

Topic	Activity	Description
Supply Chains & Networks	Public Sector Engagement	Meet with the public sector to learn of organisations looking for new customers and suppliers and hear of future opportunities to engage in industry leader supply chains.
	Cross-Sector Collaborations	Be told how other organisations have collaborated with businesses in other sectors to access new opportunities
	Discover Local Champions	Meet industry leaders and local champions. Integrate into supply chain, or embed the local champions within an existing supply chain

Topic	Activity	Description
Skills & Leadership	Leadership and Management Talks	Presentations delivered during the session allow the exploration of what makes a good leader and manager. What training is available to businesses?
	Comparative Advantage, Building on History & Heritage	Discuss the existing skills and comparative advantages held by businesses and how they can be excelled through effective leadership
	Mentoring and Shadowing	Create opportunities for junior members of organisations to work alongside senior leaders to learn and create a community for learning.

Topic	Activity	Description
Sustainability & Carbon Reduction	Carbon Reduction Funding Support	Have businesses interact with partners knowledgeable in funding available for carbon reduction, such as BeeAnglia.
	Green Benchmark	Distribute 'Green Benchmarks' to businesses attending sessions to discover the journey of becoming truly sustainable.
	Sharing Best Practice & Learning New Techniques	Through the tours delivered during Manufacturing Groups, questions and discussions will be created, learning new ways of reducing the carbon footprint.

Topic	Activity	Description
Competitiveness & Trade	Access to International Ambassadors	Provide manufacturing businesses with the opportunity to meet with industry leaders and local champions actively exporting and learn how their journey can be replicated.
	Discover Growing Markets & New Opportunities	Through conversation with attendees at a group, opportunities into new markets can be realised, and introductions to relevant contacts created.
	Learn of New Tariffs and Export Charges	Presentations delivered at manufacturing groups can include the DIT, and provide information to attendees on the latest tariff and export changes

Topic	Activity	Description
Innovation and Commercialisation	Collaboration Opportunities	Businesses will meet with others not typically engaged with and create new opportunities to collaborate and develop new projects within the region.
	Access New Markets in Emerging Sectors	Businesses engaging in the cleantech, biotech or life sciences sectors and attending manufacturing groups can gain access to manufacturers and enter emerging sectors such as biocomposites, battery storage and quantum technology.
	R&D Tax Credit Support	A limited number of finance businesses should be invited to the group to allow support when accessing R&D tax credits, alongside other financial services required
	Discover Prototyping Opportunities	Prototyping opportunities can become available to SMEs when meeting with industry leaders, providing smaller businesses with the opportunity to test new technology before significant investment

Topic	Activity	Description
Productivity & Performance	Lean Training	Lean training presentations can be delivered to the attendees of manufacturing groups, providing snapshots of insight into tools being used by productive leaders such as Toyota
	Best Practice Tours	Tours given during Manufacturing Groups allow best practice to be discussed and for problems being experienced within other organisations to be actioned.
	Access to New Technology	Through the tours delivered by the host business, SMEs will gain access to new and different technology not currently in use. The hosts may provide the opportunity for others to test the technology, streamlining the investment process.

WHERE WILL FUTURE GROUPS BE LOCATED?

HOW TO IDENTIFY NEW GROUPS?

When creating new manufacturing groups, it must be considered where clusters of industry, research and support are located, as each are paramount to the success of the group. As discussed in Developing Manufacturing Groups, mapping must be performed to identify the recognisable industrial estates, science parks and industry leaders which will host the sessions of the group.

Mapping has already been coordinated by the Hethel Innovation team, and the recognised areas for Manufacturing Groups can be seen in Fig. 2, including the likes of Peterborough, Cambridge, Huntingdon and Fenland. These sites have been identified due to their geographical location featuring a high concentration of manufacturing businesses and the close proximity to a variety of academia and researchers.

The St Neots Masterplan

Cambridgeshire already possesses a Manufacturing Group in the shape of the St Neots Masterplan. Headed by Gordon Round and David Wells, the group are passionate for the development of a local skills strategy and regularly discuss with local employers of the challenges being experienced within the region.

The group meets on a quarterly basis and involves a tour of a manufacturing premises before launching into a forum discussion.

LOCATION OF FUTURE GROUPS

As can be seen in Fig. 2, 6 initial Manufacturing Groups have been identified for formation. The white line between circles shows a major road connection linking the two manufacturing regions. If demand for the groups outgrows capacity, then these connections will be removed and split to create 10 different Manufacturing Groups.

Each Manufacturing Group identified possesses keystone businesses in the region, access to a support partner, similar to that of Opportunity Peterborough, links to academia, and manufacturing businesses situated in and around industrial estates.

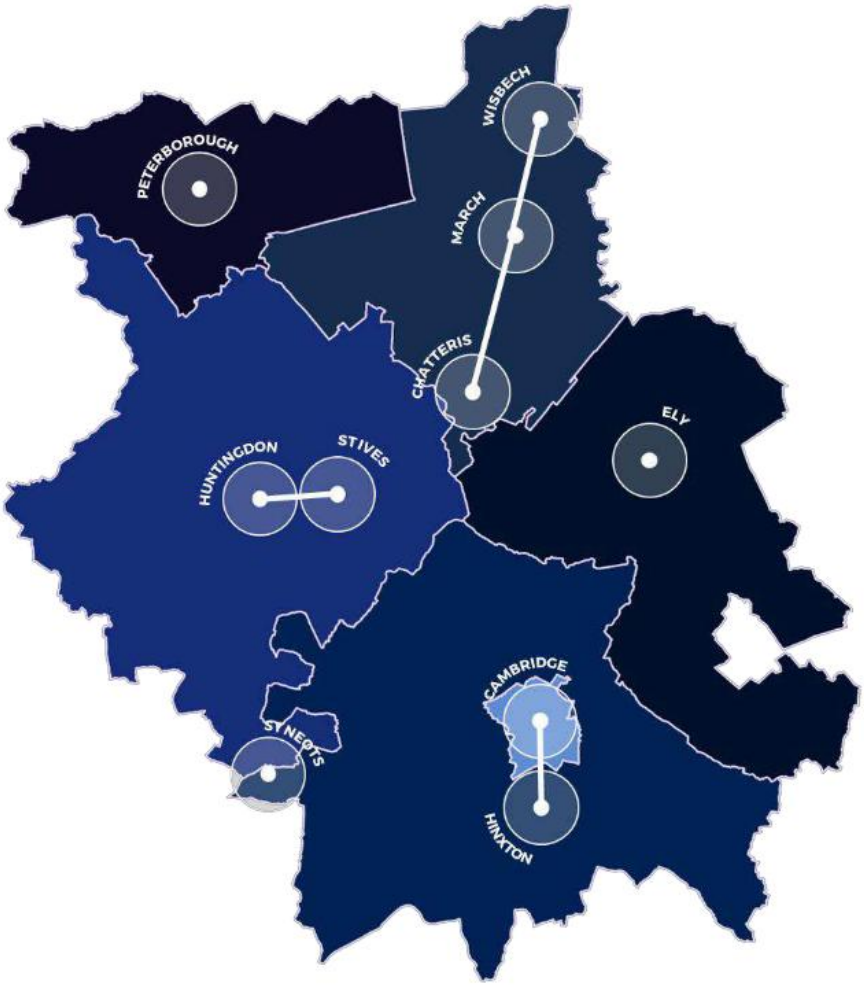


Figure 2 – Recommended Sites for Manufacturing Groups

NORWICH MANUFACTURING GROUP

- Established in 2016
- Delivered quarterly at manufacturing sites
- Meetings see attendance of around 40
- Digital and tech sector welcomed to discuss Industry 4.0
- 20 collaborations created over 12 meetings
- Competencies of members available on website

REALISING HIDDEN GEMS

"The Manufacturing Groups are a great opportunity to learn of businesses you never knew existed. There are some great things going on in corners of industrial estates you had never heard about!"

- Richard Seager (Thurne)

(Member of Norwich Manufacturing Group)

Recommendation

Develop manufacturing groups across Cambridgeshire & Peterborough to drive place-based growth and collaboration

LEADERS FORUMS

WHAT IS A LEADERS FORUM?

A Leaders Forum is a group of pre-selected members that meet often, usually quarterly or bi-annually, with the intention of facilitating the growth of the selected sector in their region. We are suggesting the formation of three Leaders Forums:

- The Cambridgeshire Advanced Manufacturing and Materials Leaders Forum
- The Peterborough Advanced Manufacturing and Materials Leaders Forum
- The Huntingdon Advanced Manufacturing and Materials Leaders Forum

The creation of three forums to cover the whole area governed under the Cambridgeshire and Peterborough Combined Authority removes the need for extended travel by members and allows agendas to be customised for each area within the region. Despite this, it is integral that there remains a means for connection between the three to allow for collaboration and other opportunities to be identified. For example, should a member of the Cambridgeshire board wish to attend a meeting of the Huntingdon forum that would not be an issue and would, in fact, be encouraged.

WHAT DO YOU DISCUSS AT A LEADERS FORUM?

One of the main benefits of a Leaders Forum Is that anything that is deemed important within the sector at that particular time can be spoken about, the agenda is informed by the chair, other members, opportunities in the area and continuation of topics from previous meetings. We have created a list of strategic questions that could be used to inform a Leaders Forum:

1. Who are our **ambassadors/early adopters**?
2. Where are our **demonstrators**?
3. Where are the **investment/funding** opportunities?
4. Who is **commercialising**/where are the **opportunities**?
5. Where is the **innovation**?
6. Future gazing
7. What **platforms** exist/are in development?
8. How is the region **growing**?
9. How are we **supporting** businesses (and the Forum)?
10. How can we encourage **businesses** to come to Cambridgeshire and Peterborough?
11. What **training** opportunities are there ono the journey?
12. How is our network **growing**?

By answering these questions, you are ensuring that those attending the forum are staying on topic and always looking forward to where the AMM sector could go in the region. It is important that the Leaders Forum is elevated from a manufacturing group, the people attending are local champions and interested in growing the sector as a whole, not just sharing best practice to grow their business. Collaboration is key here. However, as said before, the agenda should be informed by those present, it probably will not involve the answers to those questions every time. Something that can also work quite well is inviting speakers to your Forums. These might be external businesses, representatives from research institutes or academia or even students. It is always useful to get a fresh perspective and can trigger conversations and actions for future opportunities.

WHO ATTENDS A LEADERS FORUM?

A Leaders Forum should be majority private businesses as these are the people who will be interested in, and benefit from, the growth of the AMM sector directly. That does not mean you have to include every AMM business' CEO in the meetings. It may be a member of staff at a lower management level who has more time to spare but is really focused on the growth of the sector and can contribute innovative ideas to conversation. Although businesses will form the majority of the Leaders Forum it is important to include those in the public sector who can contribute to the growth of the sector. This could include government or council representatives, researchers, academics or funding body representatives. These people may be able to bring an outside perspective identifying opportunities for innovation, collaboration and expansion of the AMM sector in the region. It is also valuable to

have participants from other sectors who may be able to identify opportunities for cross-sector collaboration and skills provision.

As mentioned before, though we recommend the formation of three Leaders Forums across the Cambridgeshire and Peterborough Combined Authority area, it may be beneficial to invite visionaries from across the whole region to contribute to recognise areas for collaboration.

WHO FACILITATES A LEADERS FORUM?

A Leaders Forum usually has two positions of leadership; the Chair and the Facilitator. We would recommend that the facilitator remains the same for the three Forums. This gives more symmetry to the Forums in the region and having the same facilitator for all meetings means they are more likely to spot opportunities for collaboration and common threads throughout the three meetings. The facilitator would be in charge of all communication to attendees as well as the organisation and logistics of meetings. We have collated some questions that would allow the facilitator to complete their job in a progressive way:

1. Where were we **hosted** last time, will it be the same again?
2. Do you have **photos**?
3. Have you posted on **social media**?
4. Have you got **action-focused minutes**?
5. Have you sent a **follow up/thank you**?
6. Do I address every **board member**?
7. Do you have a **strategy** for the next two meetings?
8. Do you have a clear **focus**?

Arguably, one of the most important roles of a facilitator is the write up and distribution of minutes following each meeting. These minutes should be organised by theme and action focused. If a discussion point did not warrant an action it may not need to be included. The facilitator may follow up on many of the actions themselves but would also be in charge of delegating actions to appropriate board members. It is common for a facilitator to be from an external organisation, rather than another board member, for example Hethel Innovation facilitate Leaders Forums for Biotechnology, Clean Technology and Manufacturing and Engineering in New Anglia.

The Chair of the Leaders Forum does a similar job to any chair at a board meeting, they introduce the points that are to be discussed move the meeting along and identify points of interest that can be followed up by the facilitator. It is important for the chair to engage with all members present to ensure all opportunities for growth are being explored.

HOW DO YOU MEASURE THE SUCCESS OF A LEADERS FORUM?

The purpose of a Leaders Forum, as specified, is to grow the sector within the region, contributing to better productivity, higher levels of collaboration and greater output of commercial products. It may be useful to have an annual report on what the Forum has achieved using solid measures. To break this down we have categorised the five objectives of a Leaders Forum and how you can measure the success of them quantitively:

SOLUTIONS

Gathering leaders from the AMM sector and beyond to address issues within the region is an effective way of finding innovative solutions to problems.

COLLABORATIONS

Having a large proportion of businesses can give way to solutions that involve the collaboration of these AMM companies. Gathering experts from across various sectors can help to encourage cross-sector collaboration and drive innovation and growth within the region.

IDEAS

A fresh outlook on a situation can often help provide new ideas. Leaders Forums can often provide alternative ideas as often people are looking at a problem from different angles. This is why bringing in a large variety of people is so important.

GROWTH

Fresh ideas and innovative solutions and strategies can allow increased growth within companies, networks and regions. This can be measured by an increase in company size or GVA/GDP.

BUSINESS OPPORTUNITIES

Round Table discussions, like those facilitated during a Leaders Forum, should lead to business ideas or those involved. Businesses want to get tangible results from events/opportunities and making sure the right people are brought into Forums can help create these opportunities.

HOW DOES THE FORMATION OF A LEADERS FORUM CONTRIBUTE TO THE OTHER RECOMMENDATIONS IN THIS STRATEGY?

In this strategy the first two recommendations are the formation of a region-wide Advanced Manufacturing and Materials network and coordinating local manufacturing groups. We suggest that the regional Leaders Forums are made up of businesses that attend the local manufacturing groups and that their agendas are influenced by discussion and opportunities that are brought up at these groups. By working collaboratively, through the facilitator, you are ensuring that all challenges across the Cambridgeshire and Peterborough area are being solved and all opportunities being taking advantage of.

Another of our recommendations is to ensure that the skills gap is identified, and measures are taken to close this. Businesses at both manufacturing groups and Leaders Forum will be able to feed back any issues they may be having with low-skilled workers and Leaders Forums can take measures to solve these such as events, training and workshops to be help in the respective regions. The gathering of local champions from businesses also means that knowledge transfer between organisations, another of our recommendations, is much more likely.

By giving the opportunity to staff at local companies to join the conversation in these Leaders Forums you are also aligning to the recommendation of growing local leaders. As members continue to talk with each other they are able to learn from best practice in other organisations and gain skills they may not have the opportunity to in their own companies. You are also giving them a wider outlook on how the sector can grow, gaining connections with investors, training providers and local government agencies that they can take back to their own companies.

Lastly, in this strategy we have recommended the formation of both innovation platforms and emerging technology groups. Leaders Forums are the perfect environment where the topics of such groups can be brainstormed. These may come out of practices that a particularly innovative business is already completing that others should be learning about (solution-led) or could come from a problem that is being faced in that area or even across the region (challenge-led). The end-goal would be that each member of the Leaders Forum would be an ambassador for a technology group or innovation platform, pushing the design and technology area of this sector to its limits and establishing the area further as an innovation hub.

'MAKE-IT' SPACES: MANUFACTURING INNOVATION DISTRICTS

A Manufacturing Innovation District, or 'Make-It Space' is a cluster of manufacturing hubs within a region that provides collective strength for the sector. A collection of different organisations, infrastructure and support is required to maximise the effectiveness of a Make-It Space, and each have a pivotal role to play to accelerate the development of supply chains and sharing of knowledge.

IDENTIFYING MAKE IT SPACES

COMPLIMENTING CAMBRIDGE'S RESEARCH STRENGTHS

Cambridge has the fastest growing economy in the UK. This is caused by the city's world-leading research base creating significant value for businesses in the surrounding science parks, incubators and accelerators. With an unemployment rate of 3% compared to the national average of 4%, the city is booming, with it having one of the highest postgraduate residency levels in the country. The high value work and research being performed out of the city can reach out to surrounding hubs, tap into competitive capabilities and reach out even further into the UK.

WHAT COMPONENTS CREATE A MAKE IT SPACE?

A sophisticated physical and digital infrastructure is required in order to create an effective Make It Space. Physical infrastructure, to provide space to innovate and develop new ideas, and a digital infrastructure to allow the facilitation of collaboration and communication to be streamlined.

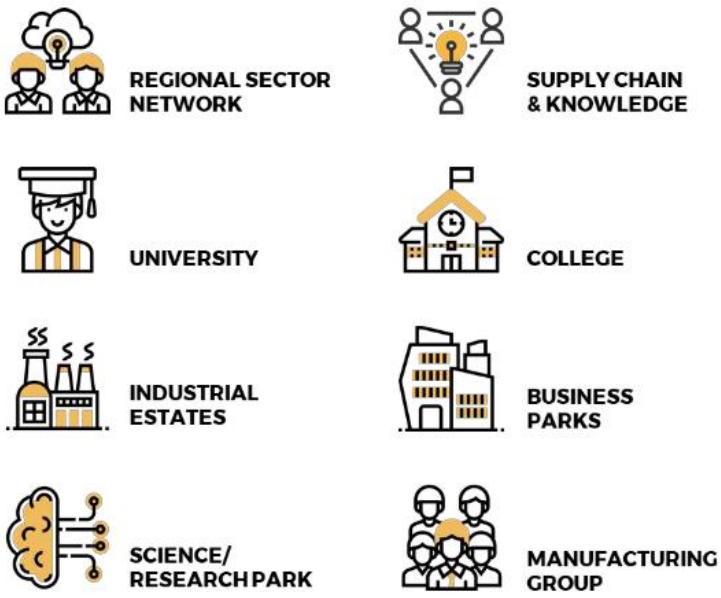


Figure 1 – Components of a Make It Space

Each of the eight components displayed in Fig. 1 have a role to play in distributing the innovation and knowledge of a sector across the region:

THE NORTHERN POWERHOUSE

The Northern Powerhouse is made up of the regions of Liverpool, Manchester, Leeds, Sheffield, Hull, and the North East.

- 23 universities
- 13.3% contribution to the UK's GVA (compared to London's 24.5%)
- Home to 10.7 million people
- Manufacturing was worth £46 billion in the North in 2014 (over a quarter of the UK's total manufacturing output)
- Over 650,000 cars were manufactured in the Northern Powerhouse in 2015

CAMBRIDGE AND PETERBOROUGH HUBS FOR 'MAKE IT' SPACES

There are approximately 2,659 manufacturing businesses in the region. Heatmapping has been performed showing significant concentration in Cambridge and Peterborough.

Regional Sector Networks: Regional Sector Networks act as the mediators for Make It Spaces, bringing together different parties to undertake new research projects and develop new innovative ideas. The network benefits from having an extensive list of contacts, mapping of academic and business infrastructure, and awareness of future opportunities available in many different markets. The network is the party introducing the project members, activating the knowledge and supply chain to spill into hubs across the region, back into Cambridge and out into the UK. Regional Sector Networks will also act within the Make It Spaces to engage SMEs less likely to access support and interact with researchers, encouraging knowledge and supply chains to expand out of the Cambridge Cluster.

Supply Chain & Knowledge: The purpose of a Make It Space is to encourage Supply Chains and Knowledge not only to spill out into the hubs with Cambridgeshire and Peterborough, but also in further regions of the UK. However, if the Supply Chain and Knowledge does not stem back into the Cambridge Cluster, then there is no benefit for Cambridge to support the surrounding area. By giving back sector specialities, supply chain relationships and knowledge back into the city, research can be advanced even further, accelerating the ability for Cambridgeshire and Peterborough to become a manufacturing powerhouse, similar to that of the Northern Powerhouse or the Midland Engine.

University: Cambridge is home to the UK's best university. Boasting a heritage of over 800 years, the university specialises in research which could support the development of Cambridgeshire and Peterborough's manufacturing industry accessing new emerging markets, such as robotics, clean technologies and biotech. The graduates that finish their studies with the university will have the opportunity to work for manufacturers, innovate and create opportunities to access new markets. Cambridge's institute for Manufacturing is a designated engineering school which prides itself with delivering revolutionary training programmes to Cambridgeshire and beyond. The knowledge created through these graduates will spread across the region, throughout the UK, and transfer back into the Cambridge knowledge economy.

College: It is widely regarded by manufacturers and engineers that there is a skills gap. A common complaint is that many engineering graduates come out of university without technical skills; by developing the interest in STEM and engineering at an early age at college, the knowledge and skills developed in future will have a greater effect to drive the knowledge and supply chains of the region. Utilisation of apprenticeships and degree apprenticeships will allow young students to develop skills for the future, giving them the power to pick and choose their role as their skills stand above other young engineers. The skills developed at an early age will be mastered as they gain experience in employment and contribute more effectively to their employing organisation. The mastered skills will allow young workers to contribute more to the future of the business and allow new engineering and operational techniques to be explored, advancing the business. These comparative advantages developed will allow integration into new supply chains across the region and UK, accessing new opportunities, and the ability to embed local partners in alongside. All sector specialities developed by young engineers will feed knowledge into Cambridge, allowing more extensive research projects to be performed, further enhancing the knowledge of the region.

Industrial Estates & Business Parks: Housing the majority of the region's manufacturing and engineering businesses, industrial estates and business parks will act as individual hubs where sector specialities will begin to be recognised. The industrial estates and business parks will be introduced to researchers coming out of Cambridge by the regional sector network, and projects set within the businesses. Networks will also play the role of 'matching-making' businesses within and across regional hubs as it sets to establish cross sector innovation opportunities. Through development of supply chains, knowledge will be shared between industrial estates, business parks and the city of Cambridge, building a stronger collective sector speciality. Research in the city of Cambridge will be engaged following an increased need to commercialise the findings and launch new businesses out of the hubs.

Science Parks: Built upon a strong science infrastructure, Cambridge's many science parks have already contributed to the Cambridge Phenomena, the accelerated development of new businesses out of Cambridge around 50 years ago. Conducting the research to develop the knowledge to be shared within businesses, science parks will act as the collaborating hub of the Make It Space, connecting experts to industry; creating new opportunities into emerging markets, such as Clean and Bio-Technologies. Entering the markets early will allow the businesses in the surrounding hubs to benefit from a first-mover advantage, establishing themselves in the market and cementing their position. Once established in their respective markets, businesses which have benefitted from research support from science parks will be able to dictate their supply chains more effectively, managing their chosen suppliers. The supply chain can remain local, retaining expert knowledge, or expand further to benefit from external variables, such as currency fluctuations. Knowledge will continue to be shared throughout the region as the sector specialities are built upon and explored further.

Manufacturing Groups: The Manufacturing Groups conducted by the regional sector network will allow manufacturers, engineers, academia, researchers and the public sector to meet on a quarterly basis and explore the challenges and opportunities being experienced in the present business environment. These meetings allow the chance for internal business problems to be overcome as best practice is discussed, and for opportunities to be realised as connections with researchers are established. By making connections which overcome barriers to growth, and satisfy access to opportunities, the existing sector specialities will grow greater, sharing knowledge and developing supply chains across the region.

The transferring of knowledge and supply chains within and outside of Cambridgeshire can be seen in Fig. 2.

WHERE WILL THE MANUFACTURING HUBS BE LOCATED WITHIN THE 'MAKE IT' SPACE?

For 'Make It' Spaces to be successful, each manufacturing innovation hub will need to contribute to the collective gain of the region. The knowledge shared between science parks, industrial estates and business parks should be encouraged, and supply chains transparent, allowing the identification of weak links in supply chains to be actioned.

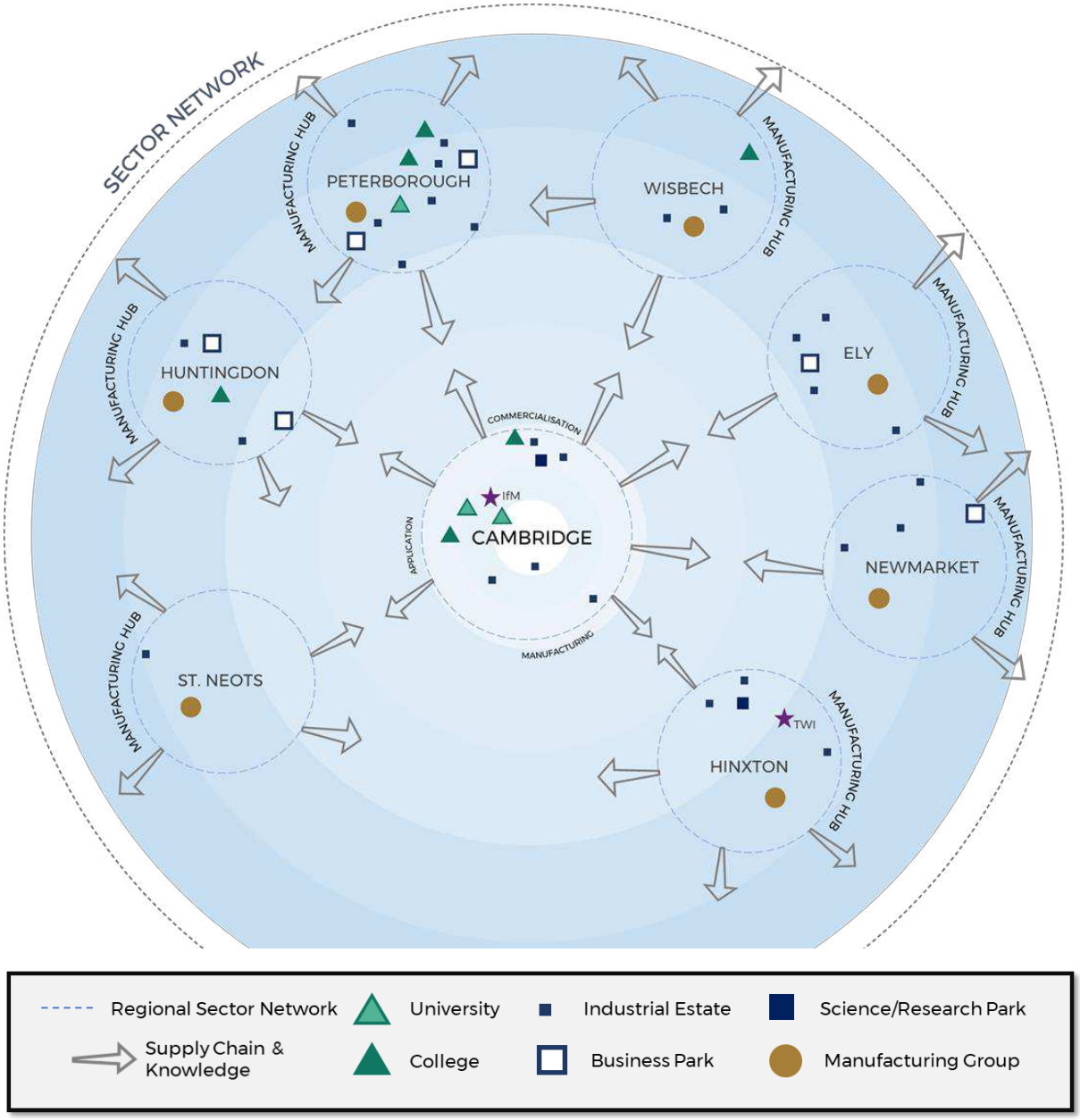


Figure 2 – Components and Locations of a Make It Space

Fig. 2 shows a number of possible manufacturing innovation hubs which could contribute to creating 'Make It' spaces, including established manufacturing locations, such as Peterborough, through to emerging manufacturing regions such as Huntingdon, Ely and Hinxton.

The purpose of 'Make It' spaces are also to accelerate the rate at which research can be commercialised, spinning out businesses across the region, applying a multiplier effect for research and the development of sector specialities. Looking at the locations in Fig. 2, certain hubs will be better equipped to develop sector speciality, due to an increased academia and research presence. However, the role of the regional support network will act as a mediator to connect businesses in industrial estates far from research, overcoming the distance barrier and inability to meet the relevant researcher.

The locations suggested in Fig. 2 will also see the formation of Manufacturing Groups to support the development of 'Make It' spaces. By creating opportunities for businesses to network and connect with likeminded manufacturers, stronger local supply chains can be developed; accelerating sector specialities in the region.

UK Industrial Strategy

The creation and development of Make It Spaces aligns to the UK Government's Industrial Strategy due to a focus being placed upon innovation clusters across the UK.

"Innovation clusters will form and grow around our universities and research organisations, bringing together world-class research, business expertise and entrepreneurial drive. These clusters can create thousands of skilled jobs in R&D, innovation and wider sectors, driven by the growth in science, technology, engineering and maths (STEM) skills led by new teachers and more doctorates."

Recommendation

Form and brand 'make-it' spaces as places to commercialise products (design, prototype, manufacture and scale-up)

Recommendation

Develop 'make-it' clusters/districts with key LaunchPad sites and strategic satellite locations, i.e. catapult centres, centres of excellence, research institutions etc.

Recommendation

Create a capacity utilisation program around 'make-it' clusters to maximise productivity (via an online platform)

SUPPLY CHAIN DEVELOPMENT

Cambridge's significant strengths in research and development make the region an attractive location for manufacturers and engineers to expand into. With every new business that moves to the region, so too does it's supply chains. Through the creation of a recognised supply chain development programme, businesses in Cambridgeshire and Peterborough can benefit from connecting with local suppliers and becoming more competitive on the domestic and international stage.

Figure 1 – Supply Chain Development Journey

Figure 1 shows the six steps that businesses must review to develop effective supply chains. This journey, which can be self-reviewed through a benchmark or through a day long workshop, will allow SMEs to position themselves more competitively, integrate into industry leading supply chains, and create new innovative ways on engaging and supplying clients.

WHAT IS THE SUPPLY CHAIN DEVELOPMENT JOURNEY?

1. Organisation and Culture:

Before a business can begin to think about integrating into industry leading supply chains or to develop new supply chains of their own, research must be carried out to review the organisational readiness to engage with clients and suppliers.

Through organisational benchmarking businesses will be able to identify barriers which could prevent them from accessing new opportunities; saving the business financial, human and time resources designated to pursue new business. Like the Productivity Journey, businesses must understand where the business is positioned before a strategy can be created.

2. Quality Management:

Once a plan has been created to overcome the organisational and cultural barriers which could prevent the business from accessing new opportunities, the quality standards of the supply chain must be reviewed. From both an internal and external perspective, the quality management stage provides businesses with tools to identify how they themselves, as well as suppliers, are managing quality throughout the supply chain.

Here, lean principles are introduced, with training and workshops available for businesses to improve the efficiency of day-to-day operations; continuously finding new solutions to increase quality and reduce lead times. The lean tools introduced at this stage will allow businesses to better manage their processes and introduce new quality control and assurance methods.

3. Cost Management:

As a business becomes leaner, it is able to increase the rate at which it creates goods, therefore, it is able to fulfil a greater amount of orders; increasing revenue. Businesses must be able to position themselves effectively within the market and not undercut or overprice themselves.

During this stage, a pricing plan is created, utilising the competitive strengths created from becoming a lean manufacturer.

A plan is also created to review and compare potential new businesses seeking to integrate into established supply chains. By creating a client costings plan, it reduces the resources allocated to forming supply chains, and through digitisation, creates time for office staff to focus on other tasks.

4. Delivery Management:

At this stage, the business involved in the supply chain development programme has reviewed its steps to overcome organisational and cultural barriers, leaned its production capabilities, and created a costing plan for new entrants into the supply chain. It has not however realised the steps it must take to deliver the goods to the right client at the right time.

Delivery management will allow businesses to perform process mapping, identifying ways of streamlining, removing or combining processes in the logistics of fulfilling an order. These interactive sessions bring together multiple businesses allowing the sharing of best practice to discover new ways of operating.

5. Sustainability:

As consumers become more environmentally conscious and demand businesses to act in the same manner, efforts must be increased to improve the sustainability of the business' logistics and operations. Through use of a Sustainability Benchmark, businesses will be able to identify solutions which can reduce energy costs, reduce the carbon footprint and utilise local businesses to supply goods.

The principles of lean will again be focused upon, with increased attention placed upon the reduction of financial, physical and time-based wastes.

6. Innovation:

Following the creation of a sustainability plan to reduce the carbon footprint of the business' logistics, an Innovation Thinking session will be delivered, introducing interactive tools and activities to accelerate the implementation of innovative operational processes.

The Innovation Thinking session will again bring together cross-sector organisations to discuss existing operational practices, and how technology has been used to accelerate growth. Tools such as Border Crossing and the Innovation Statement will be delivered to businesses to realise their true innovative potential.

Implementing the Journey

The supply chain development journey is a process which should be repeated on a regular basis and should follow the lean mindset of seeking perfection and continuously improving. By performing the steps of the journey, businesses will be in a greater position to enter existing supply chains managed by industry leaders, or to create supply chains of their own.

BRITISH SUGARS EXTENSIVE SUPPLY CHAIN

Cambridgeshire and Peterborough are home to the nations largest sugar manufacturers: British Sugar.

The British sugar industry is the lowest cost sugar industry in the world. This is partly due to the strength of UK supply chains driving costs down.

- British Sugar work with over 3,000 farmers to grow sugar beets.
- Beets are processed at one of four UK plants
- Refined sugar is shipped across the UK as both industrial British Sugar and commercial Silver Spoon.
- They are then exported to other nations or delivered to domestic supermarket chains.

British Sugar support 3,000 farms through its supply chains, creating 9,500 jobs.

Recommendation

Develop supply chains in to Cambridgeshire and across the UK via delivery of a supply chain development journey, through a manufacturing network

STRENGTHS & OPPORTUNITIES

HERITAGE AND HISTORY OF CAMBRIDGESHIRE

Cambridgeshire is one of the most known counties in England due to Cambridge University as being one of the most ancient of European universities and is a world-renowned university internationally. Cambridgeshire consists of three main cities which are; Cambridge, Peterborough, and Ely. Cambridge being the most popular and there are over 5000 hi-tech companies founded in the city and employing 40,000 people. Peterborough has been ranked 5th amongst the top 10 UK cities predicted to dominate the UK tech scene over the next few years. This has been strengthened by recent infrastructure created to support tech businesses. The historic Fenland city of Ely and is home to one of the most important cathedrals in the country.

The Cambridge Phenomenon, a term first coined by Peta Levi in a Financial Times article in November 1980, describes the incredible explosion of technology, life sciences and service companies that has occurred in the city since 1960. Cambridge's rich history has set the scene for the development of high-tech clusters, making the city one of the world's most enterprising networks of people and companies.

Cambridgeshire history features Cambridge University and manufacturing heritage. Going over how the university have impacted and changed not only the county, or the UK, but worldwide. History of manufacturing at Cambridge consisted of three organisations that changed and improve manufacturing and engineering and they are; Institute for Manufacturing (IFM), Perkins and The Welding Institute (TWI).

IFM is part of the University if Cambridge's Department of Engineering, it is a world-leading research that aims to educate students to create manufacturing leaders of the future and research work is based on wide range of manufacturing-related topics. IMF has been in place for 50 years and have changed and educated many students.

Perkins has 85 years of experience and is one of the world's leading provider or diesel and gas engines. They have 100 trained distributors delivering the right engine and aftermarket service solution. Perkins have been with Caterpillar since 1997, creating the world's largest diesel engines manufacturer.

TWI's specialty is in welding and they are research and technology organisation. They are known to be the world's largest provider of welding technology and inspection with training related for individuals and companies too. 200,000 students every year benefits from their comprehensive training programmes.

CAMBRIDGE UNIVERSITY

Cambridgeshire's university sector has a rich history, and the knowledge from these institutions sets the foundation of the region's commercial success. Cambridge's history and influence has made it one of the most prestigious universities in the world.

In 1209, the town of Cambridge became inextricably linked with its historic university. The first college was founded in 1284, with more colleges added over the following 400-500 years. From 1869, Cambridge University embarked on another period of expansion. In that year, Girton was established as the first women-only college. From 1945, the university experienced further expansion.

Between 1882-1939, it was a period divided naturally into two by the First World War. The War had profound effects on the life of the University, and it was among on the places for general state aid. One of the major changes was the broadening horizon and awakened the university's

Timeline

1209	Established scholars settled in Cambridge . The beginning of University of Cambridge
1534	First hi-tech company founded in Cambridge – University Press (oldest publishing house in the world)
1858	John Ruskin opens Cambridge School of Art (later Anglia Ruskin University)
1896	Cambridge University establishes first women only college
1893	electricity was generated in the city for the very first time.
1975	Establishment of Cambridge Science Park by Trinity College
1992	Anglia Polytechnic university founded
2005	Anglia Polytechnic becomes Anglia Ruskin University
2006	Cambridge Enterprise is formed
2016	Launch of Innovation Lab in Allia Future Business Centre

sense that Cambridge had duties to its wider community both in England and outside of it. The university developed extension and affiliated local colleges in England, and this was the growth of a new international consciousness, leading to the encouragement of overseas students through the award of research degrees (British History, 1959).

The university is known for speciality in Physics, Chemistry, Biology, Maths, Computer, Engineering and Technology. From this created talented and intellectual achievement of some of its famous students such as Charles Darwin, Ernest Rutherford, Oliver Cromwell, Stephen Hawking, David Attenborough, and Charles, Prince of Wales.

The innovative and entrepreneurial spirit of the members of the University of Cambridge is due to the university's vision and mission statement. The university is the first world university to introduce Computer Science degree program. The first Computer Science degree allowed students to be innovative and creative, producing some of the world known companies such as ARM, RuneScape and Raspberry Pi (Cambridge Phenomena, 2016).

Today the university have 31 colleges and over 13,000 students. They are undertaking major expansion to further the north-west of Cambridge and transform a 150-hectare site into a new district that is part of the university and the city. The expansion aims to provide the right facilities to attract and retain the best staff and researchers across the world (Cambridge University, 2019).

INSTITUTE FOR MANUFACTURING (IFM) AND CAMBRIDGE

IFM started off from James Stuart, Professor of Engineering at Cambridge, he created workshops for his students in a wooden hut when he saw inadequate teaching facilities. He inspired everyone with his wilful spirit that created the story of manufacturing in Cambridge.

In the 1950s Britain accounted third of the national output from manufacturing and employed 40 percent of the workforce. This helped rebuild Britain was the post war, however, due to the lack of serios competition at that time and less incentive for companies to modernise their factories or improve workers skills that cause lagging productivity and decline on the county's contribution to the share of world export market.

The Advanced Course in Production Methods and Management (ACPMM) was created by Sir William Hawthorne, John Reddaway and David Marples to emulate professional work rather than student tasks. The course involved intense training for two-three weeks of projects in factories across the country with lectures from professionals and academics too. In 1987, ACPMM was changed into Advanced Course in Design, Manufacture and Management (ACDMM), this was in due to the growing recognition of the importance of design as a competitive advantage. Later in the 1970s, the course was introduced to University of Lancaster and then Durham after to expand Britain's expertise.

The course was renamed again in 2004 as Industrial System, Manufacture and Management (ISMM) and became an MPhil. The course was reduced to nine intensive months with a major dissertation. This increased the number of students and is oversubscribed by a factor of five and attracts talented candidates all over the world.

A new course for undergraduate was established called the Production Engineering Tripos (PET). This course was first for Cambridge University, as it allowed engineering students to specialise for two years about manufacturing from both engineering and management view. In 1988 PET was changed to Manufacturing Engineering Tripos (MET).

Centre for Strategy and Performance was established by Ken Platts to give managers a set of tools and approaches they could apply in the industry. It sold 10,000 copies and this helped establish Cambridge's credentials. This approach is now widely adopted across IFM. Technology researcher Duncan McFarlane established the Cambridge Auto-ID Lab and is one of a group of seven labs worldwide. It was in this group that coined the phrase 'Internet of Things', that looked at how smart system and smart data in factories and across the supply chain can be used to create more intelligent products and services.

The creation of Industry Link Unit (ILU) was established in 1997, just a year before IfM was set up. The Gatsby Charitable Foundation previously sustained ACPMM through their financial struggles. Gatsby encouraged ILU to set up a separate University-owned company (Cambridge Manufacturing Industry Links or CMIL) through which it can generate income from the ILU's activities to fund its future research. In 2001, IfM was awarded a major grant and became one of the EPSRC's flagship Innovation Manufacturing Research Centres. IfM raised £15 million from a fundraising campaign from several its generous benefactor, this enabled IfM to build its new home. In 2009, they moved to its current purpose-built premises on the West Cambridge site. A year later, they took on the management of IdeaSpace, an innovation hub in Cambridge that provides flexible office space and networking opportunities for innovators and entrepreneurs.

Today, IfM ECS continues to grow, research into practice in redesigning 'multinational companies' operation networks and helping to develop robust innovation and technology strategies and system. They continue to plan to develop a 'scale-up centre', which is a physical space to support the transition from ideas and concept from the lab-based prototype into scalable industrial applications.

StainlessMetalcraft-https://www.ifm.eng.cam.ac.uk

Stainless Metalscraft is a British manufacturer of high specification of stainless-steel equipment. The government coordinated clean-up of 17 former nuclear sites in the UK and Metalcraft suited the role. However, to do this, they had to re-align the business strategy to compete for work. They joined CNSIG programme and was introduced to IfM. IfM helped Metalcraft on **research-based road mapping techniques** were used to update Metalcraft's **landscape**. Through IfM ECS strategy they were able to identify **three growth opportunity** in the nuclear industry. One of their critical success factors was establishing of the **High integrity Container Manufacturing Facility** at their Chatteris location.

PETERBOROUGH'S TECH STRENGTHS

Perkin's was founded in 1932 in Peterborough and its aim was to persuade manufacturers in the motor industry to take diesel engines for the cars and trucks they were producing. The company is now one of the world's leading suppliers of off-highway diesel and gas engines. The company was built by two extraordinary men; Frank Perkins and Charles Chapman. Charles was an engineer genius and was happy to be at the workshop and away from the spotlight, while Frank was in enterprising, he was this imaginative and energetic salesman. Both had complimentary talents and with their idea and vision to start on the diesel engine, which they believed could be revolutionary in the motor industry.

At the time when they had the diesel engine idea, diesel was heavy, slow-reeving workhorse which meant it had poor relation compared to the petrol engine, this concerned the motor industry. Charles had the idea of redesigning it as a high-speed unit to give it the performance just like petrol engines., which is meant lower running costs. Frank could see the effect it of the engines on the motor manufacturer, so he set out to do the marketing.

After the company was founded, its first high-speed diesel engines went out that consisted of 4 cylinders Vixen, then followed by a more powerful version called 'The Wolf'. The Motor manufacturer Humber began using the model for their Commer trucks. Perkins built their success from Humber as being the first of the Original Equipment Manufacturer (OEM).

The company produced 35 engines for trucks and car in their first year. Three year later, they became the first company to hold six world diesel speed record at Brooklands race track in Surrey. The production was moved to Eastfield site in Peterborough, however, their focus was expansion and after six years, Simpson and Co of India became the first of hundreds of licensees and distributor all over the world. Today, they have around 3500 outlets and are in 180 countries, this allows the company to remain focused on fast and efficient delivery.

PERKINS - https://www.perkins.com/

Peterborough based Perkins Engines recently revealed its latest innovation, SmartCap, a low-cost engine telematics device. The device replaces a standard oil filler cap allowing the user to track engine information and alert the user to when it requires servicing. The cap is also been used as an introduction to Perkins' service and support system.

Peterborough has been ranked 5th amongst the top 10 UK cities predicted to dominate the UK tech scene over the next few years. This has been strengthened by recent infrastructure created to support tech businesses. The Allia Innovation Lab, part of the Future Business Centre Peterborough, opened in 2016, is a facility that holds a range of gear for testing, proto-typing and simulating product ideas for local entrepreneurs and innovators.

Reference:

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https://www.perkins.com/en_GB/company/heritage/the-perkins-story.html

SMART SPECIALISATION

Smart Specialisation in a method used to identify your comparative advantages by focusing on the assets, strengths and resources of a place and how these can be used to enable new growth. It is about being visionary and forging pathways to success that make a place stand out from the crowd.

INNOVATION INFRASTRUCTURE

Cambridgeshire and Peterborough (CP) has a reputation for having significant strengths in providing innovation infrastructure. Compared to its neighbouring LEPs, there are a high number of incubators which are providing the much-needed infrastructure of start-up businesses. However, in comparison to LEPs across the UK CP is not the strongest area. Oxfordshire has a high number of RTOs, incubators, universities and catapults. The mix of infrastructure in CP does reflect the composition of the businesses. A large number of incubators has supported the expansion of start-ups and the RTO concentration contributes to the region's high spend on R&D.

A key selling point of CP is the number of science parks, focused around Cambridge. The science parks in CP have the highest proportion of businesses involved in science and innovation. When comparing to other areas, although the R&D intensity is high, the overall number of businesses on the parks is less than one might have thought. Greater Manchester, Cheshire and Warrington, Oxfordshire, Enterprise M3 and Solent all have more businesses in their science parks.

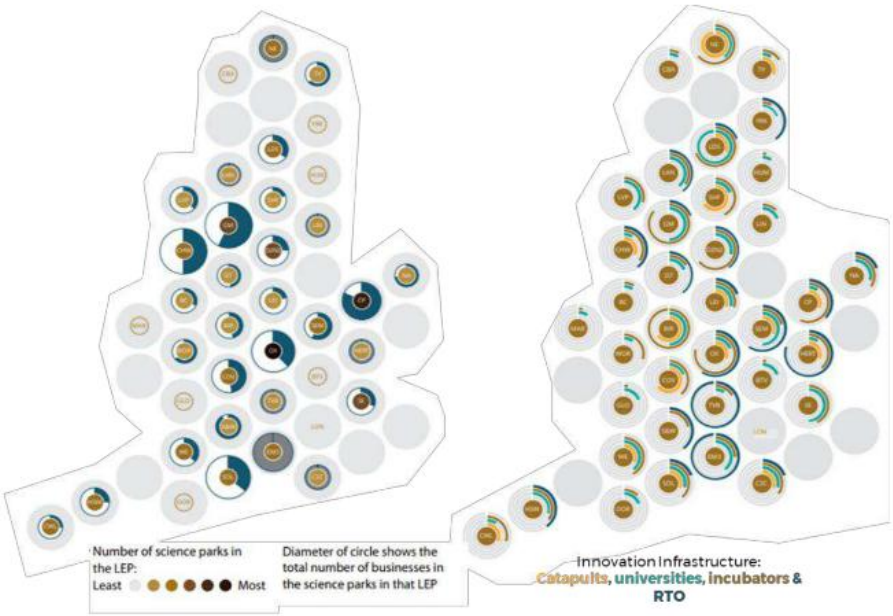


Figure 1 – Number of science parks, catapults, universities, incubators and RTO. Diagram by Smart Specialisation Hub.

CP has a relatively high number of industrial areas, but this is by no means a unique selling point. 7 other LEP regions are in the same 'high' category. There are a high number of industrial estates which are of a smaller scale than those in other LEPs. In general, northern LEPs with high number of industrial estates also have a larger geographical area given over to industrial use – this could be an area of improvement for CP as a key challenge identified is the lack of grow on space.

Enterprise zones can be a driver of business growth and scale up, providing favourable

Business numbers are **lower** than you would expect for the density of science parks. Businesses need to be **pulled** to the area as well as support for spin-out businesses from research.

Businesses want physical space to **grow**. They also need support with **scaling up**. Local businesses want to be more involved with researchers and need more opportunities for **information to be shared**.

Increasing the number of industrial estates will increase the **capacity for businesses.** Support programmes are needed alongside these to **maximise** effect.

The workforce in CP is strong but leaders for start-ups need to be **identified**.

Businesses need lower skilled, more **technical** workers.

terms on space. CP with 2 enterprise zones, has a good foundation as these are large in comparison to other regions.

As well as a lack of space to grow, there has been a consensus that scale up support is a challenge in CP. When looking at Accelerator provision, CP is ranking below the likes of Birmingham, D2N2, and Greater Manchester. Accelerators can give businesses a strong footing with businesses who take part are more likely to scale. Overall the innovation infrastructure in CP is good in comparison to the rest of the UK. The composition of the innovation organisations and the science park and incubator provision has led to an R&D intensive culture which focuses on spinning out innovations and start-ups. However, CP would benefit from looking at how these innovations are likely to grow and their requirements around support and space to grow. This could come from increasing the number of industrial estates with integrated support programs to stimulate growth and scale up.

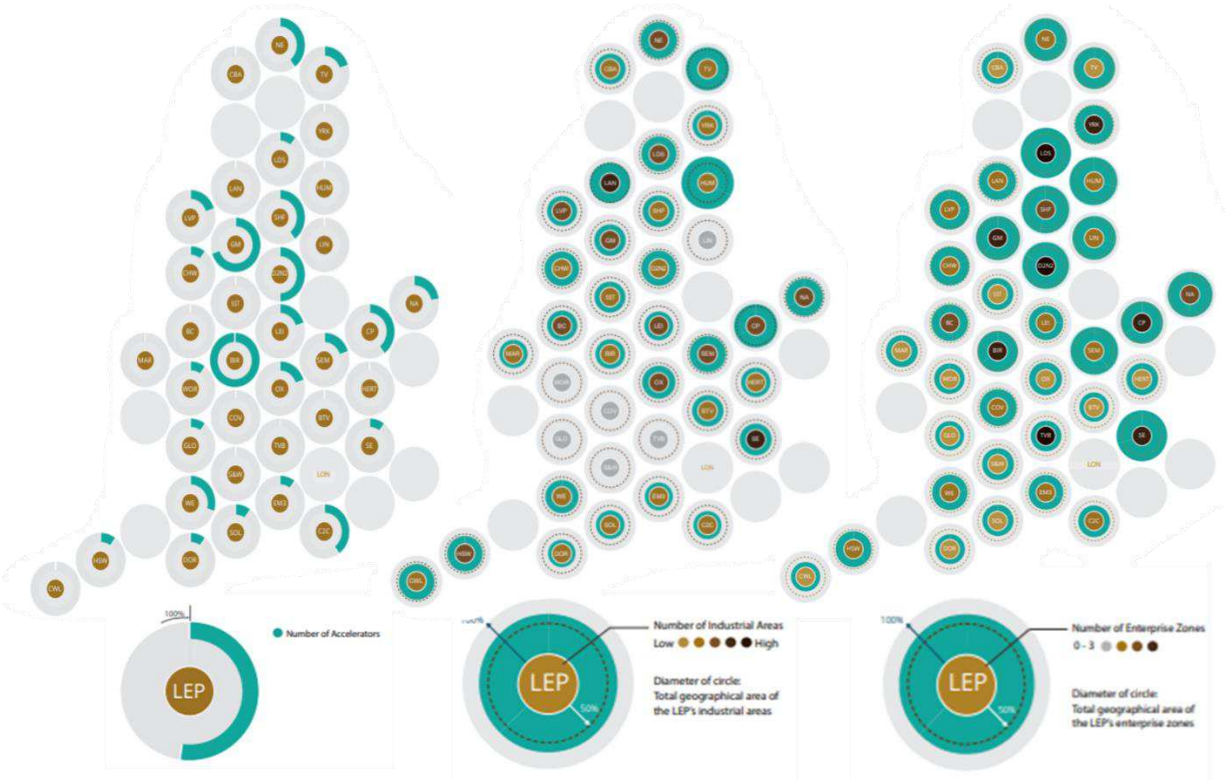


Figure 2 – Growth Potential based on Industrial Areas, Enterprise Zones and Accelerators. Diagram by Smart Specialisation Hub

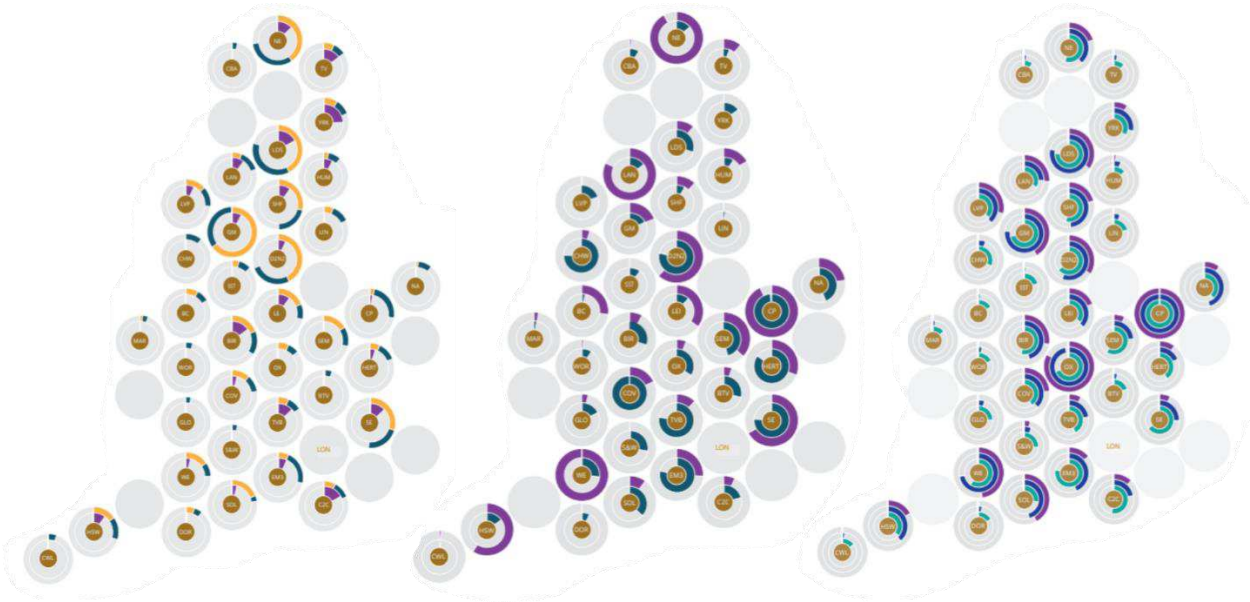
COLLABORATIVE ENVIRONMENT

There is no doubt that CP has a comparative advantage around its research base. No other LEP areas can boast the number of funded publications, research projects and organisations that CP can. The research base has huge potential to drive innovations and economic growth, is it can be coupled with enterprise to ensure the research is commercialised.

Knowledge Transfer Partnerships (KTPs) are an established mechanism to facilitate research and business collaboration. KTPs do not have to include business and research partners, however often the most successful in terms of innovation and commercialisation do. CP's universities do not undertake a large number of KTPs, being amongst the lowest performing LEPs in terms of KTPs undertaken by Universities and the proportion and KTPs involving both a business and university. This is a limiting factor of CP and will impact the impact of the knowledge and research base on the local economy. It is clear that CP universities are making a significant income from businesses and compared with the above data on the number of KTPs would suggest that those that are occurring are high value.

The local business spend on R&D in CP is high, not the highest in the UK, however it is still a key strength. The national target of 2.4% is being beaten in CP, with BERD being 3.41% of local GVA. Coventry and Warwickshire are the highest performing area with 5.97% of local GVA being spent on R&D, which could be due to the sector focus and the catapult on High Value Manufacturing.

The research base is a significant strength, but more effort needs to be placed on ensuring the impact of this excellence is felt within local businesses. KTPs are traditionally a good mechanism to transfer research knowledge into businesses, CP may see better results from a different approach. There is a high spend on R&D but without the link with the research base, this spend may not been as impactful or innovative as it could be – there must be a way to realise the full potential.



KTPs undertaken by local university
KTPs undertaken by local business
KTPS of total including both

HE income from business
Business expenditure on R&D

Funded Publications
Funded Research Projects
Funded Organisations

Figure 3 – Evidence of collaboration in the C&P. Diagrams by Smart Specialisation Hub.

INNOVATION SKILLS AND WORKFORCE

CP has a strong workforce with higher qualifications (NVQ4+), higher occupational categories (classes 1-3) and productivity. Although this is a strength and provide a pool of resources which will be able to drive growth within the region, it has been identified that businesses need lower skilled, more technical focused skills within their workforce. CP needs to ensure that all qualification levels are covered to ensure businesses in technical sectors can grow just as quickly.

A key strength of the workforce and human resource in CP is their entrepreneurial skills and ability to launch new businesses. It is the highest-ranking region in the UK for entrepreneurship, which has been aided by the Cambridge phenonium pulling in high calibre people. The business activity reflects this with a high business density and innovation activity. The start-up rates appear low, however this could be due to there already being a high number of existing businesses, so the proportion of start-ups is low. This does raise the question of whether start-up businesses should be a focus or if the comparative advantage of CP lies within the existing businesses.

The workforce of CP is highly educated and has a strong expertise in enterprise. There is a focus on start-up businesses and finding the leaders need to develop these, however established businesses make up the highest proportion of the business landscape. These businesses have challenges with finding technically trained staff to allow them to grow their internal capabilities after initial launch and growth.

SPECIALISMS

CP as a whole comes out on top for innovation activity, with strengths in all sectors identified by the Smart Specialisation Hub. Although this is good, it does pose an issue with identifying areas of specialty and focus.

The East of England Science and Innovation Audit identified Advanced Manufacturing and Materials as one of the four key strengths of the Eastern region. When we drill down into the specialisms of CP, advanced manufacturing and materials certainly are a strong sector, however it is necessary to pinpoint comparative advantage as the sector is broad.

Smart specialisation is about finding the areas in way you have a unique offer and can produce cutting edge innovations. To do this, we mapped expertise with the AMM sector, how these links into other regions, and the extent of their geographic spread.

From this map, and exploring the emerging technologies from the expertise, we have identified a few of the following comparative advantages within the AMM sector:

- Precision Agriculture – National Institute of Agricultural Botany (NIAB), productive farmland, big data handling, Internet of Things / smart devices, links to Norwich Research Park, National Centre for Food Manufacturing, Greater Lincolnshire LEP Food Enterprise Zone
- Quantum Technologies – communications history, big data handling, large tech companies, industry 4.0, University of Cambridge
- Future Energy – history of printing, PV expertise, sustainability expertise, battery research, materials research
- Logistics – sustainability mobility, cities and transport research, automotive and materials businesses, A14 link, demand from pharma for logistics, automation.

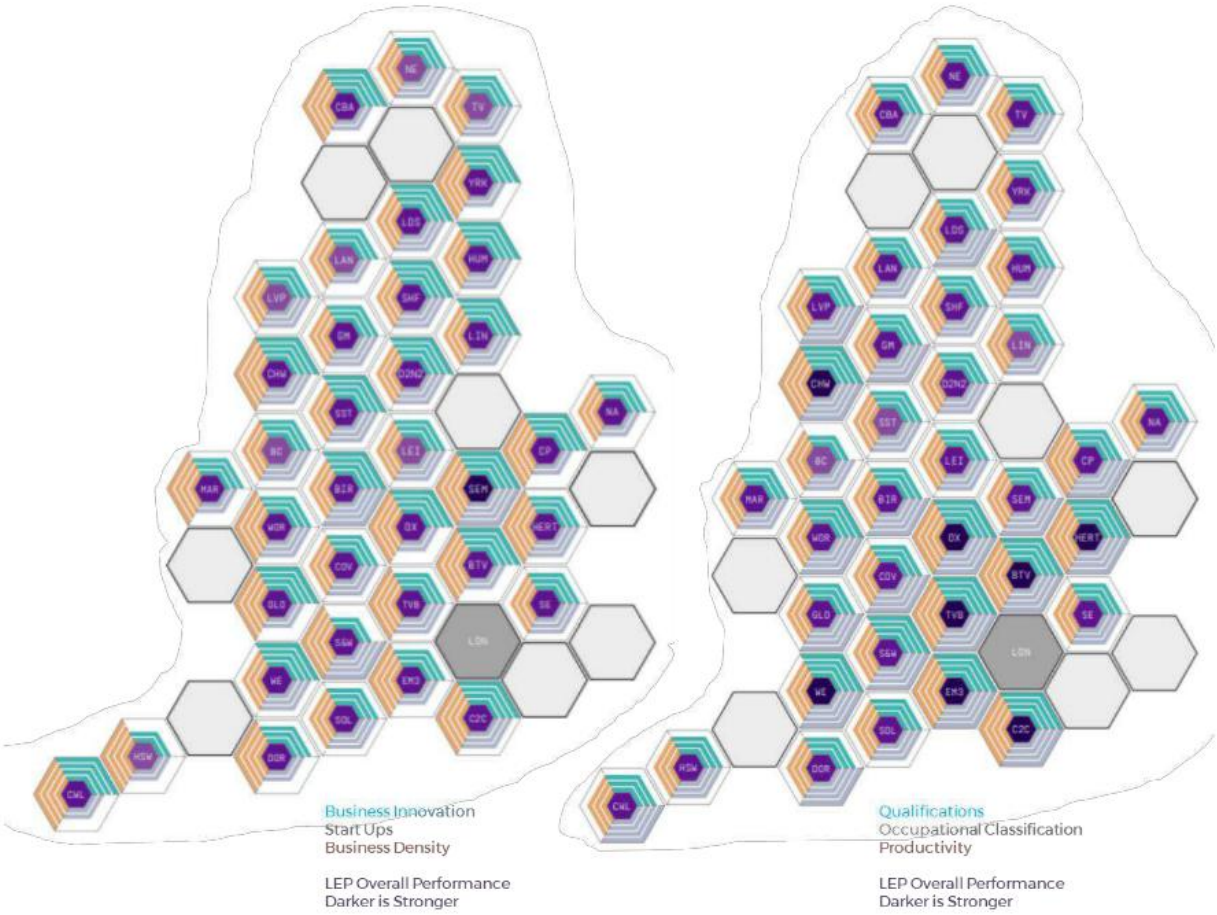


Figure 4 – Mapping England's Innovation Environment. Diagrams by Smart Specialisation Hub.

Recommendation

Facilitate knowledge transfer between organisations via the development of 'knowledge bridges'

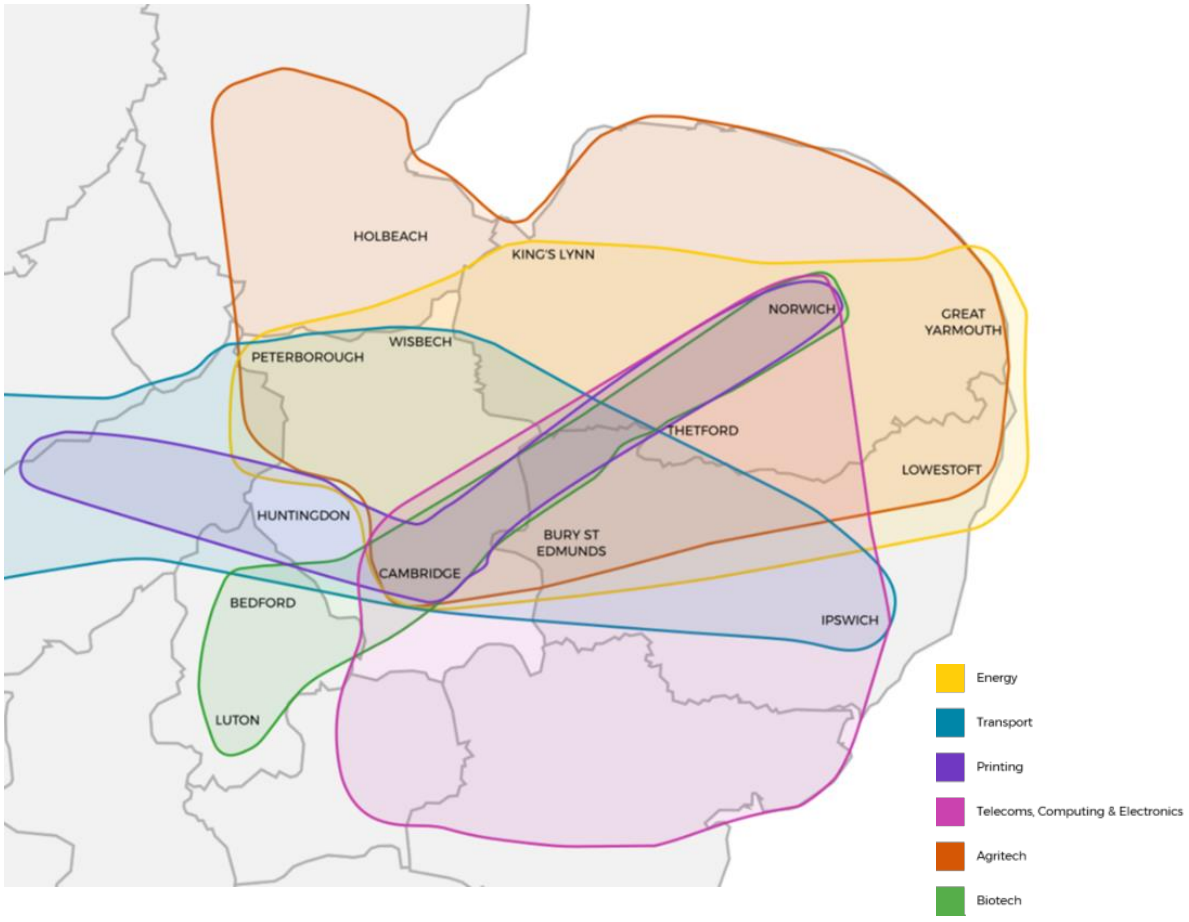
Recommendation

Develop smart specialisation programs within Cambridge, Peterborough, and Fenland to identify their individual strengths

REGIONAL SECTOR STRENGTHS

The East of England is home to a diverse range of businesses across a multitude of industries. In order to fully understand the commercial strengths of each region it is necessary to first break down the key sectors in which the East of England leads the way.

SECTOR BREAKDOWN



ENERGY

Energy is a major economic driver in the East of England with a turnover of over £3.6bn. Access to the south north-sea oil and gas combined with expansion in offshore wind infrastructure and the scheduled construction of the Sizewell C nuclear power facility provides the region with a diverse portfolio of from which to draw upon. The cost of new offshore wind power has fallen by 50% since 2015 and focus in this sector is likely to increase as RenewableUK strive to meet their ambition of generating 30GW from offshore wind. This equates to between 20-30% of the UK's electricity.

TRANSPORT

Transport is a fast moving and increasingly relevant sector with more and more focus on how we move goods and people as efficiently and sustainably as possible. The world is in the midst of an arms race to solve the issue of green transport with everyone from vast multinationals to independent start-ups competing to find the most innovative and effective, sustainable transport solutions.

The ever-present pressure to meet the needs of a growing economy ensures that the region retains a solid footing across this sector from haulage and logistics, to manufacturing and engineering. Future growth is assured by large investments such as the £1.5bn by Geely into the Lotus Cars based in Norfolk.

PRINTING

Printing has a rich history in this region. Many of the printing presses in the region are hundreds of years old, Cambridge University Press, Jarrold and Barnwell print for example were founded in 1534, 1777 and 1840 respectively. These companies are embedded into the fabric of the local economy and have strong links within their communities. Cambridge University Press is still owned by the University and the Jarrold department store has become a landmark in Norwich. Despite their historic association each of these businesses are embracing innovation and many new competitors such as are helping to further stimulate growth. As a result, the sector has grown to one of the largest in the UK. The printing sector in the East of England is home to 1249 companies and employs over 14,000 people. The printing sector in the East of England creates a turnover of over £1.4bn, more than Scotland, Wales and Northern Ireland combined.

TELECOMS, COMPUTING AND ELECTRONICS

This sector is among the fastest growing in the UK expanding at 2.6 times the rest of the economy. This growth is driven by clusters like that found at Adastral Park in Ipswich which has seen 14700, jobs created in 2018. Home to BT and over 100 other businesses Adastral Park will be opening a UK hub in partnership with BT and Facebook for creating next generation telecoms technology as part of the global Telecom Infra Project. The East of England is also home to world leaders in computer technology, Arm Holdings.

AGRITECH

The home of agriculture in the UK the East of England boasts over 40% of the country's grade one agricultural land. As a result, the East of England produces the highest output of crops and the second highest output of livestock of any region in the UK. The demands of this booming agriculture industry are ever increasing and as such the Agritech sector has grown to meet the new challenges it poses. Agritech businesses in the East are ideally placed in close proximity to one some of the best equipped research pipelines in Europe. The John Innes Centre based in Norwich is an international centre of excellence in plant science and microbiology. Networks such as Agri-Tech East work to bring growers, scientists and entrepreneurs together to drive forward innovation and collaboration in pursuit of growth.

BIOTECH

The Cambridge Cluster is world renowned as one of the most established and exciting research hubs for life sciences and biotech research. Within the cluster are over 241 biotech companies including industry giants such as AstraZeneca, Pfizer, MedImmune and PPD. In addition, world leading life science research centres including the Sanger Institute, The European Bioinformatics Institute, the Babraham research park and the Cambridge University Laboratory of Molecular Biology all combine to create one of the most exciting and prosperous economic prospects in the country. The sector is performing exceptionally well currently turning over more than £3bn annually. This sector also defies expectations surrounding the threat of Brexit with current levels of investment eclipsing the £1.2bn of 2017 and rising to £1.6bn within the first eight months of 2018. This bodes very well for the future performance of this sector in the East of England.

Cambridge is home to 241 Biotech businesses.

Cambridge Cluster Map available at: http://www.camclustermap.com

Beating Brexit

The biotech sector Is defying expectations around Brexit.

- The Sector received £1.2Bn in investment in 2017.
- Many feared a reduction in the level of investment due to Brexit uncertainty.
- Despite these fears, investment rose to 1.6Bn in the first 8 months of 2018.

KEY ASSETS BY REGION AND SECTOR

CAMBRIDGE

Energy

- Energy@Cambridge Is an interdisciplinary research centre based at the University of Cambridge designed to bring together the work of over 250 academics to tackle the technical and intellectual challenges relating to energy, technology and policy.
- Cambridge Nuclear Energy Centre (CNEC). Run by the University of Cambridge Department of Engineering and in conjunction with the Judge Business School (JBS), and the Departments of Physics, Materials Science and Metallurgy, and Earth Sciences. CNEC is aimed at meeting the demand for highly skilled workers in the field of nuclear energy.
- Cambridge Energy Partners founded by former MBA students at the University of Cambridge are producing the world's first prefabricated and movable solar tracker.
- The Cambridge University Energy Network (CUEN) is a special interest group based at the University of Cambridge with members in faculties including the Department of Engineering and the Judge Business School
- Wadlow Wind Far is a 26MW onshore wind farm near Newmarket.
- Solar farms at Great Wilbraham and Soham.
- Elean Straw fired biomass power station based in Ely.

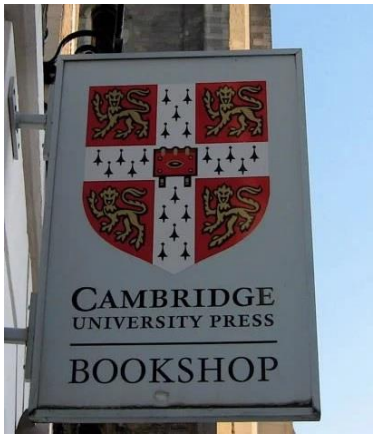
Bridging the Skills Gap

John Molloy the regional development manager at the National Physical Laboratory indicates a need to focus on:

- Developing higher level skills and technologies.
- Helping engineering businesses to find technicians and skilled workers

Printing

- Founded in 1534, Cambridge University Press is the second largest university press in the world. Recognised internationally as a leader in academic educational publishing and responsible for generating over £300m in revenue in 2018 the Cambridge University Press employs over 2000 people.
- The Inkjet Research Centre is based part of the Institute for Manufacturing based at the University of Cambridge. Areas of research include fluid mechanics, visualisation, analysis and computation to study jet and drop creation, drop flight and drop/surface interaction. With the global Inkjet market growing at 9.4% year on year and set to pass £100bn by 2023. research carried out by the Inkjet research centre is likely to prove invaluable in the coming years.
- Inca develops, designs and manufactures industrial inkjet technology. Although wide format printing has been on wide format printing more and more applications are being found for this technology.
- Domino Printing Sciences is a printing company based in Bar Hill focussed on printing, codes, serialisation and anti-counterfeiting. Catering to a wide range of industrial printing application Domino printing services is at the cutting edge of high-quality printing technology.



Transport

- Welch's Transport are a growing company founded in 1934 with a firm foundation in Cambridge. Based in Duxford Welch's transport has expanded from haulage into specialist scientific and laboratory removals, crane hire, warehousing and truck and van centres.
- Turners Distribution another long established transport company, based in Soham for over 80 years runs over 1850 vehicles from 32 sites around the UK. Specialisms include temperature-controlled transport and warehousing, container logistics, bulk building powder products, food products both liquid and dry, fuel distribution, fruit produce picking, packing, storage and distribution, frozen and chilled storage and added value services.
- Cambridge International Airport and Stansted Airport both lie within a 30-mile radius of Cambridge allowing strong links abroad.
- Marshall Motor Group is one of the largest motor dealer networks in the UK with over 106 dealerships representing 26 motor brands including BMW, Jaguar, Land Rover, Ford and Vauxhall. Marshall Motor Group operates 8 dealerships in Cambridge and has headquarters at Cambridge international airport.
- Vindis Group is a motor dealer group originally founded in the village of Sawston just south of Cambridge. Now headquartered in Huntingdon, Vindis group has since expanded and now operates a network of 21 centres in and around Cambridge.

Telecoms, Computing and Electronics

- Arm Holdings is a multinational semiconductor and software design company, Listed by Forbes as the 12th most innovative company in the world in 2016. Arm currently has a market penetration of 90% in mobile application processors, 10% in automotive processors and 35% in consumer electronics including desktop PCs. Arm's broadening influence in artificial intelligence and automotive processors offers a great deal of potential.
- Granta Automation is a bespoke robotics and automation company that is offering companies a means to; Improve productivity, reduce labour costs, increase efficiency, reduce plant downtime, expedite throughput and raise production speeds, reduce costs and increase accuracy and repeatability. They achieve this by offering a tailored automation system and cutting-edge robotics technology.
- CMR Surgical are innovating in the electronics sector by developing advanced surgical robotics to cater to the Healthcare industry.

Agritech

- The Eastern Agri-Tech Innovation Hub near Soham was completed in 2015 with £500,000 funding from NIAB and East Cambridgeshire. Primary areas of research are: Waste reduction, Waste management, value increase and new product design from waste streams, waste recycling and energy production, field loss reduction, quality loss prevention.
- Cambridge Agritech is an investment syndicate that is accelerating the uptake of innovation by providing finance and support to companies in the Agritech sector.
- Agri-Tech East is an organisation based at the Hauser Forum in Cambridge that seeks to improve the international competitiveness of plant and crop-based agriculture and catalyse economic growth.
- Bayer Cropscience is a research based Agritech business operating out of Cambridge Science Park

Biotech

- The European Bioinformatics Institute is a research institute based at the Wellcome Genome Campus in Hinxton. EBI is a world leader in computational biology research and conducts research into gene sequencing and analysis.
- The Laboratory of Molecular Biology is a research institute dedicated to understanding the fundamental processes of molecular biology. The LMB made pioneering contributions to science including X-ray crystallography, electron cryo-microscopy (cryo-EM), the sequencing of DNA and the development of monoclonal antibodies. Twelve Nobel Prizes have been awarded for work carried out by scientists at LMB.
- The Sanger Institute is a genome research centre based on the Wellcome Genome campus at Hinxton. Primarily research by the Sanger institute focusses on genome variation in humans, pathogens, human cells and mice.
- Babraham Research Campus is an enterprise focussed research campus that lies just south of Cambridge. Already home to 54 biotech and life science businesses BRC has the ambition to become the best place in Europe to start up and scale a life science business.
- Granta Park is a partnership between TWI and BioMed Realty Trust. Offering a purpose-built Science Park covering 120 acres. With strong foundation in the biotech sector Granta Park houses offices for industry giants including MedImmune, Pfizer and PPD.
- Cambridge Science Park is the oldest science park in the UK and is home to over 100 companies and employs over 7500 workers. CSP is focussed mainly on science and technology businesses and notably houses AstraZeneca, Astex Pharmaceuticals

PETERBOROUGH

Energy

- Peterborough Energy is a partnership between Peterborough City Council and OVO Energy with the aim of giving residents of Peterborough more affordable energy.

- Since 2008 Peterborough has working toward the ambition to be the environmental capital of the UK.
- A renewable energy park is under development in the Fengate area of Peterborough. Once complete the £350m facility will supply 40,000 homes with energy purely from renewable sources.
- Peterborough Energy Recovery Facility is a state-of-the-art plant which diverts 85,000 tonnes of waste from landfill and uses it to generate 7.25 MW of power, enough for 16,000 homes. Peterborough ERF will reduce the amount of carbon produced by the city of Peterborough by 10,000 tonnes per year.
- Peterborough City Council has signed a strategic partnership agreement with Chinese firm AVIC to deliver renewable energy regeneration projects across the city including upgrading the 17000 of the city's streetlights to LED technology and installing solar panels in car parks.
- Solar Farms have been announced and are under development in Stanground and Woodston near Peterborough.
- Located in Fengate Peterborough Power Station is powered by natural gas and generates 360MW of energy, enough to power two cities the size of Peterborough.

Transport

- Peterborough is also home to Perkins' cutting-edge factory capable of producing 500,000 engines a year and employs 2500 people. Owned by Caterpillar Inc their Europe Research and Design Centre (ERDC) is driving innovation and conducting research into engines that are more fuel efficient, reduce CO2 and which will meet future emissions standards.
- Bradshaw, the largest UK manufacturer of industrial electrical vehicles, supplies vehicles to a wide range of applications in a variety of sectors including, aerospace, manufacturing, leisure and medical.
- There are five international airports within 75 mins of Peterborough. This helps Peterborough maintain strong links overseas.
- London Kings Cross is only 45 minutes by train providing easy access to the capital.
- Felixstowe, the UK's largest container terminal, is only 45 miles from Peterborough allowing for easy and cost-effective transport of goods overseas.

Agritech

- British Sugar supplies over 60% of the British sugar industry and partners with over 3000 growers. This giant of British agritech is based in Peterborough.
- Del Monte foods a major force in the global cut-fruit market has a large facility in Wisbech employing hundreds of people.
- AB Agri is a global agritech business focussed on sustainable agriculture & animal nutrition. By bringing innovative technology into agriculture they hope to allow the production of more food from fewer resources.
- Flo-Mech is one of the leading providers of manufacturing equipment to the food and drinks industry.
- Olympus Automation supply market leading food processing and *automation* solutions from their headquarters in Peterborough.

NORWICH

Energy

- Norwich City Council has plans to launch an energy company in partnership with Engie in Spring 2019
- Ren Energy are a Norwich based company working as both consultants and suppliers of renewable energy technology. RenEnergy have recently installed a 6,508 solar panel farm on Briar Chemicals' factory site on the Sweet Briar Industrial Estate in Norwich. On a sunny day the farm produces 1.7MW which his enough to power the entire factory and office.

- Impact Renewables are an award-winning supplier of renewable energy technology based in Norwich that seek to make cutting edge renewable technology available to everyone.
- The University of East Anglia is home to a wide range of companies and initiatives focussed on sustainability and low carbon energy generation. The Low Carbon Innovation Fund is a venture fund seeking to support innovative new low carbon businesses. Fittingly housed in 'Britain's Greenest Building' The Enterprise Centre it seeks to drive innovation and growth in this sector.

Printing

- Jarrold is a Norwich institution, founded in 1777 by the Jarrold family, Jarrold has been at the centre of Norwich's printing industry, despite largely moving away from printing Jarrold still run a print shop in the centre of Norwich alongside its flagship department store as well as the John Jarrold Printing Museum based at the site of the former printing press. The Jarrold family is still in control of the Jarrold operation. Furthermore, Charles Jarrold still exerts influence in the Printing sector in his role as head of the British Printing Industries Federation.
- Barnwell print founded 1840 is the oldest family run printing company in the UK is embracing technology having recently invested £1m in cutting edge printing equipment.
- ColourPrint is a specialist printing company offering consultancy, design, printing and distribution from its base in Norwich.
- The Colman group is wholesale and stationary company with over 160 years of history. They operate from three sites in Norwich with over 50,000 square feet of warehousing space.

Transport

- Hethel based car manufacturer Lotus Cars has just received £1.5Bn investment from Geely and is planning to take on the likes of Porsche and Mercedes in a bid to expand its market share.
- Proteo is a company providing transport management systems to the haulage industry. With large clients such as Chiltern Cold Storage Group and Firmin Proteo is attempting to revolutionise the way the haulage industry operates.
- Axon Vibe is a global transport company seeking to create smart cities and simplify mobility by delivering smart travel assistance. Through partnerships with public transit authorities they are able to deliver intelligent travel advice in real time to passengers. Axon Vibe has an engineering team based in Norwich
- Coventive Composites are a company working with the University of East Anglia to research innovative sustainable composite technologies for the automotive sector.
- Connected Energy are an energy storage company based at Hethel engineering centre. This pioneering may prove invaluable as demand for electric vehicles rises.
- Equipmake are another Hethel based company developing the next generation of electric drivetrains.
- MSF technologies are developing system solutions for electric motors, controllers and inverters.
- Corum Technology provides vehicle dynamics expertise to motor manufacturers, tier 1 suppliers, aftermarket suppliers and other companies in the automotive industry.

Telecoms, Computing and Electronics

- The Cambridge Norwich Tech Corridor represents one of the most exciting growth opportunities in the East of England. With two of the world's leading universities within reach, strong transport links and affordable space for disruptive businesses to move into.
- Location Sciences AI is a Norwich based AI company that seeks to connect the online world to the offline world.
- Thyngs is a Norwich based technology company whose aim is to transform any physical product, packaging or advertisement into an instant point of transaction without need for an app.

Agritech

- Norwich Research Park is an international centre of excellence in life and environmental sciences research. Their research is focussed on plant and microbial sciences, genetics and genomics, climate and geo-sciences and food, health and human nutrition.
- The John Innes Centre is an independent, international centre of excellence in plant science, genetics and microbiology based on Norwich Research Park.
- The Sainsbury Laboratory also based on Norwich research park carries out fundamental biological research and technology development on aspects of plant disease, plant disease resistance and microbial symbiosis in plants.
- Weatherquest is a privately-owned weather forecasting company housed in the University of East Anglia's enterprise centre. Their partnership with the university's world-renowned climate change centre provides

them with cutting edge research and this combined with their state-of-the art technology allows them to offer tailored weather solutions to many of the regions farmers as well as the shipping industry.
- The Agritech Water Cluster promotes new collaborations between researchers at the University of East Anglia and the agritech and water industries.

Biotech

- Norwich Research Park is home to three out of seven of the national institutes of bioscience run by the Biotechnology and Biological Sciences Research Council.
- The Earlham Institute is a £13.5m research facility on Norwich Research Park. The centre seeks to be the foremost institute for data base biological and bioinformatics research in the world.
- The Quadram Institute is a British centre for research and training in food science and health. Also based on Norwich Research Park, the institute is driving research investigating the interface between food science, gut biology and health to develop solutions to worldwide challenges in food-related disease and human health.
- Norfolk and Norwich University Hospital is a key link between the biotech research conducted at Norwich Research Park and the University of East Anglia. Allowing for transfer of knowledge between the two institutions.
- GoBio is an Innovation Network in East Anglia that is focussed on the biotech sector.
- University of East Anglia provides highly educated and skilled workers to the Biotech sector. It is a vital link in the skill supply chain for the biotech sector in this region.

HUNTINGDON

Transport

- The Alconbury Weald project aims to deliver a high-quality low carbon Enterprise Campus near Huntingdon with 3 million square feet of commercial space; 5000 homes; 700 acres of green open space; and investment in a range of facilities for the transport and energy sectors.
- Alconbury Enterprise Campus is an enterprise zone near Huntingdon allowing businesses based there to capitalise on tax relief and government incentives to facilitate growth and innovation.
- Vindis Group a motor group with over 20 sites across the region has its headquarters in Huntingdon.
- Huntingdon is well situated on the Cambridge/Peterborough corridor with strong transport links to London, The Midlands and the North.
- iMET is a key link in the skills supply chain, providing industry standard equipment and facilities to develop a highly skilled workforce.

Printing

- Mimeo, one of the world's leading online printing companies used by over 50,000 companies in 140 companies. Mimeo are a multi award winning global force in the printing sector, their UK offices are in Huntingdon.
- BigPrinting is a company based in Houghton which offers design, print and signage to global brands. Previous partners include Universal Studios, Titleist, Puma and Argos.
- Ciconi is another Huntingdon based print company that also offers design and marketing services to its customers.

LOWESTOFT AND GREAT YARMOUTH

Energy

- Hornsea One, the world's largest offshore wind farm is in development just of the coast of Great Yarmouth and Lowestoft.
- With an anticipated £50Bn investment into the energy sector in the East of England in the next 20 years an enterprise zone has been set up to help to capitalise. The Great Yarmouth and Lowestoft Enterprise Zone will include 6 sites around the region.
- Ideally situated with access to the South North Sea, Lowestoft and Great Yarmouth are key to the future success of the energy sector in the UK.
- Sizewell B Nuclear Power Station is located south along the coast from Lowestoft. The only pressurised water reactor in the UK Sizewell B is contributing 1198MW to the national grid.
- EDF has plans to construct an additional plant at Sizewell. Sizewell C, when complete, will contribute 3260MW to the national grid, enough power for 6 million homes.

- Halliburton is a multinational company that supplies products and services to the global energy sector. They employ over 50,000 worldwide and have a facility and Great Yarmouth.
- Seatrax UK is one of the world leaders in supplying deep-water lifting equipment to the energy industry. They are based in Great Yarmouth.
- Aker Solutions ASA is a global engineering company. They provide the products, systems and services that to support energy extraction from oil, gas and offshore wind. With 15,000 employees around the world one of their offices is in Great Yarmouth.
- WorleyParsons Is a world leading consultancy in the engineering and energy sectors and have been based in Great Yarmouth for over 35 years.
- The East of England Energy Group is a non-profit trade body for the energy sector in the East of England. With over 300 members they support businesses in the energy sector by offering training, networking and running events and activities.

BURY ST EDMUNDS

Agritech

- Suffolk business park is currently under development in Bury St Edmunds. Based on a 14-hectare enterprise zone and with a total size of up to 68 hectares Suffolk Business Park will appeal to many businesses in the agritech and food sector. Thanks to its central location equidistant and strong road links to other key agritech institutions in Cambridge and Norwich.
- Rothamsted Research have been conducting research into improving crops and productivity at Brooms Barn Farm near Bury St Edmunds.

Telecoms, Computing and Electronics

- Stowmarket enterprise park is an upcoming business park scheduled to be built near Bury St Edmunds. It will consist of 37 units and benefit from its inclusion in a government backed Enterprise Zone.
- West Suffolk College is one of the country's leading suppliers of apprenticeships catering to over 10,000 students and over 1,500 apprentices. A vital link in the skill supply chain in the region.

Energy

- GTC is a market leading infrastructure company based in Bury St Edmunds. Aimed at providing cost-effective gas, electric and water networks along with sustainable solutions to the construction industry.
- Integrated Energy Consultants are a consultancy based in Bury St Edmunds that advise consumers on energy solutions including solar and wind as well as water solutions.

IPSWICH

Transport

- ITO World is a global transport tech company working at improving travel by delivering real-time transit data feeds for journey planners. Originally founded in Ipswich they still have offices in the region.
- Ipswich has hosted 'Innovation Roadshows' run by the Transport Systems Catapult to drive innovation in the transport sector.
- Anglia Freight is a haulage company based in Eye, recently they have launched an innovative new scheme called ProDriver, which rewards with enhanced pay for meeting development objectives relating to safety and performance each month.

Telecoms, Computing and Electronics

- Adastral Park is a large cluster of technology and communications businesses including Huawei, Cisco and BT. A huge contributor to the local economy, the park will be home to a joint project between BT and Facebook as part of the global Telecom Infra Project.
- Ipswich is also planning an 'Enterprise Island' to add to its existing marina development. The development will include a STEM hub, incubator and housing as well as high quality green spaces.
- Futura park is a retail park in Ipswich with 6 units. There are plans to further develop this site with an additional 19 units.
- Suffolk New college is based in Ipswich and forms a part of the local skills supply chain. With over 3,500 students studying vocational courses.

KINGS LYNN

Energy

- Siemens are scheduled to start work on installing a new gas turbine at the current King's Lynn power station which has been closed since 2012. When complete the power station will provide 500MW of power.
- Ecotricity have installed a wind turbine at the Queen Elizabeth Hospital in King's Lynn to provide power to the hospital.
- AMR Group is one of the leading providers of Electrical, Mechanical, Fire & Security, Aircon & Refrigeration, and many other services throughout East Anglia.
- Solar Shed is a King's Lynn based solar technology company that offers solar solutions and advice to consumers and SMEs.

Agritech

- Kings Lynn Innovation Centre (KLIC) is a purpose built £3m innovation complex built within an enterprise zone. Built to stimulate growth and innovation in the region as part of the Nar Ouse Business Park.
- Ideally situated with links to the region's agricultural heartland as well as cutting edge agritech research institutes in Cambridge and Norwich via the A47 and A10.
- Dodman Ltd is a manufacturing company based in King's Lynn that designs and manufactures industrial food manufacturing equipment.

BEDFORD AND LUTON

Biotech

- SRG is The UK's leading life sciences recruitment agency. Delivering skilled scientific, clinical and engineering professionals to the local economy.
- Life Science Group Ltd is a Bedford based company that supplies the biotech and life sciences industries.
- The University of Bedfordshire is a crucial link in the skills supply chain in this sector. Providing skilled graduates in the field of biology and life sciences to drive research and innovation in the region.
- Corning Life Sciences is a company that supplies specialist glass, ceramics and advanced optics and to the life sciences sector. Corning is a vast multinational with offices in Bedford.

HOLBEACH

Agritech

- Holbeach Food Enterprise Zone seeks to provide a hi-tech agri-food hub for the district's agricultural and food sector, offering high-quality business accommodation, business support, technology, education and training facilities to businesses and stimulate growth.
- Peppermint Park is an upcoming development designed to capitalise on the benefits of the government sponsored food enterprise zone. With the University of Lincoln as an anchor tenant Peppermint Park will provide 59,500 square meters of employment space.
- Lincoln University plays a key role in the skill supply chain as well as housing the Lincoln Institute for Agri-Food Technology. LIAT Is a specialist research institute dedicated to delivering world class research and skills to the global Agri-tech industry.

TECHNOLOGY ROADMAPPING

Innovation helps to drive the development of new technologies. In order to properly understand our opportunities in facilitating growth in manufacturing in Cambridge and Peterborough we need to know what technology is being developed in the region and how it will evolve in the future. It will also be useful to identify growing technology sectors that do not have a strong presence in the region so that we can look at potential opportunities to attract more businesses involved in those sectors. Technology is separate into many different sectors and in this section and we will go over what they are, what is already in Cambridgeshire and Peterborough and what advances might be made in the future.

QUANTUM

WHAT IS IT?

Quantum technology is defined as a global challenge that the UK could put themselves at the forefront of. Its use in cyber security and defence has made it a hot-topic emerging sector. Specifically, quantum technology involves working with sub-atomic particles that have tiny energy levels. These particles are capable of existing in more than one quantum state at a time and we can use this to enhance our technology. There is plenty of potential to link with healthcare, space and computing.

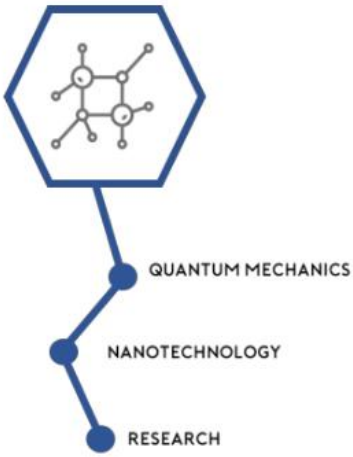
WHAT IS IN HAPPENING NOW?

The University of Cambridge has a dedicated Centre for Quantum Technologies. Recently, they have become a partner in the Quantum Flagship, an EU-funded research and innovation initiative to develop quantum technologies all across Europe. They provide opportunities to learn more about quantum tech that is useful to businesses who want to understand the opportunities that might be available to them in this field.

There are already a few examples of businesses in the region that are working on quantum tech. Cambridge Quantum Computing (CQC) is a company that specialises in quantum computing and Artificial intelligence (AI). They have designed a proprietary operating system for quantum computers as well as a method of quantum encryption that utilises quantum resources to create true randomness. Their work in AI has seen them create Arrow, a collection of algorithms for anomaly detection and the classification of real-time data. CQC is also the co-owner of a protocol to create unforgeable token authentication that has potential for application in the digital finance.

Toshiba are one of the UKs top companies for research into quantum technology. They have a research lab in Cambridge where they look at applying the fundamental laws of quantum physics to network communications and computing, specifically in IT, speech recognition and dialogue. They have developed the world's leading system for quantum cryptography and are looking to make partnerships with companies or organisations that are interested in developing applications for it. They also develop advanced nanotechnology that is required in future quantum computers.

Hitachi is working with the University of Cambridge to develop a highly sensitive reader for a quantum computer at its Cambridge Laboratory. The new readout detector is 5x more sensitive than a previous technology and marks another important step towards having a fully realised quantum computer.



WHERE WILL IT GO IN THE FUTURE?

As quantum technologies inevitably develop and manufacturing techniques are enhanced, quantum technologies will become more

The quantum computing market is expected to grow at **2.5 billion** dollars by **2022**.

Businesses want to know how to **engage** with SMEs.

SMEs are struggling with **logistics** and **supply chains.**

The first **quantum network** was launched in Cambridge in 2018, enabling **secure communication** between three sites around the city.

The **Networked Quantum Information Technologies Hub (NQIT)** is the largest of four hubs in the **£270m** UK **National Quantum Technology Programme.**

compact, and lower costing, opening up multiple market opportunities as a result. It is easy to see how more computing capability could advance our technologies and services. The future of quantum computing could potentially see the first ever quantum computer being made within the next 5-10 years and after that there would be an explosion of quantum computers as businesses would compete to continuously improve them and then sell them. At first these computers will be hugely expensive and only available for the largest companies in the world, but commercial quantum computers are likely to follow, with the public having access to advanced computing and security. Quantum computers are going to require the development of software and hardware and this means there will inevitably be an opportunity for translation of the technology involved in making the physical parts of quantum computers to other fields including advanced manufacturing and materials.

ENERGY

WHAT IS IT?

The energy sector is focused on developing the way we generate, manage and supply electricity and gas through the grid. The demand for energy is rising alongside the development of advanced technology used in both businesses and the public sector. With the challenges of climate change a large focus has been placed on developing efficient, clean energy generation to reduce our dependency on fossil fuels. At the moment solar panel and wind turbine technology are some of the leading alternatives but they are not efficient and cheap enough yet.

WHAT IS IN HAPPENING NOW?

The University of Cambridge has an Environment and Energy department that focuses research into this field. They support businesses and students to make a positive impact through environmental performance. The energy research themes are broken into 3 broad areas; supply, conversion and demand. These themes include topics like Bioenergy, Nuclear Energy, Photovoltaics, Energy Storage, Engines and Turbines, Buildings, Cities and Transport.

Bioenergy includes energy being generated from biological products or processes. A good example of a current biofuel is biodiesel as it can be made in a few different ways. The feedstock for making biodiesel is always oils and fats but these can be retrieved from different places, including animal fat, vegetable oils or even algae. Research into the best methods of generating biological products for making biofuels is a hot topic, constantly improving and garnering more interest from businesses that want to be involved with this type of energy generation.

Nuclear energy is very powerful but is only used to provide 6% of the world's energy supply. The problems with nuclear energy are its cost and its dangers and the public pressure that comes with that. Solar Panels are much cheaper, safer and are already available commercially. Present trends focus on finding abundant materials, increasing efficiency of the energy generation, better storage and increasing efficiency of the energy conversion. Wind Turbines have seen recent developments including vertical axis wind turbines that save space and have adjustable blade pitching.

Energy businesses are numerous in the C&P region. There are a number of notable networks with members all over the east of England. The Cleantech East network, co-ordinated by Hethel Innovation, has a large member list of energy businesses and regularly hosts events and develops innovation platforms to facilitate collaboration and networking between these companies. Some of the member companies include Tufeco, Swift Tech Group, Enlight and Adnams.

Smart energy systems will provide benefits up to **£40bn** to the UK economy.

53% of power generation in the UK now comes from **low carbon** sources.

Businesses want **technology roadmaps** to connect research to what they do and understand the **opportunities**.

Singapore aims to be the world's first '**smart nation**'. It has sensors to get big data on parking, traffic and cleanliness.

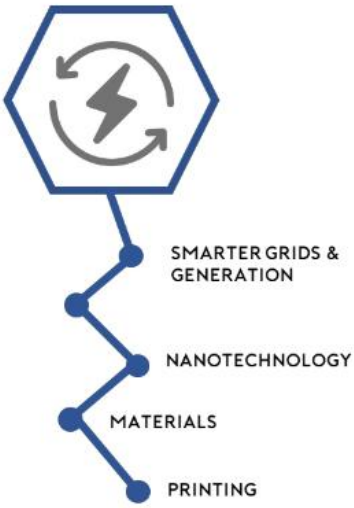
Orbis Energy has a **hub** of energy businesses in the East of England that are already leading the **growth** of small businesses.

WHERE WILL IT GO IN THE FUTURE?

When we consider the future of energy, we have to look at how the technology we have right now is going to change. We also need to look at the birth of new technologies that don't currently exist but may develop from advancements in other sectors of science and manufacturing,

Improvements in the efficiency of Solar and Wind energy generation can be expected as there is a lot of research being pushed forward. There is also potential for the merging of these technologies with each other, for example we may end up seeing wind turbines covered in solar panels. We can help to nurture growth in this field by engaging with businesses and academia, connecting them with others at events and meetings and then facilitating the collaboration. The development of new advanced materials may help to change how we build our turbines and solar panels.

Hydrogen is something that gets mentioned a lot when looking at the future of energy generation. Concerns have been voiced about the potential for explosions however, compression canisters have been used all over the world for decades and this probably won't hold back the technology. The potential for hydrogen energy generation is really promising as it is a zero-emission fuel when burned with oxygen, is more efficient and lasts longer than normal batteries and will ultimately remove the need for a grid as everyone can have a hydrogen fuel cell in their home. This creates a challenge with big energy businesses as they could ultimately lose money if this happens. The emergence of graphene as an advanced material creates an opportunity with hydrogen technology as the process of creating graphene produces hydrogen as a bi-product.



A revolutionary technology that is coming out of Cambridgeshire concerns printing PV panels. The PV panels can be made using specialised semiconducting inks and can be printed using a conventional reel-to-reel printer. These modules cost less than $10 per square metre when manufactured at scale. Each solar cell consists of several individual layers printed on top of each other, which are then connected in series to form a bank of cells. These cells are then connected in parallel to form a solar module. There are many benefits by using this energy solution is as the printable PV panels are lightweight, quick to manufacture and very easy to install on a large scale.

AGRITECH

WHAT IS IT?

Agritech focuses on technological advancements in farming and agriculture. There are two main challenges that drive the development of new agricultural technologies and they are crop genomics and crop management. On the side of crop genomics, the focus is all about understanding the genes that control the plants attributes. For example, how can we engineer a crop species to be more resistant to diseases, to grow faster or to have higher yield. Crop management is a bit broader as it can cover planting, monitoring and harvesting and all other aspects of physical farming and tends to involve smart systems and robotics.

WHAT IS HAPPENING NOW?

The agricultural sector is very strong in Norfolk and Suffolk and as they are relatively close to Cambridge and Peterborough there is a lot of benefit to be gained from forging important links. Locations like the Norwich Research Park are doing studies into crop management systems and have even recently developed a new system called CropSight. Lincolnshire is also another hub that is particularly strong with the food industry, being home to the National Centre for Food Manufacturing. These locations are close enough to Cambridge to make strong links and connect businesses.

Some examples of businesses in and around Cambridge that work on crop science are ADAS, Bayer Cropscience, Analytik, Ceres Connected Agri-Tech and ITAKA. The National Institute for Agricultural Botany has its home in Cambridge and provides businesses membership to its network, giving numerous benefits. They have researchers studying all aspects of crop science and farming systems.

UK agritech sector is worth more than **£14bn** and employs over **500,00 0** people.

Businesses want **more engagement** with researchers.

Farmers need help **keeping up** with the speed of innovation.

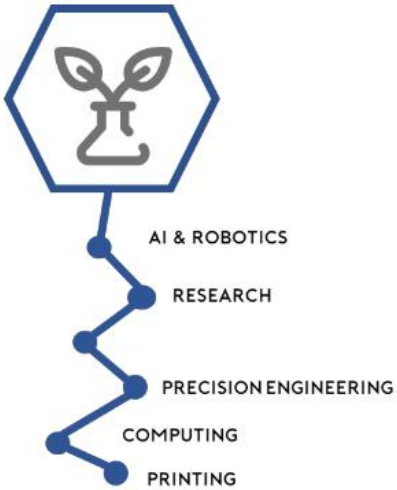
The **John Innes Centre** in Norwich has helped increase UK wheat production by **£75m per year** and its contribution to world wheat production is estimated at **£3.4bn.**

Agri-tech is being led in our sector by **research breakthroughs** in institutes and universities. Engagements with businesses and farmers need to increase.

Cambridge also has its own long history of agriculture and, of course, the University has a department of plant sciences that researches crop genomics. This is a fountain of expertise and knowledge that businesses can tap into. There are a large number of farming equipment suppliers in Cambridgeshire and this will allow the formation of easy supply chains for businesses wanting to develop and sell the latest farming equipment.

WHERE WILL IT GO IN THE FUTURE?

The future of Agritech lies heavily within Synthetic biology, Robotics and AI. Our understanding of the way plants grows and respond to the environment will improve and we will gain the ability to create hardier, faster growing crops with higher yields using genetic modification. The emergence of 'Agribots' will put a focus on automation, by removing the need for people to watch over and harvest crops, farms will be run by AI systems with vast arrays of sensors and equipment while the farmer can sit back and put his feet up. We could see manufacturers selling agribots of different levels of complexity as they would sell tractors and other farming equipment now.



ICT & TELECOMS

WHAT IS IT?

Advances in computing help ease our lives all the time. New applications, software and computing power can provide us with quick and easy solutions to our problems. Computers don't have a relatively long history when compared to something like agriculture, however, the past 30 years have a seen a boom in computing technologies and smart devices with more connectivity than ever. The main components of ICT are generally considered to be hardware, software, cloud technology, internet access, data, communications and transactions.

Telecoms covers any technology that helps people to communicate with each other. Clearer and faster communications are particularly important in defence and space exploration but are still also applicable to the public sector and businesses to improve productivity.

WHAT IS HAPPENING NOW?

Solarflare is working within Cambridge to provide comprehensive and integrated technologies for distributed, ultra-scale data centres. They can improve cloud systems by reducing abandonment, increasing download speeds, minimising loading and eliminating buffering. This benefits any business with a large data centre.

Pelican Computing work closely with Cambridge University and provides advanced databases and bespoke database software for businesses. They work with hospitals in the region and can design and support databases that increase productivity for a broad range of sectors including biotech and healthcare.

Speechmatics are a leading provider of speech recognition technology based in Cambridge. Their technology can be deployed in the cloud, has high accuracy for spoken inputs and covers a broad range of languages with the ability to develop new language inputs at a rapid rate. Linguamatics are another company in Cambridge located just over the road from Speechmatics that focus on AI solutions for knowledge discovery and decision support based on text. They help the healthcare sector and aim to speed up drug development and improve patient outcomes.

The Cambridge Business Park is mostly home to IT companies and serves as a hub for development in this sector. Another hub can be found at Adastral Park in Suffolk, it's a cluster of high-tech telecom and technology companies. It has a national operation centre, test facilities and a global R&D unit, all set amongst a thriving community of collaborative technological innovation.

Global Information technology industry is set to reach **$5 trillion** in 2019.

Larger businesses don't want the **same support** as small businesses.

Businesses want **room to expand** and grow without moving.

London was ranked top in the EMEAs **largest** technology clusters with employment in ICT at almost **2.5x** the EU average.

BT are global leaders in telecoms with a **good history** of research and innovation

Peterborough has **no supply** of highly trained students.

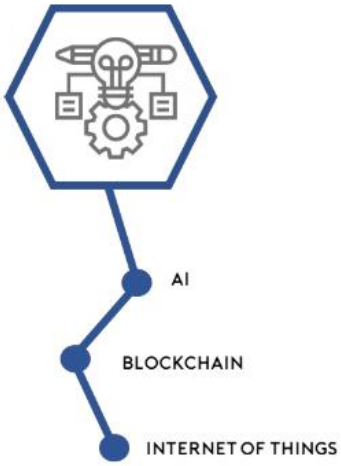
The Telecommunications industry is currently looking at related areas to the ICT industry and that's why we've included them together in this section. Current work in this field involves developing 5G wireless technology, unleashing the full potential of augmented and virtual reality, security, developing smart cities and tackling challenges with the Internet of Things (IoT).

It's clear that there are other businesses in Cambridge that specialise in ICT and Telecom technology and in tandem with research being performed at the University of Cambridge there is a really strong foundation for ICT and Telecom development going into the future that we can support.

WHERE WILL IT GO IN THE FUTURE?

Computing is changing to become more adaptable. There is potential for computers to embed in nearly every aspect of our lives, including manufacturing and materials.

Electronics in our clothing, smart prosthetics that can send signals back to the brain, adverts than can read our facial expressions and change, robots that can learn and adapt to new tasks on their own. Eventually 5G will become a reality and then things will move onto a sixth generation with data speeds becoming faster and faster with more throughput per second. The way we handle large datasets from the IoT will change and as our systems allow more and more data to be managed, we will be able to monitor more easily and extract the key information with ease.



Augmented and Virtual Reality is still in its infancy, but rapid developments in this field with have a big impact on our day to day lives in terms of entertainment and communication and even defence. The challenges of developing smart cities will be the coverage, capacity, security and existing infrastructure systems so opportunities exist in tackling these challenges in order to grow the industry and make steps towards fully realised smart cities.

SPACE

WHAT IS IT?

The space sector contributes £13.7 billion to the UK economy annually. Satellites were named one of Innovate UKs 8 great technologies for growth in the future. Our planet is already surrounded by numerous satellites but there is a continuous demand for satellites with faster communication and better monitoring systems.

WHAT IS HAPPENING NOW?

Within the Cambridgeshire and Peterborough region there are only a handful of space and satellite focused businesses working on research and development of this technology. This is an obvious shame as Cambridge presents a few very strong opportunities to support this sector. First of all, there is the University. Currently ranked as the 5th best University in the world for physics, chemistry and maths by the Times World University Rankings there is plenty of opportunity to facilitate engagements and partnerships between the department and businesses that may move to the region.

There are a number of notable companies in and around Cambridge. Airbus Space and Defence are a global leader that primarily focus on the manufacture of multi-role aerial tankers and advanced combat aircraft. Located in Stevenage, they are only 30 miles from Cambridge. They have a dedicated space division that looks at developing and delivering cutting edge space technologies including telecom satellites, satellite navigation and earth observation. They already utilise open innovation in their business and are therefore likely to engage with other businesses to provide expertise.

The global space economy market is estimated to grow to **£400bn** by **2030**.

Businesses struggle with links; space tech is **not as wide spread** as other technology and its harder to collaborate.

Cornwall has a diverse and thriving space industry, which is estimated to provide **horizontal launch** capabilities by **2021.**

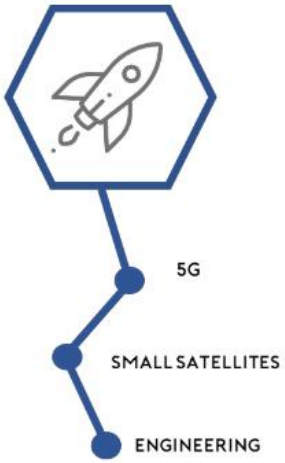
The leader in the C&P region is Airbus Space and Defence, they can act as an **anchor** to pull in more space-based companies.

Other aerospace companies in or close to Cambridge that don't have divisions devoted to space technology include GKN, IMS Aerospace Engineers, Marshall Aerospace and Defence Group, 365 Aerospace and Satavia, The aerospace industry has a lot of transferable assets that could be used in developing space technologies and so there is potential here to encourage these companies to work with partners or create their own space divisions.

WHERE WILL IT GO IN THE FUTURE?

Satellites were originally exclusive to wealthy governments and corporations. Nowadays, satellite technology is becoming more accessible and we eventually could see sophisticated technologies in the hands of the public. Miniature satellites called CubeSats are already being developed with limited capabilities, but the future of satellite technology will see the capabilities of small devices improve drastically in terms of monitoring and communication. The latency of communication could be reduced by networks of small satellites launched into Low Earth Orbit (LEO).

Working on the physical launch technology for rockets is going to change the industry as satellites piggy-back rides from these launches in order to be deployed. Exciting systems like the Falcon 9 reusable rocket system being developed by SpaceX are reigniting some of the lost interest in satellite and space technology as reusing rockets will reduce the massive deployment costs.



Service providers are looking at developing 5G networks in the future that will have super low latency and higher data speeds, and this can only be achieved by improvements beyond our current satellite technology. In the not too distant future, it's not impossible to imagine that we will see ridiculously fast internet being available anywhere in the world.

ROBOTICS

WHAT IS IT?

The field of robotics is particularly important in terms of manufacturing as robots have the potential to not only change what we manufacture, but also the potential to change how we manufacture. The field of robotics is split into two main themes, the design and construction of physical machines and the development of computer systems for their control and information processing.

WHAT IS HAPPENING NOW?

Current applications of robots are spread very broadly across a large number of industries. Robotics are being used by companies in Cambridge in fields such as agritech, healthcare, energy and engineering. Some of the main present-day applications are robot training, 3D vision and cloud robotics. Advances in AI are making robots easier to train and this makes them a better investment for small companies as they don't have the costs of ongoing programming or buying entirely new robots for a new task. 3D vision is what enables a robot to grab an object and move it to a desired location, it's crucial that the robot can construct a 3D image of its environment and then translate that information into an action. Huge datasets to allow robots to perform speech recognition or image classification are required and are often larger than local systems can handle. Cloud robotics will help to tackle this and allow information to be shared.

Dogtooth technologies is an example of business in the Cambridge area that is trying to use robotics to tackle the problem of a lack of staff in soft fruit picking. Their robots are capable of autonomous navigation, locating and picking fruit, grading the picked fruit and then placing them into punnets. This is an early example of robotics used in agriculture that will help make steps towards automating the industry.

The biggest customer of industrial robots is the **automotive industry**,

2018 saw **record breaking sales** of industrial robots at **£1.31bn** in the first nine months.

Businesses want to know what technology is actually **usable**, how hard it is to **implement** and the **benefits** they can receive.

Silicon Valley Robotics is the **largest** cluster of robotics and AI innovation and investment in the world. They run numerous successful **programmes**.

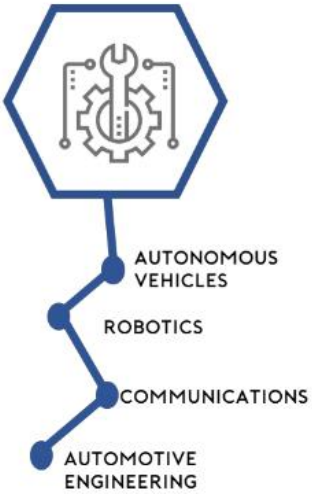
Currently there is a large number of robotics-based SMEs in Cambridge willing to **collaborate** and looking for **new potential**. Leaders need to be **identified** through a strong robotics network

CMR Surgical are another robotics company based in Cambridge. They focus on healthcare and have designed a the Versius Surgical Robotic System. This system works alongside surgical teams to help them perform surgery with precision. Currently the system requires direct human control using two joysticks and a 3D screen.

Other robotics companies in Cambridge are working at the forefront of robotics in areas like micro robotics and factory automation. The technology is still relatively young overall and the applications at the moment are limited but filled with potential. One of the main challenges is making the technology scalable and affordable.

WHERE WILL IT GO IN THE FUTURE?

The future of robotics is incredibly exciting. As advances are made in computing, programming, sensor technology, imaging technology and advanced materials we will see robots capable of easily performing complicated tasks. Advanced AI technology will allow robots to learn and adapt to different tasks more easily, without the need to update their programming. This will cause a rise in automation in manufacturing that will benefit the industry by increasing production. Advanced materials will play a role in the way we build robots. We'll be able to make them smaller, faster, more efficient and more mobile. There is also a push for wearable robotics, like exoskeletons that help people lift heavy objects or active prostheses for people who have lost limbs. Eventually we could even see more aspects of surgery automated, reducing the staff who need to be present and therefore beginning to tackle the problem of understaffed hospitals.



LIFE SCIENCE/HEALTHCARE

WHAT IS IT?

Life science is defined as a branch of science that deals with living organisms and life processes. Work in this sector is based on biotech and healthcare. Drug development, bioinformatics, biomechanics, genetics, neuroscience and quantum biology are examples of some specific branches of life science.

WHAT IS HAPPENING NOW?

Astra Zeneca are a world leader in the pharmaceutical industry, and they are based in Cambridge. They have developed medicines for the NHS and focus on therapy areas such as Oncology, Cardiovascular, Metabolism and Respiratory systems. Another pharmaceutical company at the forefront of research and development in Cambridge is GSK. These big companies present opportunities to provide expertise to smaller businesses, in meetings, forums or even as speakers at events.

Some other businesses in the region working on pharmaceuticals are Chirotech Technology, Cycle Pharmaceuticals, GW Pharmaceuticals, Altacor, Astex Pharmaceuticals and Bard Pharmaceuticals.

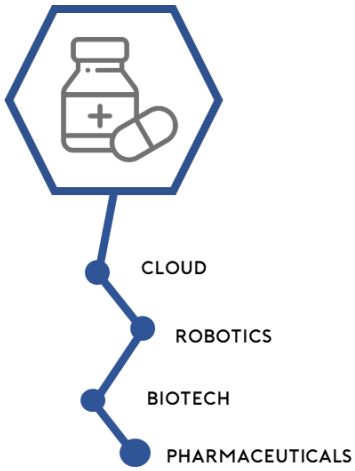
UK life sciences sector contributes over **£30bn** to the UK economy each year with a third of this being attributable to businesses that are **co-located** in clusters.

Businesses want easier **interaction** with the NHS for opportunities in **funding.**

Cambridge is already thriving in life science due to its **co-location** and **collaboration.** It has the potential to add another **£1bn** per annum to the UK economy by 2032.

Astra Zeneca are leaders in pharmaceuticals in Cambridge. They have an open innovation culture with over **250** collaborations started and **19** challenges completed.

Biotechnology companies are focused in Cambridge on the science park with over 30 companies working on preventing and diagnosing disease and patient monitoring systems. 14 of those companies are developing platform technologies or products for research scientists. This includes the supply of antibodies, informatics and data services, and technical consulting. Examples of some of the businesses are Abbexa, Nuclera Nucleics, Abcam, Amgen and Celldex Therapeutics.



WHAT WILL HAPPEN IN THE FUTURE?

Advancements in other fields will help to advance the life science sector. Cloud computing, blockchain, robotics and virtual reality will all have applications in the industry that will help it to grow. Research in life science is still heavily being invested in and it can be expected that continuous breakthroughs in technology will change the way companies provide healthcare and products. There are plenty of opportunities to support the growth of this sector by connecting companies to provide expertise and advice. The future of healthcare is looking at non-invasive delivery techniques for drugs, fast acting effects and automated/robotically assisted surgery and patient care. The future of other areas of biotech involve tackling energy problems with synthetic biology solutions like biofuels from renewable biological products and improving bioinformatics, the way we look at data we get from biological systems.

Recommendation

Form technology groups focused on emerging technologies to collect critical mass

TECHNOLOGY INNOVATION CLUSTERS

Cambridge is strategically located within close proximity to a range of 'Technology Innovation Clusters', all of which can be found within 65 miles of the city. These innovation clusters have previously been described as "global economic hot spots where new technologies germinate at an astounding rate and where pools of capital, expertise, and talent foster the development of new industries and new ways of doing business," (Engel, 2015). There are 7 innovation clusters that have been identified in figure 1 below and this section will outline their strengths, the businesses that occupy them and how Cambridgeshire and Peterborough can connect with them.

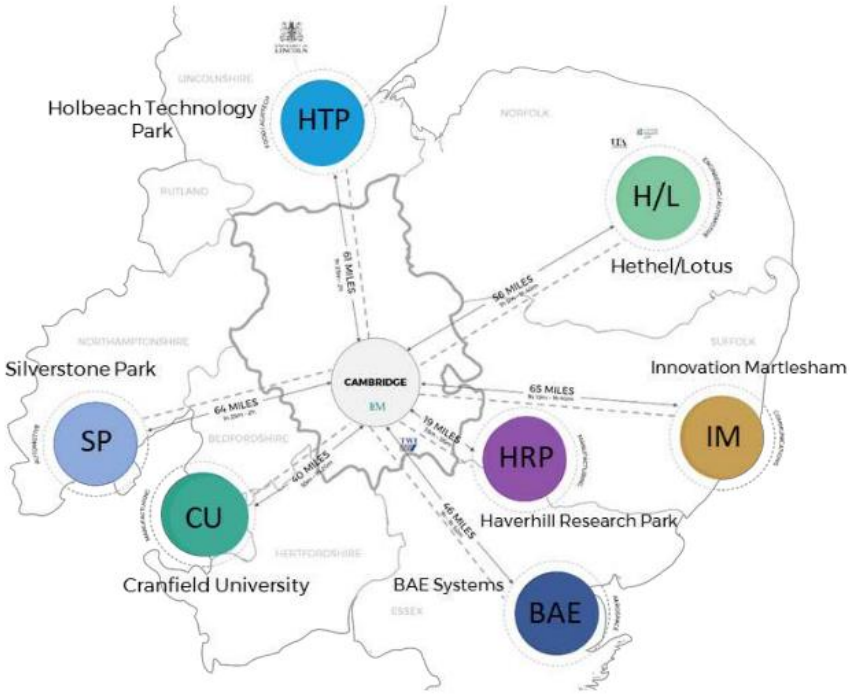


Figure 1 – The Technology Innovation Clusters Surrounding Cambridge.

HOLBEACH TECHNOLOGY PARK

Holbeach Technology Park is a relatively small 1.75-acre development site just to the north of the town of Holbeach. It is located right next to the A17, in the heart of Lincolnshire's food technology region. The park is home to the National Centre for Food Manufacturing (NCFM) that focuses on education and innovation for businesses and their employees in the food industry. The NCFM runs an innovation platform called the Greater Lincolnshire Agri-food Innovation Platform that is funded by the European Regional Development Fund (ERDF) and aims to provide support to small and medium sized businesses based in the food industry through applied research, commercial trials, knowledge exchange, training events and advice from industry experts and academics. It is also home to the University of Lincoln's Holbeach Campus. This campus offers degree courses for students that want to focus on roles within food science and manufacturing.

The key strengths of the park are its location and specialisation in food technology, business and manufacturing. The park has strong ties with Lincoln University, especially the Lincoln Institute for Agri-Food Technology (LIAT) at Riseholme. This institute conducts world class research and aims to link academics with partners in

All of these tech clusters are within 65 miles, making them only a **1-2 hour** drive away from C&P. Each cluster generally has a focus that **aligns** with research and development in Cambridgeshire.

There are great **transport links** already in place between some of these locations. Businesses want more **industrial zones**, especially in Peterborough.

The businesses of the **Cambridge Norwich Tech Corridor** have added a gross value of **£28.9bn** to the UK economy every year. More corridors could be formed between these sights for similar success.

The Universities in the region create a **strong supply of graduates** who may become potential leaders. The exception is Peterborough as it has **no university**.

industry for growth. Examples of the LIAT's partners are Marks and Spencer, Moy Park, Tesco, the centre for Ecology and Hydrology and Earlham Institute.

LIAT is a member of Agri-Tech East, a network of farmers, food businesses, scientists and academics with the goal of improving the productivity, profitability and sustainability of the food sector. They work to facilitate connections between businesses, accelerate application of technologies, enable economic growth and support businesses. Holbeach Technology Park will continue to benefit from its proximity and connections to these locations and provides a strong foundation for new businesses to grow.

Cambridgeshire and Peterborough (CP) have an active agritech, bioscience and food industry that will benefit from stronger links with Holbeach and Lincolnshire as a whole. Students graduating from NCFM and the University of Lincolnshire provide potential leadership and specialised roles in food manufacturing companies that may ultimately end up being interested in synthetic biology and crop science research in Cambridge to increase their productivity. Strategically locating business parks in the northern part of Cambridgeshire or close to Peterborough that focus on programmes supporting agritech and food sector manufacturing businesses would put them very close to Lincolnshire and the high demand of food producers that are located there.

SILVERSTONE PARK

Silverstone Park is a hub that is home to a cluster of motorsport and technology businesses. It is a crucial part of the UK's motorsport industry, with numerous connections to huge international businesses. They can share these global business opportunities with any businesses that join their community. They offer offices and industrial units to rent for emerging businesses in the sector and currently have over 50 businesses on the site. Big names within the automotive industry that call the park home are Porsche, Lotus and Ducati.

These big businesses can offer support to other companies in the cluster in the form of expertise and advice at events. The park offers a wide range of events including; local business networking, metrology networking, occupier networking, conferences and team lunches as well as providing support with public relations and marketing. Conference and meeting rooms can also be rented for businesses looking to host their own networking.

The Metrology Facility is managed by a company called Hexagon Manufacturing Intelligence and provides a hi-tech facility with precision measuring machinery that can be used by SMEs and start-ups alongside training and networking events to maximise growth.

The key strengths of this park are its international links and strong, state of the art business support focused on the special requirements of businesses in the automotive industry. For CP the benefit of Silverstone is the connections for the automotive manufacturing industry. Silverstone's global links can be attracted to sites in Cambridgeshire. As this industry is the largest buyer of robotics in the country there is also great potential for supply chains and collaborations to be set up between businesses on this site and the numerous robotic businesses located in CP.

CRANFIELD UNIVERSITY

Universities like the one at Cranfield are often found in or near innovation clusters as they provide many benefits for surrounding businesses, for example, academics performing world class research and a steady stream of graduates and post-graduates. The main focuses of research at the university revolve around big data, circular economy, risk and resilience, technology and transforming developing countries. The University has a number of notable centres and institutes that research fields related to our strategy and some of these are; the Advanced Vehicle Engineering Centre, the Bioenergy and Resource Management Centre, the Centre for Autonomous & Cyber-Physical Systems, the Centre for Defence Engineering and the Centre for Environmental and Agricultural Informatics.

The University uses academics from its research institutes to provide education and training at events to businesses in the sector. In terms of businesses in this cluster, Cranfield University has its very own technology park that is home to over 45 businesses including Qmatic, Puls UK, ESM software and Caltec. There is an innovation centre on the park, and it offers a range of business support opportunities including meeting rooms and conference facilities, professional reception services, breakfast seminars and research and technical resources.

The Nissan Technical Centre Europe (NTCE) is also located in Cranfield Technology Park. The centre focuses on design and development within the automotive sector and specifically looks at the design, development, purchasing, production engineering and QA functions.

The strength of this cluster is its manufacturing and engineering companies and their world class expertise, large-scale facilities and unrivalled industry partnerships that create leaders in technology and management globally. For CP this is another hub that can provide a strong, skilled workforce, pumping out new leaders that can branch off from R&D into start-ups. The high research culture that already exists in Cambridgeshire will benefit from competition and collaboration from the research at Cranfield.

BAE SYSTEMS

As a global leader in defence, aerospace and security, BAE systems form a cluster in Chelmsford in Essex. Research and development at their site are focused on vehicle development, future technologies, cyber security, services and electronics. BAE's vision is to be the world leading company in defence and security and their strategy involves supporting defence-based businesses, growing their own company, developing international business, inspiring a diverse workforce and enhancing financial performance.

The business has an Applied Intelligence lab and an Innovation lab. The innovation lab is where the company looks at trends driving change in the industry and how they can collaborate with their partners to promote innovation. The AI labs are the research and technology arm of BAE Systems. The Applied Intelligence business provides R&D, consultancy, specialist manufacturing and technical services for businesses, government departments and commercial entities. The company has a large focus on defence and innovation education in the UK and works in schools and colleges across the country. They also offer opportunities for graduates and inspiring a diverse workforce and enhancing financial performance. The business has an Applied Intelligence lab and an Innovation lab. The innovation lab is where the company looks at trends driving change in the industry and how they can collaborate with their partners to promote innovation. The AI labs are the research and technology arm of BAE Systems. The Applied Intelligence business provides R&D, consultancy, specialist manufacturing and technical services for businesses, government departments and commercial entities. The company has a large focus on defence and innovation education in the UK and works in schools and colleges across the country. They also offer opportunities for graduates and undergraduates as well as apprenticeships.

The strength of this cluster is in manufacturing and technology and the world-leading research being performed. BAE currently has no incubator space for other businesses but provides support to the industry by connection, collaboration and education. Cambridgeshire has numerous aerospace businesses like Airbus and Marshall's that could benefit with engagement from BAE. The reverse is also true of other technologies, however, as BAE maybe interested in SMEs and start-ups that are developing technology that could potentially be useful to them.

HAVERHILL RESEARCH PARK

The Haverhill Research Park is located right next to the A1017 between Cambridge and Ipswich. Its only 18 miles from Stansted Airport along the A11. Lying in between Cambridge is Granta Park and the Babraham Research Park. The park itself is 30 acres and has full infrastructure ready for building on. Planning consent is already available for 450,000 sq ft. over four plots. Because the park is still in development, tailored pre-let solutions can be offered to businesses looking to move to the site. Haverhill is also home to a business park and while the park isn't as focused on hi-tech companies it still brings jobs, businesses and the potential for more growth.

Haverhill has a history of business enterprise that has driven its development as a town. It has recently won Enterprise Zone status and that means potential occupiers can look at having a business discount rate of up to 100% for five years. This is a huge bonus for new businesses looking to move the site and will allow money to be saved and utilised in research and manufacturing.

Some of the most notable business occupiers on the park are AXA, Aegate, Scientia, TTP, PA Consulting, Ziconix, Tone Jet, Instem, Strainstall UK, The Welding Institute and IBM. These businesses cover a diverse range of technologies, including printing, IT and telecoms, clean tech, life science, engineering, healthcare, nanotechnology and advanced metals.

The park was created by and continues to be maintained by a company called Jaynic. They specialise in promoting employment and residential sites through development. There is currently no evidence of any form of networking from Jaynic as their focus is on the construction side of things and this leaves an opportunity open in this area to start getting businesses to come together and collaborate

Haverhill is a growing region and there is great potential to cultivate a highly successful cluster of hi-tech manufacturing and research businesses. It's very close proximity to Cambridge makes it a suitable location for businesses that are looking for space. The existing businesses are already worth engaging with in terms of collaboration and networking and there is a great opportunity for expertise to be shared.

INNOVATION MARTLESHAM

Innovation Martlesham (IM) is an innovation cluster home to a large number of ICT companies located at Adastral Park. The park is located right next to the A12 just 7 miles from the centre of the city of Ipswich. Its location puts it right in the centre of London, Cambridge and Norwich. There is a heavy focus on ICT-related businesses and research here.

They provide a 'collaborative ecosystem' for technology-based businesses to engage and connect. In terms of the physical spaces they can provide, a business can look at getting flexible furnished or un-furnished office space complete with all the necessary infrastructure. They have an innovation Martlesham Business Club that acts as an entry level virtual office to provide support specifically to smaller businesses. This can also provide a hot desk in one of their buildings and a whole suite of benefits

including expertise and knowledge sharing, access to the IM mentor group, use of their address, guest passes for hosting meetings, invitation to networking events and exclusive cluster events and free PR and marketing.

The site also has an incubator and an accelerator. The incubator space provides free office space, mentoring, data-comms and co-location with high-tech companies on top of everything already provided by the virtual office. The accelerator facility is for incorporated companies already capable of standing on their own 2 feet that have a product, service or concept and a clear plan of objectives for at least a 6-month period. It works to support businesses in growing what they already have using similar methods to the incubator and virtual office. An example of a company that has just graduated from the accelerator is Inasight, who work on predictive analytics and harnessing the power of machine learning.

IM partners are Cambridge Wireless, Hethel Innovation, New Anglia LEP, Norwich Research Park, Orbis Energy, TechEast and the Tommy Flowers Institute. This demonstrates an already high level of connectivity in on this site. Some of the big businesses that can be found here are BT, Huawei, Intel and O2. The strengths of this park lie in its specialisation in IT and the existing innovation infrastructure that already promotes connection and supports business growth successfully.

With the existing innovation infrastructure already in place at this site, there is so much potential to direct businesses through the accelerator and incubator programmes and then guide them to settle in CP. Connecting with Innovation Martlesham's network will open up access to the businesses in the region, allowing for more connections between businesses and subsequently more growth.

HETHEL ENGINEERING CENTRE/LOTUS

Hethel Engineering Centre is located in close proximity to Wymondham, near Norwich. The centre is only 9 miles from Norwich Research Park, a large hub for bio-science research and businesses. Only another mile from that is the city centre. Hethel is right next to the A11 which is the main link road in the Cambridge, Thetford and Norwich Tech Corridor.

HEC provides physical spaces for businesses in the form of hot desks, offices or large manufacturing workshops. There is a total of 72 units spread between 40 tenants. These tenants all benefit from reception services, free parking, business support from the Hethel team, free events and workshops and pre-installed ICT. They also get access to a range of meeting rooms seating between 2 and 80 people.

The tenants are mostly based in manufacturing and engineering and some examples are AC Cars, Corum Technology, Equipmake, GKN Engineering, HAAS Automation, LMEC, Optima and Safinah. Some of the tenants lie in different area like Norfolk Computer Services, Connected Energy, 3000 Swedish Biomimetics and Kagend. Hethel Innovation owns the centre and runs multiple networks including the NAAME network, Cleantech East and GoBio that aim to connect and support businesses in engineering and manufacturing, clean energy and bio-sciences respectively.

The Lotus company have a strong history in the automotive sector in the UK and their site is right next to HEC. They are an engineering consultancy and manufacturer capable of providing expertise and advice to other companies in the sector. Their strong relationship with Hethel Innovation means they can connect and collaborate through the networks and support other businesses in the area.

For CP Hethel Engineering Centre can act as a link to businesses in and around Norwich, specifically Hethel's tenants and business occupiers located on the Norwich Research Park. As this region has really strong manufacturing sectors in engineering, energy and biosciences and Hethel has a large number of these businesses in their networks there is great potential for CP to benefit from connections to this region.

Recommendation

Creating better transport links and network connections between hi-tech clusters and CP will facilitate connections, bring in more skilled graduates, generate more spin-out start-ups and help generate more supply chains.

INNOVATION TECHNOLOGY DEMONSTRATORS - CATAPULTS

A 'Catapult' is a centre equipped with cutting edge equipment and expert staff with the aim of closing the gap between research and productivity. These innovation-focussed centres are researching the products and services of the future. Catapults also help businesses to adopt, develop and exploit innovative products and technologies.

Founded as part of an initiative by Innovate UK these Catapult centres are central to a wider government goal of driving innovation in UK businesses. As such they receive significant investment from the government. This investment reduces the risk of innovation and stimulates further growth in these areas. These Catapults has been identified by the UK industrial Strategy as a priority for the future of developing commercial opportunities. As such the government will be ensuring that long term funding is in place to aid in the achievement of the development goals they have set out.

WHY CATAPULTS?

GROWTH POTENTIAL IN ADVANCED MANUFACTURING.

Cambridge has a strong foundation for growth in this field as it is already home to Cambridge University's Institute for Manufacturing, The Welding Institute, Marshall Aerospace, Hexcel and more. These organisations stand to benefit enormously from collaboration with these Catapults and subsequent innovations in manufacturing technology. The resulting growth offering long term opportunities in terms of employment, education and sustainability.

NETWORK PROXIMITY AND COMPATIBILITY

The Catapult network is not purely focussed on immediate commercial impact. In addition to supporting almost 6000 SMEs, the catapult network has taken part in over 1000 academic collaborations. This commitment to closing the gap between research and commercial productivity is key to unlocking the value in the Catapult network and leveraging it to promote sustainable growth in Cambridgeshire. This would allow Cambridge to engage its existing academic and commercial networks and capitalise on the geographic proximity of the Catapult network.

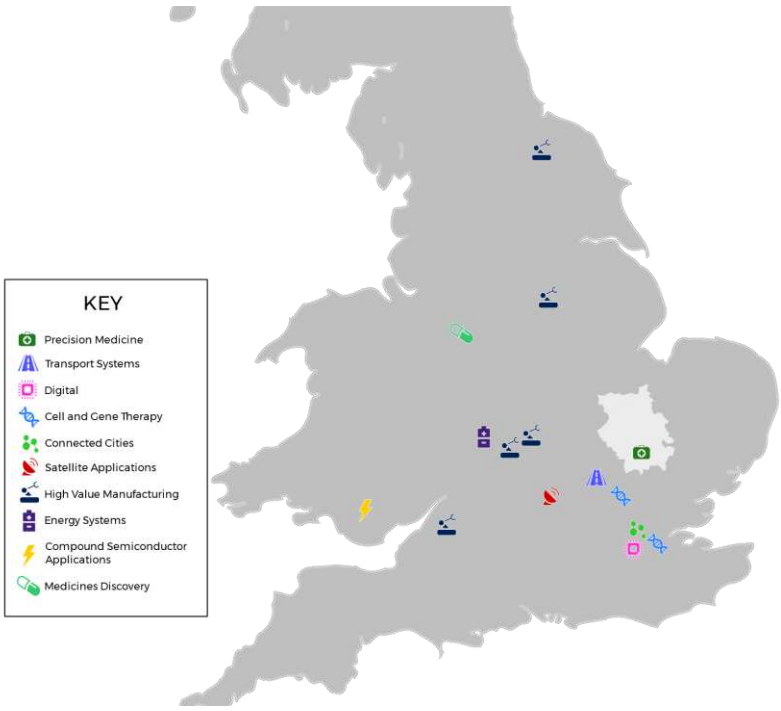


Figure 1 - Catapult Centres Around Cambridgeshire

THE BENEFITS OF WORKING WITH CATAPULTS?

Skilled Human Resource:

Catapults employ skilled experts to work collaboratively on innovation projects. As well as providing high level expertise and driving innovation this creates high value employment opportunities.

Access to Facilities:

Catapults have access to state-of-the-art facilities with capabilities beyond the reach of many in the industry. This will allow those lacking the necessary capital or specialist equipment to engage with innovative technologies and benefit from the resultant growth.

Trusted Environment:

Catapults create an environment where sharing ideas is key, and trust is at the foundation. Robust intellectual property management allows SMEs to engage freely and removes the barriers to entry.

Access to a Dynamic Network:

Catapults provide a platform for understanding business-focussed innovation, stimulating transfer of knowledge and network creation. Ideas and concepts can be iterated and prototyped in a faster and more engaging environment than is possible in a typical industry environment. Catapults also provide access to technical expertise usually not available to SMEs.

ENGAGING WITH EXISTING CATAPULTS

KEY STAKEHOLDERS AND NETWORKS

HVM Catapults

Catapults are central to the success of this initiative. Their resources, people and expertise are the primary stakeholders for this mechanism for growth in Cambridgeshire. The added value that these centres offer partners is one of the key drivers for growth. In addition to providing hands on skills and resources, Catapults are vital in accelerating the delivery of innovative, productive and sustainable growth and employment in the long term.

Universities

Cambridge is known the world over for its university. Producing some of the most highly educated and skilled graduates, the University of Cambridge will provide high level workers and research capabilities to manufacturing groups as well as collaborating with new and existing catapults. A mutual arrangement between catapults and the University could also improve the teaching capacity of the university through placements, partnerships and sharing of facilities. Cambridge University is also home to the Institute for manufacturing, a suitable potential catapult in the future.

Colleges

Cambridge has a wealth of colleges which stand to benefit from engagement with catapult centres. Through collaboration colleges will be able to deliver a higher quality of teaching and produce higher calibre workers. Through partnerships with catapults and manufacturing groups these workers will find higher quality employment more easily.

Manufacturing Groups

There are a number of manufacturers based in Cambridge and its surrounding areas, that would benefit enormously from engagement with catapult centres. The Welding Institute, Hexcel, Johnson Matthey and Inkjet research and many others stand to gain from collaborating with catapults and making use of new and innovative technologies. Some would be suited to becoming Catapults themselves. The Welding Institute and the Institute for manufacturing in particular are well equipped to take on additional government funding, become part of the Catapult network and drive growth and innovation forward

Research Parks

Research parks play a useful role in simplifying the process of collaboration and improving access of organisations to catapults. Information sharing and collaboration within a community is far easier in a localised area, especially

once the culture of trust that catapults foster has already been established. It will be easier for the benefits of catapult collaboration to spread in environments like research parks because the benefits of such collaborations are more noticeable and more likely to be shared. Furthermore, as the connections between research parks and catapults get stronger the ways in which value and innovation can be created will multiply.

Incubators

One of the groups that catapults offer the greatest value to is start-ups. These companies often deal in the cutting edge but rarely have the necessary facilities or capital available to realise their commercial potential from the very earliest stages, by utilising the catapult network start-up incubators will be capable of supercharging growth within their start-ups testing and prototyping at a pace that previously would not have been possible. This will both reduce the risk for these start-up companies and increase the potential growth.

INNOVATION IN HIGH VALUE MANUFACTURING

Currently there are 7 Catapults in the UK focussed on high value manufacturing (HVM):

1. **Manufacturing Technology Centre (MTC) – Coventry**

Areas of Research: Intelligent Automation, Advanced Tooling and Fixturing, Electronics Manufacturing, High Integrity Fabrication, Manufacturing Simulation and Informatics, Metrology and NDT and Net Shape and Additive Manufacturing.

2. **National Composites Centre (NCC) – Bristol**

Areas of Research: Renewables, aerospace, motorsport, marine and satellite

3. **Nuclear Advanced Manufacturing Research Centre (Nuclear AMRC) – Rotherham**

Areas of research: Nuclear, oil and gas, offshore wind, chemicals and aerospace.

4. **Warwick Manufacturing Group (WMG Catapult) – Warwick**

Areas of Research: Autonomous vehicles, high efficiency electric machines and power electronics systems, lightweight structure design and battery chemistry

5. **Advanced Manufacturing Research Centre (AMRC) – Rotherham**

Areas of Research: Advanced machining and materials research for aerospace and other high-value manufacturing sectors.

6. **Centre for Process Innovation (CPI) – Redcar**

Areas of Research: Development, proof, prototyping and scaling up the next generation of products and processes.

7. **Advanced Forming and Research Centre (AFRC) – Renfrew**

Areas of Research: Developing forming and forging technologies to support the design and manufacture of *products*, across a range of sectors including Aerospace, Automotive, Energy, Medical Devices and Marine.

NEW CATAPULT CREATION

WHY CREATE NEW CATAPULTS?

The benefits of Catapult Centres have already been discussed within this section, so the development of further Catapults within Cambridge should be without question.

The vision of the Catapult program is to bridge the gap between ambitious businesses and the expertise of the UK's world-class research communities. Catapults exist to:

- Reduce the risk of innovation
- Accelerate the pace of business development
- Create sustainable jobs and growth

- Develop the UK's skills and knowledge base and its global competitiveness

The Cambridgeshire and Peterborough region already possesses a number of sites that have the potential to become Catapult Centres in the future:

- **TWI** – TWI is one of the world's foremost independent research and technology organisations, with expertise in materials joining and engineering processes.

- **IFM –** IfM has strong links to the University of Cambridge and their research helps companies develop life-changing products and service

- **IMET** – iMET is an advanced technical training centre, based in the heart of the Alconbury Weald Enterprise Campus, conceived from an identified need to deliver higher-level training for the manufacturing, built environment and science & technology sectors.

SECTOR SPECIALISATION

WHY SECTOR SPECIALISATION?

Peterborough has the lowest proportion of high-level skills than anywhere else in the area. Only 25.6% of the population of Peterborough have an NVQ4 qualification compared to 38.6% across Great Britain. There is a need for a higher education facility in Cambridge and Peterborough that focuses on courses such as degree apprenticeships to supply the area with highly skilled technical workers, as well as the academics supplied by the University of Cambridge, This highlights the importance of the development of Sector Specialisation across Cambridgeshire and Peterborough.

The following areas have been identified as key opportunities for sector specialisation within Cambridgeshire and Peterborough.

PRECISION AGRI-TECH

Agri-Tech technologies have been present in the farming and other agricultural industries for the last few decades. However, in recent years precision technologies have emerged that help those working in the sector maintain their work at a much higher standard.

HOW IT WORKS

Precision Agri-tech, also known as precision farming, is a group of technologies that make the practice of farming more accurate and controlled. This includes both crop growing and raising livestock.

Variable Rate Technology (VRT)

Variable Rate Technology refers to any technology that allows farms to vary inputs in a specific location by providing them with data. The data can be collected by many different ways map-based, sensor-based or manual. The forms of technology that used in Variable Rate Technology can be from Artificial Intelligence to drones and satellites.

GPS Soil Sampling

Being able to sample soil via GPS and store the data digitally allows farmers to make informed and profitable decisions. More specifically, almost every decision related to the cultivation begins from the soil sampling. The adoption of this technology can save a lot of time as well money because you can be very precise by providing the exact amount of assistance that your farm needs. The avoidance of waste it is also an important benefit of the use of this technology.

Remote Sensing Technology

Being able to remotely monitor things like moisture levels digitally is both more precise and saves time. Remotely sensing systems can be used to in order to identify nutrient deficiencies, water deficiency or surplus, insect damage, wind and hail damage, herbicide damage, diseases and plant populations. The system that is more frequently used is a passive system that senses the electromagnetic energy that plants reflect.

NETWORK SUPPORT

Agri-Tech East supports the growth of a world-leading network of innovative farmers, food producers & processors, scientists, technologists and entrepreneurs with a shared vision of improving the productivity, profitability and sustainability of agriculture in the East of England. In November 2016 Agri-Tech East won the Knowledge Catalyst Award at the Eastern Daily Press Business Awards.

Adoption of VRT technology in the area is around 15% and growing

"The only way to deliver the food needed without harming the planet is through more efficient food production and improvements to food supply chains," says Emma Fletcher, SmithsonHill managing director.

Overall, by applying precision farming techniques on the wheat enterprise Loam Farm boosted its profitability by around £8,400. Thus, indicating a payback in Year 2

Agri-Tech East mainly drives innovation through advancing the application of research and technology development, encouraging conversations and connections, supports businesses who want to engage with the agri-food ecosystem.

OPPORTUNITIES TO ENGAGE

The use of Agricultural Technologies in research and development create the following:

- ***Commercial Opportunities***
- ***Economic Growth***
- ***Creation of Jobs***
- ***Collaborations***

KisanHub – https://www.kisanhub.com/

Cambridge-based agri-tech start-up KisanHub is a cloud-based enterprise farming platform to transform farming while using smart technologies to enhance smart agriculture decision making.

Their main aim of this start-up is to take the risk out of the supply chain and they are trying to achieve that by connecting enterprise staff and agronomists with growers, by providing as much information as possible to the farm in order to take the right decisions and by making the farm owners to understand that there is a lot of uncertainty related with supply chain and minimizing the risks is a very important element of the venture's success.

The KissanHub received £1.75 million in 2018 by two Venture Capital firms the Notion Capital and the IQ Capital.

ESTABLISHING RELATIONSHIPS

By mapping the companies across Cambridge and Peterborough that are developing innovative agricultural technologies and making connections between those companies and the regions farmers you can ensure the uptake of these technologies,

COLLABORATIVE RESEARCH

By establishing these relationships, you can ensure research and development companies are having their products used in real life situations within the sector. By gaining real feedback the Agri-Tech companies can ensure challenge-led innovation while the farmers can receive all the benefits mentioned above by using cutting edge technology in their farms.

BUILDING PIPELINES

Employing growth strategies to help establish working partnerships between academics with ideas and Agri-Tech experts and entrepreneurs to develop pipeline of businesses that can grow within Cambridge and Peterborough.

UK Strategy for Agri-Tech

The UK government considers agriculture an important pillar of the country's economic growth and it will be making a £160 million investment in national Agri-Tech in the near future.

QUANTUM TECHNOLOGY

HOW IT WORKS

The phrase Quantum Technology was first used by physicist Gerald Milburn in 1997. He said that by harnessing the properties of quantum mechanics we could revolutionise technologies such as cryptography, imaging and computing.

Quantum Computing

Traditional computers require data to be stored as binary units (0 or 1) in quantum computing data can be stored as qubits, both 0 and 1 at once. The main benefit of quantum computing is the high level of security it provides. Quantum computers are not only more secure, but they are faster as well. Furthermore, because they work in a different way compared to the conventional computers, they allow us to model and understand more complex organic processes which are driven by quantum effects.

Quantum Sensors

Quantum sensors use a quantum technology called entanglement to provide greater sensitivity and/or resolution than can be gained from traditional sensors. The sensitivity of quantum states can be harnessed for sensors, because they can be used to detect light, gravity and magnetic fields. We will be able to see things we have never seen before: surveyors will be able to sense underground hazards by measuring gravity and cars will be able to sense pedestrians and cyclists obscured by fog or hidden just around the corner

Quantum Meteorology

Precision measurements are important across all fields of science. In particular, optical phase measurements can be used to measure distance, position, displacement, acceleration, and optical path length. Quantum Meteorology is the study of make high resolution and highly sensitive measurements of physical parameters using quantum theory. It enhances precision of measurements that could not be taken using classical techniques.

NETWORK SUPPORT

CHASE is an association of SME businesses and individuals in the Cambridge area whose main activity is in the high technology area. A talk on a technology-related topic takes place on the first Monday of each month and additional networking events are arranged on an ad hoc basis.

OPPORTUNITIES TO ENGAGE

The use of Quantum technologies could revolutionise industries such as:

Automotive

Cyber Security

Defence

.

Healthcare

The UK government will be making £20 million investment in national Quantum technologies.

- **£20 million** of Innovate UK funding is available through the Industrial Strategy Challenge fund

It will engage researchers, to translate quantum science into quantum engineering, and manufacturers, who can use this work to develop new quantum-enabled devices and products.

The UK governments focus is on quantum technologies end users and how to make the most of the opportunity by building on the UK National Quantum Technology Programme. This programme was set up by the UK government to translate academic research on quantum mechanics to commercial, quantum technology products.

Dr Liam Blackwell, head of quantum technologies at EPSRC said: "Development of the network has brought together in the quantum communications hub partnership many world-class researchers and facilities from both UK universities and industry.

Professor Ian White from Cambridge's Department of engineering said: "The development of the UK Quantum Network has already led to a much greater understanding of the potential of this technology in secure applications in a range of fields, in addition to bringing new insights into the operation of the systems in practice,"

The CHASE association membership comprises some 50 enterprises and individuals and covers a wide range of activities, including computing, electronics, communications, biotechnology, as well as support services such as patent agents,

GROWTH STRATEGY FOR QUANTUM TECHNOLOGY INNOVATIONS

Establishing Relationships

By mapping the companies across Cambridge and Peterborough that are developing innovative quantum technologies and making cross-sector collaborations between businesses and academia across the county you can ensure the uptake of these technologies,

Collaborative research

By establishing these relationships, you can ensure research and development companies are having their products used in real life situations within the sector. In detail academic research and developing companies can work together and they can test the developed products to businesses within the sector. By gaining real feedback you can ensure challenge-led innovation.

Building pipelines

Employing growth strategies to help establish working partnerships between academics with ideas and Quantum Tech experts and entrepreneurs to develop pipeline of businesses that can grow within Cambridge and Peterborough

UK Industrial Strategy

Quantum Technology was defined in the UK Industrial Strategy as a global challenge that the UK could put themselves at the forefront of. Use in cyber security and defence makes it a hot-topic emerging sector.

According to the Department for Transport the year 2017 the total amount of goods moved for all domestic waterborne freigh declined by 18% to 24.9 billion-tonne kilometres (bt-k) in 2017 compared to the previous year.While the amount of goods moved for all inland waters freight rose by 2% to 1.6 billion-tonne kilometres (bt-k) in 2017 compared to the previous year.

This increase in the inland water use in the UK despite the big decrease in the total volume of the goods that had been moved demonstrates that there is potential for the creation and expansion of inland ports.

INLAND FARMER PORT

HOW IT WORKS

Wisbech served as a port in medieval times. The port offers a high-quality service, including excellent road service to all parts of the country, diesel bunkers, water and stores available, competitive wharf age dues, modern mobile cranes, rapid turnaround and equipped for bulk handing. With easy access to The Wash and major road routes such as A1101 and A47, the Port of Wisbech is perfectly placed. The port offers export and import opportunities as well flexible working hours.

NETWORK SUPPORT

With the expansion and upgrade of the facilities of the existing Inland Farmer Port of Wisbech as well with the possible creation of a second inland farmer port at the bank of the Great Ouse river they could assist the creation of a network. More specific the Inland Framer Port can also work as a hub that brings together businesses from different sectors where the only thing that they have in common is the will to receive and ship their goods through an Inland Farmer Port in Cambridgeshire and Peterborough. By bringing together businesses and entrepreneurs it could lead in the creation of cross sector collaborations with many different mutual benefits for all the involved parts (decrease of transportation costs, etc.).

EFIP brings together almost 200 inland ports and authorities in 18 countries of the European Union, Switzerland, Serbia and Ukraine.

EFIP aims to promote and gighlite the role of European inland ports as real intermodal nodal points in the transport and logistic chain, combining inland waterway transport with rail, road, and maritime transport.

OPPORTUNITIES TO ENGAGE

The use of am Inland Farmer Port can also create the following opportunities:

Transfer of goods

Economic Growth

Creation of Jobs

Collaborations

GROWTH STRATEGY

Establishing Relationships

By mapping the companies across Cambridge and Peterborough that are using inland farmer port and making connections between those companies you can encourage the creation of collaborations with mutual benefits for both the companies and the inland farmer port.

Collaborative research

By establishing these relationships, you can ensure research and development companies are having their products used in real life situations within the sector. By gaining real and instant feedback the inland farmer ports will be able to improve their services. In addition, through the network the businesses might discover new ways to reduce their costs by using economies of scale.

Building pipelines

Employing growth strategies to help establish working partnerships between academics with ideas and inland farmer port experts and entrepreneurs to develop pipeline of businesses that can grow within Cambridge and Peterborough.

MIT researchers are confirming that by 3D printing the Solar Panels and avoiding to use materials such as glass polysilicon and indium the production costs can be reduced by 50%.

In addition, the 3D printed Photovoltaic Panels can be 20% more efficient compared to the traditional ones and this happening thanks to the technological advancement.

PRINTING PV PANELS

HOW IT WORKS

The PV panels can be made using specialised semiconducting inks and can be printed using a conventional reel-to-reel printer. these modules cost less than $10 per square metre when manufactured at scale. Each solar cell consists of several individual layers printed on top of each other, which are then connected in series to form a bank of cells. These cells are then connected in parallel to form a solar module. There are many benefits by using this energy solution is as the printable PV panels are lightweight, quick to manufacture and very easy to install on a large scale.

"The question is how much does the energy cost? These materials are so cheap to make, manufacture and install that when you calculate the total cost of energy when manufacturing at scale, it's going to give you a competitive product." Paul Dastoor Newcastle University Australia

NETWORK SUPPORT

With the creation of a network like CHASE in the Cambridge and Peterborough for PV printing companies' opportunities for collaborations and networking will occur that would accelerate the growth process. Cambridgeshire and Peterborough are famous worldwide for their academic capabilities and by bringing together these academic institutions with the local enterprises that specialised in printable PV panels the technology would advance and new improved products could be created.

The printed solar modules could easily be installed onto any roof or structure using simple adhesive tape and connected to wires using simple press-studs.

ESTABLISHING RELATIONSHIPS

By mapping the companies across Cambridge and Peterborough that are printing PV panels and making connections between those companies and the regions businesses and consumers you can ensure the uptake of these technologies.

COLLABORATIVE RESEARCH

By establishing relationships among PV panels developing companies, academia and local businesses you can ensure the new products that research and development companies manufactured with them are having their

products used in real life situations within the sector. By gaining real feedback you can ensure challenge-led innovation.

BUILDING PIPELINES

Employing growth strategies to help establish working partnerships between academics with ideas and printing PV experts and entrepreneurs to develop pipeline of businesses that can grow within Cambridge and Peterborough.

The use of Printing PV Panels in research and development create the following opportunities:

Housing Energy

Automotive

Industry Energy

Agriculture

Recommendation

For all the reasons that have been demonstrated above, it is important to create and implement a Sector Specialisation strategy in Cambridgeshire and Peterborough. By achieving Specialisation on these Sectors the local business would have the chance to improve their products and services and compete in an international level. Finally, there will be lots of benefits for the users of this technologies in the County and for the local research institutes that would have the chance to get improved by receiving real life instant feedback.

SECTOR GROWTH PATHWAYS

Through our research and background within Manufacturing and Engineering, we have determined 2 distinct pathways for driving growth of the sector (see Figure 1).

These pathways are both based off the assumption that highly developed supply chains attract medium and large businesses to the surrounding area, which will therefore lead to a more developed manufacturing and engineering sector.

The pathways depicted below are place-based, dependent on whether the geographic location has strengths in research (i.e. Cambridge), or manufacturing (i.e. Peterborough).

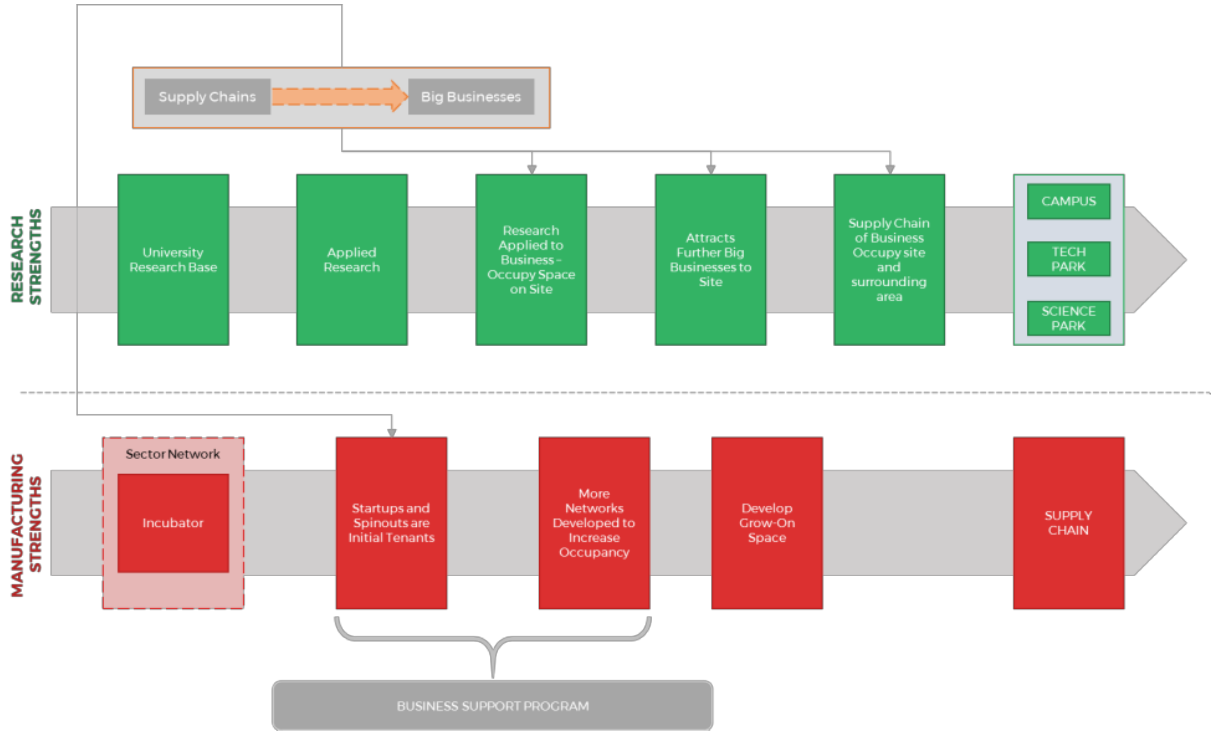


Figure 1 – Sector Growth Pathways

PATHWAY 1 - RESEARCH STRENGTHS

1) **A Strong University Research Base**
The key to this sector growth pathway lies in the area having significant strengths in research.

2) **Focus on Applied Research**
A significant focus on applied research, developing solutions that can be used to solve specific problems within the manufacturing sector.

3) **Application of Research to Businesses**
Once manufacturing businesses are aware of the benefits of said applied research, and how they can provide solutions for them, they may set up base within the area.

4) **Attracts Further Big Businesses to Site**
Businesses based around research bases are often followed by further businesses that will also benefit from research applications, and potential collaboration opportunities.

5) **Supply Chain of Businesses Occupy Surrounding Areas**
Soon, a cluster will be formed, comprising of smaller businesses providing different stages of the supply chain.

PATHWAY 2 – MANUFACTURING STRENGTHS

1) **Build a Sector-Focused Incubator**
   Develop a business incubator that has a specific sector focus on advanced manufacturing and materials

2) **Develop a Manufacturing Network**
   Growth of the manufacturing sector is best supported through the creation of knowledge-intensive sector networks, that will be based around the incubator.

3) **Initial Tenants are Startups and Spinouts from Larger Businesses in the Area**
   Many of the initial tenants of the incubator will be new manufacturing businesses. The key to this pathway is basing the incubator in an area with a rich manufacturing and engineering background, in order to provide space for potential spinouts from employees of larger businesses.

4) **Create More Sector-Focused Networks**
   To increase occupancy of the incubator, supporting sector networks focusing on areas such as clean technology should be created.

5) **Create Grow-On Space**
   Once occupancy has reached its capacity, there will be a need to develop grow-on space to provide incubation for new tenants, as well as high growth existing tenants that are looking to expand.

SPACE & CAPABILITY

ASSET MAPPING

During research, 6 sites were identified as areas of potential growth. These areas have all the necessary components to become powerhouses of industry which could transform Cambridgeshire and Peterborough's economy completely.

Figure 1- Potential Technology Parks

The importance of scaling up growth space for advanced manufacturers was highlighted, especially the need for more Campus spaces to encourage collaborations

The importance of support from councils in developing open, innovative sites was highlighted.

RED BRICK FARM

One of the most established and innovative manufacturers in Cambridgeshire and Peterborough is Perkins Engines. Perkins has been a national manufacturing powerhouse since it was founded in 1932 as a diesel engine manufacturer.

A large cluster of manufacturing businesses has formed around Perkins Engines in Peterborough, known as the Perkins Cluster. The area has been highlighted as a potential growth site.

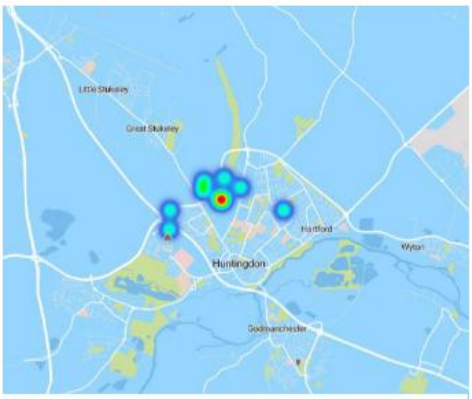
Red Brick Farm presents an investment and development opportunity to create a new employment area in a successful light industrial part of the city with a strong mechanical and engineering presence. The site is in a prime geographical location, only 45 minutes away from London by train, Cambridge only 40 miles away, and ports of Tilbury, Felixstowe and Hull just over 100 miles away. Red Brick Farm has been shortlisted for expansion by Innovation Corridor UK.

Already home to a number of Manufacturers, the Redbrick site has the potential to become a high-performance Technology Park.

The proximity of the site to University Centre Peterborough also provides opportunity for skills development schemes, enabling skills growth in the area.

ALCONBURY WEALD

As highlighted in 'Spaces and Capabilities', Huntingdon has the potential for high levels of growth as a manufacturing hub. As can be seen from the opposite map, there is a high concentration of Manufacturers in Huntingdon, including a hub of Composites businesses



A heatmap showing Manufacturing Businesses based on Industrial estates in Huntingdon

Alconbury Weald sits just outside Huntingdon and has the potential for rapid growth. There are plans in place to expand the current Alconbury Weald Enterprise Campus to create a technology hub.

Located Adjacent to the A14 and the A1, the site has easy access to Stanstead, Luton and Heathrow Airports. There are also plans for a new railway station, improving opportunities for commuters.

Plans are also in place to develop up to 5000 homes near the site, encouraging families to move to a community near their workplace.

Source: http://www.alconbury-weald.co.uk/enterprise-campus

The Site already houses iMet, which provides innovative training in manufacturing, engineering and technology. Having an innovative training institution on site such as iMet provides a unique opportunity to create a diverse, highly trained base of skills, with a range of apprenticeships available on site.

Along with New build space, there is already an incubator on site which provides flexible working conditions designed to nurture and grow small businesses.

Source: http://alconbury-weald.co.uk/enterprise-campus/buildings/incubator

Work is already underway on construction on the site, meaning that the future looks bright for the development of Alconbury Weald and Huntingdon.

The Proposed Alconbury Weald site will transform a 1420-acre site into a unique community consisting of homes, schools and the Enterprise campus. The campus itself will offer bespoke business space ranging from 250 sq. ft to 500,000 sq. ft.

iMet addresses the need to high level Advanced Manufacturing and Engineering skills by delivering high end training and Apprenticeships.

SAWSTON DEVELOPMENT

There is a large distribution of Manufacturing businesses and research parks near Sawston in South Cambridgeshire. Duxford is home to Hexcel, an international composites company. Duxford houses six manufacturing buildings, as well as the European Centre for Research and Development.

Nearby is the Wellcome Genome Campus, a biotech centred research campus in Saffron Walden. Opened in 1994 the campus is focused on undertaking genome and biodata research. Providing resources for the scientific community worldwide, they also offer various training opportunities in genomics and biodata.

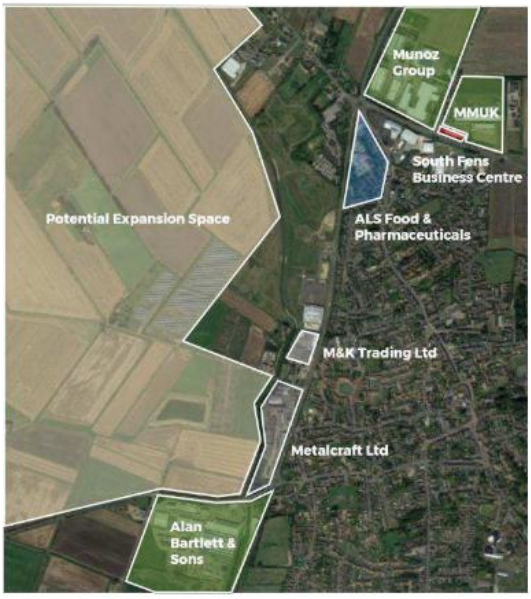
Also nearby is Granta Park, a well-established Science, Technology and Business Campus. Originally established by The Welding Institute, the site includes R&D facilities and also space for businesses. The Park focuses on creating a quality working environment, focusing on not only research and business development, but also on creating a workplace that encourages innovation and excellence.

The Sawston Development is a project headed by Huawei will see development of an old Paper mill outside Sawston. The project could develop a Technology park with the tech giant as an Anchor Tenant.

Close to the M11 and roughly 10 miles from the centre of Cambridge, the site is ideally situated.

CHATTERIS TECHNOLOGY PARK

Located at the junction of the A141 and A142, Chatteris is a small Town in the Fenland district with a bright future. Currently the Honeysome Industrial estate is mostly occupied by Metalcraft Ltd. The land to the side of the industruial estate is currently owned by metalcraft, who have aspirations to develop the site into a Smart Tech Park. The Chatteris Smart Tech Park would allow the existing strengths in Chatteris to develop alongside automated machinery manufacturers. Good transport links and close proxemity to both Cambridge and Peterborough provide an ideal expansion site.



Martin Lawrence, Metalcraft: 'There must be commitment from CPCA to provide future funding for further phases, allowing grow on space'

HAVERHILL RESEARCH PARK

Home to at least 10 manufacturing companies ranging from Precision Engineers to Food and Drink Manufacturers, Haverhill is perfectly equipped to become an advanced cross sector hub. Haverhill research park was recently awarded Enterprise zone status, which in turn will generate rapid Business growth in the area. Just 17 miles from Cambridge and with easy access to the A11, Haverhill has the potential infrastructure to help create a leading cross sector Make It Space.

Haverhill Research Park is made up of four plots spanning over 30 acres and has over 450 000 sq ft of lab and office space. The park is designed to support a wide range of businesses, from SMEs to global corporations.

Planning has also been submitted for 'The Epicentre' a 30,000 sq ft innovation centre which will combine office space, R&D areas, conference spaces and training facilities, along with leasure facilities such as a coffee shop, to create a state of the art facility.

https://www.cambridgenetwork.co.uk/news/haverhill-research-park-gets-new-signage/

Work is also underway on 150 new homes which could help to develop Haverhill into a thriving business community with a multitue of high value companies innovating and growing within the research park.

PEMBROKE AVENUE MANUFACTURING CLUSTER

Pembroke Avenue houses a high number of advanced Manufacturing companies such as Huxley Bertram. The site sits opposite Cambridge Innovation Park, which provides business space across 3 buildings.

Pembroke avenue is home to at least 11 manufacturers, from a wide range of sectors, including Metalworks, Laser cutting and even Food and Drink.

Cambridge Innovation Park sits on the edge of the old RAF Waterbeach airfield, which was used by the RAF from 1940 through until 2013.

The RAF Waterbeach Site. Source: http://www.abct.org.uk/airfields/airfield-finder/waterbeach/

The old airfield provides the perfect site for an Enterprise park, possibly based around advanced Materials and Manufacturing. The site's proximity to Cambridge and relative ease of access to Felixstowe port makes it a perfect site for exporting globally, which fits in with Cambridge's standing as a global competitor.

Old Airbases make ideal sites for Enterprise and Innovation Parks as they provide a large amount of space, often with buildings and workshops ready to use. A prime example is Scottow Enterprise Park in North Norfolk. Scottow Enterprise Park is based at the former RAF Coltishall airbase, which operated between 1938 and 2006. RAF Coltishall served as a fighter airfield in the Second World War, and afterwards a station for night fighters.

Scottow Enterprise Park

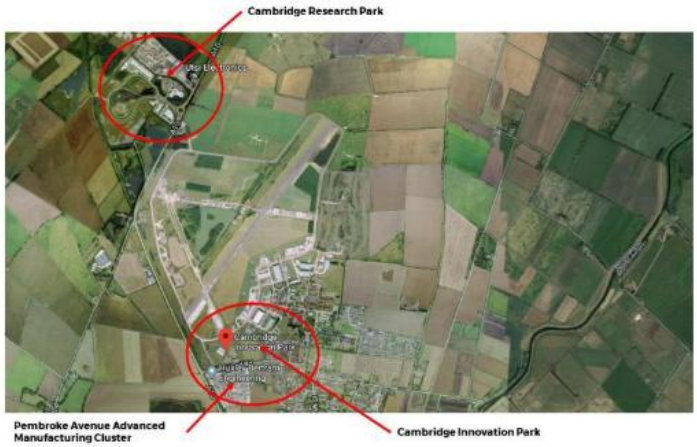
- Over 500,000 Sq Ft of Lettable space
- 135 Businesses in occupancy
- 36 new start ups on site

Now one of New Anglia's Enterprise Zones, the site focuses on supporting STEM skills and businesses with 76% of the businesses based on site focusing on STEM.

With roughly 700 acres of land available, the site has the potential to become a leading Enterprise park which could help Waterbeach expand and grow.

Cambridge Research Park is also situated at the northern end of the site, creating even more opportunities for growth and expansion. Part of the Cambridge Compass Enterprise Zone, Cambridge Research Park provides accommodation for Offices, laboratories, High tech companies and industrial space.

Looking at the surrounding assets, there is a strong opportunity to create a global research, innovation and Manufacturing hub at Waterbeach, which could develop to become one of the most productive and innovative technology parks in the country.



The existing business support facilities already in place would help to provide an infrastructure of business support, encouraging innovation, productivity and growth in the park.

INCUBATION SPACE IN CAMBRIDGESHIRE

Despite its reputation as a life sciences cluster, Cambridgeshire and Peterborough also houses a large number of Manufacturing businesses, with high concentrations in areas such as Cambridge, Peterborough, Huntingdon and Ely as can be seen in Figure 1. Many of these Businesses are based in Industrial estates, Business Parks and even some based on Science and Research Parks.

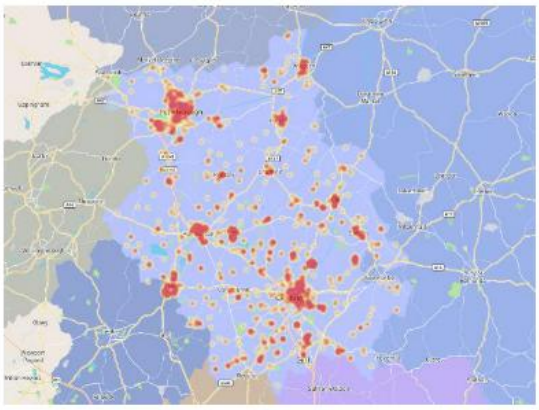
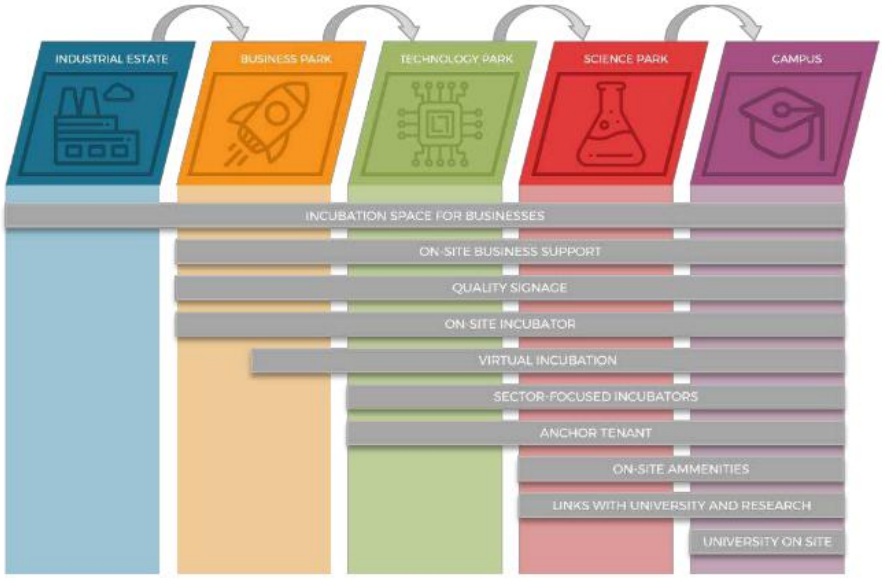


Figure 1 – Concentration of Manufacturing and Engineering Businesses in the region.

There are more than 50 Industrial estates and Business parks across Cambridge and Peterborough, along with at least 8 Science or Research Parks.

HOW TO GROW OUR PARKS



Developing spaces in the region is vital to encouraging growth in SMEs in Manufacturing and Engineering. As can be seen in the following section, a vast number of Manufacturing businesses are based on Industrial estates. In simple terms, an industrial estate provides business space for companies.
In order to encourage growth, sites must look to develop their offerings. The simplest way of encouraging growth is to provide incubation services, be it rent free start up space, or simply business support services.

Having a well advertised site is key for development. If a site has good signage and a strong online presence, it opens up a large number of growth opportunities. Companies looking for premises are drawn to well organised sites, especially if incubation services are provided to nurture start-ups and help them grow. The biggest success for an incubation space is to see businesses outgrow their space.

In order to develop further, sites must often provide more specialised services to tenants, such as Sector focused incubators. Sites with a strong Anchor tenant will attract companies from similar fields, often creating centres of excellence in certain sectors.

A prime example of this is Mira Technology Park, the largest transport-based technology park in Europe. It houses automotive giants Aston Martin, which contributes to other automotive companies being drawn to the park. As a site grows and develops, it drawn more and more people to the site as employees, resulting in a need for amenities such as adequate parking, canteens and even shops.

Granta Park prides itself on its amenities, which include a fitness centre, a restaurant and even a cricket pitch. Having links with universities and research centres allows tenants to collaborate with academia and create tangible businesses from research.

The UK Government's Department for Business Innovation and Skills have produced 'Our Plan for Growth: Science and Innovation', which stresses the importance of Science and Technology Parks in the UK

Researchers and business leaders need access to the best expertise and infrastructure wherever it is located. We are supporting innovative clusters by connecting them with partners such as Catapults, Research and Technology Organisations, universities, science campuses and science parks.

INDUSTRIAL ESTATES

Industrial estates are a key provider of business premises for Engineering and Manufacturing businesses across the country and are often key providers of growth for a small business.

WHAT MAKES A GOOD INDUSTRIAL ESTATE?

Industrial Estates (sometimes known as industrial parks or trading estates) are typically an area designated for industrial development, with more of a focus on heavy industry as opposed to office space.

Industrial Estates are typically located away from residential areas of a town or city and are provided with good transport links.

Compared to other incubation options for businesses, Industrial Estates are considered the most basic. As mentioned, incubation space on Industrial Estates are often focussed on basic infrastructure.

INDUSTRIAL ESTATES IN CAMBRIDGE AND PETERBOROUGH

As can be seen in the heatmap, there are high concentrations of Manufacturing Businesses based on Industrial estates across the region, with a large concentration surrounding the city of Peterborough, and several smaller clusters surrounding Huntingdon, St Neots and Ely.

Several estates were also identified surrounding the city of Cambridge, and on the outskirts of the region near Haverhill and Market Deeping.

BUSINESS PARKS

Often seen as more developed that Industrial Estates, Business Parks are normally smaller and more personalised that Industrial estates. Instead of solely providing a business premises, Business Parks normally help tenants to develop their company.

WHAT MAKES A GOOD BUSINESS PARK?

Typically, the best business parks tend to include at least one incubator within the site.

Incubators differ from research and technology parks, as incubators are usually more devoted to target start-up and early-stage companies.

Services might be built up as:

- Facility management related services: the renting services (offices and other facilities) are among the main function
- Horizontal services, which are available for all tenants or specialised, tailor-made services for specific clients, based on detailed needs assessments
- Targeted services for micro-, small and start-up business
- Provision of co-financing resources or counselling to have access to these: loans, guarantees, venture capital funds,
- Organisation of business partnerships and facilitating networking of tenants
- Presenting, promoting and stimulating innovation for the small business sector,

Many industry leaders agreed that access to readily available business support facilities is vital to the development and growth of the local economy.

BUSINESS PARKS IN CAMBRIDGE AND PETERBOROUGH

The map opposite shows the biggest Business parks in Cambridgeshire and Peterborough. Often business parks are much smaller than Industrial estates, and as a result, there is not as high a concentration of Manufacturing Businesses based on these business parks.

One notable Businesses Park is the Lancaster Way Business Park in Ely. Home to over 100 businesses, it provides a high number of jobs to the area, and houses over 9 small to medium Manufacturers, of which 5 are precision Engineering companies, giving Ely the potential to become a Precision Engineering hub of Excellence.

TECHNOLOGY PARKS

Technology Parks are at the forefront of driving Innovation and productivity in the modern era. It is estimated that there are over 900 Technology Parks worldwide, and Cambridge Tech companies, many of which are based on Technology parks, collectively turn over £13bn per year.

WHAT MAKES A GOOD TECHNOLOGY PARK?

Amongst the characteristics displayed across the majority of the technology parks that clearly differentiates them from a good quality business park are the following:

- Operate careful tenant selection policies
- Selectively prioritise the newer knowledge-based technology industries
- Engage with the knowledge base (primarily universities and public research organisations)
- Engage cooperatively with other public and private sector entities
- Own and/or operate one or more business incubation schemes

- Provide professional business support and innovation services designed to increase the depth and extent of innovation-led and knowledge-based business in their region or locality as well as within their park.

TECHNOLOGY PARKS IN CAMBRIDGE AND PETERBOROUGH

Peterhouse Technology Park houses ARM technologies, a major manufacturer of microchips which exports to 70% of the countries in the world.

Recently an application has been made to approve the expansion of the technology park to create a hub of technology and manufacturing in the heart of Cambridgeshire. Located at the edge of the city, the site has vast potential to expand. Being located just 10 minutes from Cambridge airport, and being located close to both the A14 and the A11/M11 provides excellent transport links for the Park.

Cranfield University Technology Park combines world-class business support alongside Cranfield University's expertise, skills base and facilities

The Tech Park is home to nearly 60 science, technology and knowledge-based businesses, ranging from start up companies through to internationally recognised brands such as Trafficmaster and Nissan European Technical Centre.

Since its launch, the Tech Park has become a thriving 'Innovation Habitat' offering businesses both exceptional quality office space, alongside the University's distinctive expertise and skills base.

SCIENCE AND RESEARCH PARKS/ CAMPUSES

Science parks work closely with academic institutions and attract a large number of advanced tech and Life Science companies. The main aim of a science park is to facilitate growth and innovation for businesses, entrepreneurs, start-ups and communities in fields such as IT, AI, machine learning, IoT, biotech, virtual reality, robotics and more.

WHAT MAKES A GOOD SCIENCE/ RESEARCH PARK?

A Science Park should consist of the following components:

- A Strong science-based infrastructure such as Universities, Research and teaching hospitals, Research Institutes and Critical mass.
- Good premises and infrastructure including Incubation spaces, flexibility of space and opportunities for expansion, as well as good communication links.
- A growing Company base with exciting start-ups and spin outs, and more established companies to act as 'Role models'
- A culture of Entrepreneurship which encourages innovation and unique solutions to problems.
- Available finance for start-ups such as Venture Capital or Business Angels.
- Effective networks such as shared aspirations to clusters, regional trade associations, cross sector collaborations and shared facilities.

SCIENCE PARKS IN CAMBRIDGE AND PETERBOROUGH

Cambridge Science Park is a prime example of a successful, innovative science park. Founded by Trinity College in 1970, Cambridge Science Park is the oldest science park in the UK.

CSP has strong links with the University of Cambridge, and houses over 100 science and technology related businesses, including Huawei, Toshiba, and Bayer.

The 152 acre park, located to the north of Cambridge, consists of 57 buildings, and is home to approximately 6,500 employees. 61% of the companies on the site originated in Cambridge.

The park is constantly expanding, with the next developments highlighted in blue in the diagram below.

The nature of a lot of businesses in Cambridgeshire and Peterborough means that there are numerous opportunities to expand existing science and research parks, as well as forming new ones.

Source: https://www.cambridgesciencepark.co.uk/media/uploads/files/CSP_New_Developments_June_2018.pdf

Opened in 1970, Cambridge Science park is the oldest Science park in the UK. Since then it has grown to have:

- 105 on site companies
- 6500 on site employees
- 152 acres of space
- 57 buildings
- 1.4m sq.ft of existing buildings

GROWTH POTENTIAL IN CAMBRIDGESHIRE AND PETERBOROUGH

Peterborough

In 2017, manufacturing made up roughly 7% of Peterborough's industry. There are 4 roughly 6 industrial estates in the city, with a large concentration of manufacturing businesses located on the estates just off Frank Perkins Parkway. This cluster of estates is home to at least 11 manufacturing businesses from a wide range of sectors, including Fabrication and Joinery. The location of these businesses, as well as the influence of industry leaders Perkins Engines, is one of the reasons that there is so much potential for growth in this area, and with the right development and strategy, this hub of industrial estates could develop to become a powerhouse of manufacturing in Peterborough.

Huntingdon

Huntingdon is a town that sits roughly 20 miles northwest of Cambridge. The town is located next to the junction of the A14 and the A1 giving it excellent transport links, making it an ideal area for business. Over 300 new homes are being constructed in the Huntingdon area, providing excellent opportunities for business expansion. The Stukeley meadows industrial estate and the surrounding area houses roughly 14 manufacturing businesses with at least 4 composites businesses. This cluster of Composite businesses, combines with the proximity of various larger manufacturers such as Valvetech and Xaar, give the area lots of potential for growth and even holds the possibility of a 'Make it Space' centred around Composites, Smart materials and their various applications.

Ely

Ely's Manufacturing businesses are predominantly split between two business parks, with the majority being located on the Lancaster Way business Park or the Cambridgeshire Business Park. Ely is home to at least 18 Manufacturing businesses including 6 Precision Engineers, and an automation robotics company. Ely sits on a major junction of the A10 and the A142, making it an ideal location for businesses. With the added bonus of being only 17 miles from

Cambridge, and with a railway station, Ely is well situated for commuters. The opportunity to develop Manufacturing and Engineering in Ely is enhanced by the development of 3000 new homes in the north of the town, providing housing solutions to increased workers being brought to the area.

Haverhill

Home to at least 10 manufacturing companies ranging from Precision Engineers to Food and Drink Manufacturers, Haverhill is perfectly equipped to become an advanced cross sector hub. Haverhill research park was recently awarded Enterprise zone status, which in turn will generate rapid Business growth in the area. Just 17 miles from Cambridge and with easy access to the A11, Haverhill has the potential infrastructure to help create a leading cross sector Make It Space.

Cambridge

Home of one of the oldest Universities in the world, Cambridge has a world leading economy focusing around life sciences, Software development and Electronics. Home to industry giants such as AstraZeneca, Huawei and ARM technologies. Located close to London with excellent access to road networks, Cambridge has potential to grow exponentially. Close proximity to Stanstead airport, and sitting just over 100 miles from Felixstowe port, Cambridge is ideally suited to export to the rest of the world.

On a Smaller scale, Cambridge itself has a large number of SMEs and start-ups, many of which are spin outs from University Research. With over 10 Industrial estates, Business Parks, and Research and Science Parks in the city itself, Cambridge has a culture of Innovation and Growth.

The 'Cambridge Phenomenon' refers to the success of businesses in the area and is normally attributed to the opening of Cambridge Science Park, boosting innovation and productivity in the region.

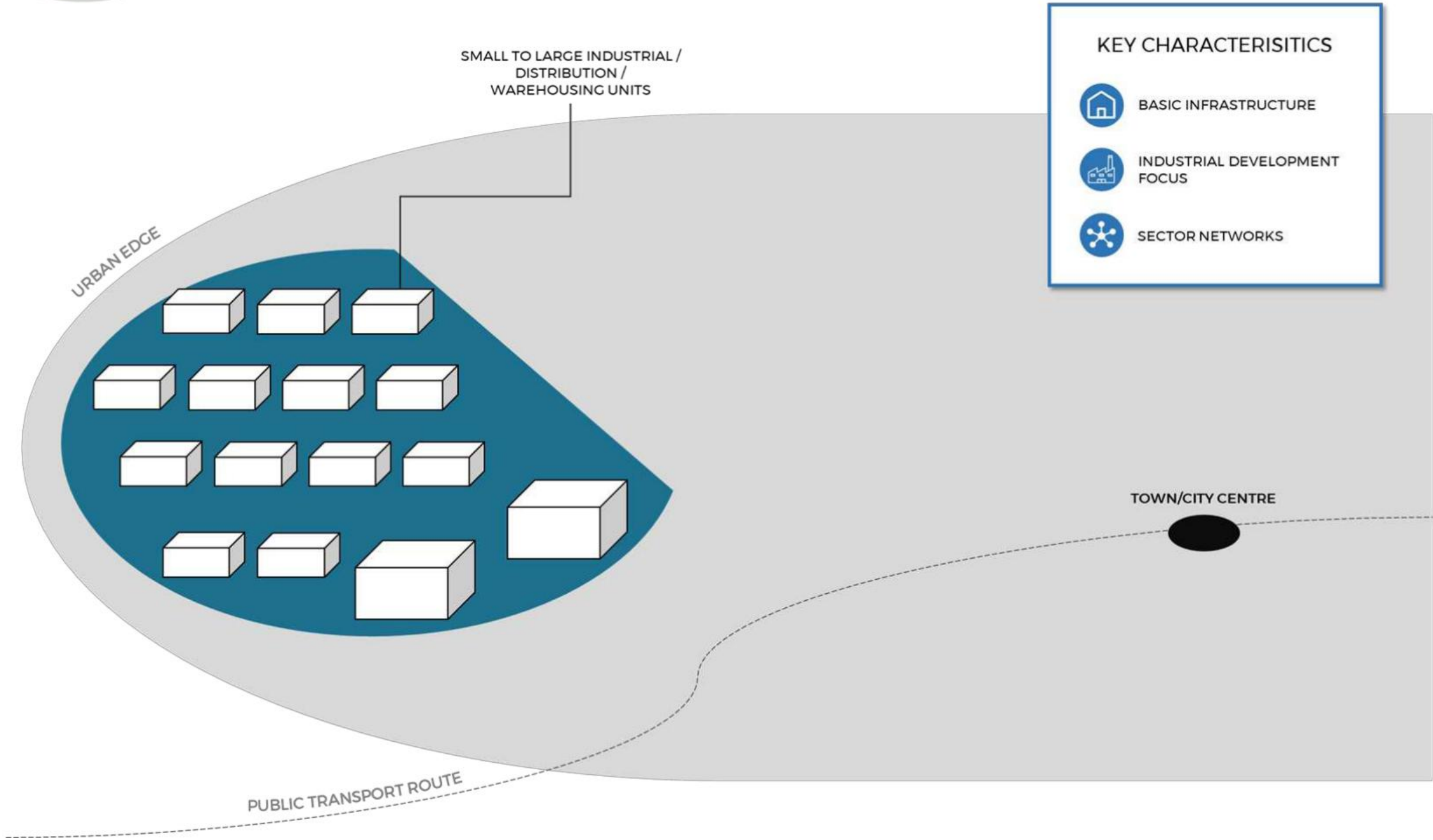
Recommendation

Utilise existing incubation space

Recommendation

Develop new grow-on space with specific support programs with conditions relating to Industry 4.0 and Productivity

WHAT MAKES A GOOD INDUSTRIAL ESTATE?



KEY CHARACTERISITICS

- BASIC INFRASTRUCTURE
- INDUSTRIAL DEVELOPMENT FOCUS
- SECTOR NETWORKS

WHAT MAKES A GOOD INDUSTRIAL ESTATE?

EXPLANATION OF THE DIAGRAM

Industrial Estates (sometimes known as industrial parks or trading estates) are typically an area designated for industrial development, with more of a focus on heavy industry as opposed to office space.

Industrial Estates are typically located away from residential areas of a town or city, and are provided with good transport links.

Compared to other incubation options for businesses, Industrial Estates are considered the most basic. As mentioned, incubation space on Industrial Estates are more often than not focussed on basic infrastructure.

Compared to more developed parks (e.g. Science and Technology), Industrial Estates don't typically have access to amenities or other facilities on site.

STRATEGIC ALIGNMENT

Lambert Smith Hampton

In their 2018 Industrial and Logistics Market Report, Lambert Smith Hampton highlighted that south East Industrial Estates saw volume of £1.4bn.
LSH predicted that in 2018, at least 7.3m sq ft of units above 50000sq ft of industrial space would become available through development.

CAG consultants

In an analysis into the demand for industrial land in London, CAG highlighted that demand for industrial land is increasing, with demand coming from various sectors such as: Warehousing, Transport, Waste and Utilities. Such trends can be seen outside London too, with demand for space increasing in most urbanised areas.

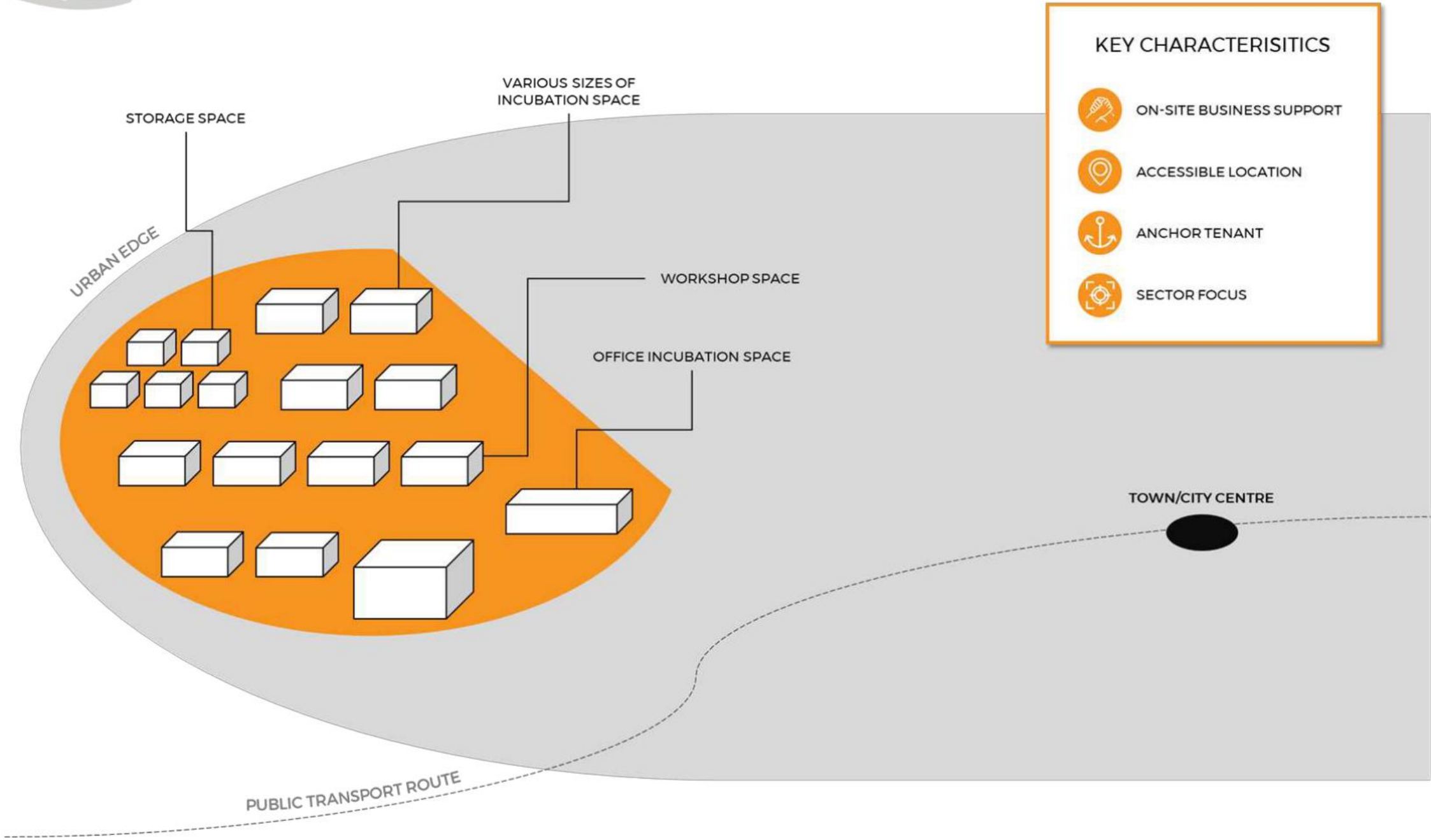
BEST PRACTICE

TRAFFORD PARK INDUSTRIAL ESTATE

Trafford Park Industrial Estate is one of the largest industrial estates in Europe, covering approximately 785 hectares.

Key Facts:
- Over 1,500 businesses on site
- Employs approx. 40,100 people
- Key specialisms in agriculture & mining, and advanced manufacturing
- £4/sqft for industrial/distribution space
- £17/sqft for office space

WHAT MAKES A GOOD BUSINESS PARK?



KEY CHARACTERISITICS

- ON-SITE BUSINESS SUPPORT
- ACCESSIBLE LOCATION
- ANCHOR TENANT
- SECTOR FOCUS

WHAT MAKES A GOOD BUSINESS PARK?

EXPLANATION OF THE DIAGRAM

Typically, the best business parks tend to include at least one incubator within the site.

Incubators differ from research and technology parks, as incubators are usually more devoted to target start-up and early-stage companies. Services might be built up as:

- Facility management related services: the renting services (offices and other facilities) are among the main function
- Horizontal services, which are available for all tenants or specialised, tailor-made services for specific clients, based on detailed needs assessments
- Targeted services for micro-, small and start-up business
- Provision of co-financing resources or counseling to have access to these: loans, guarantees, venture capital funds,
- Organisation of business partnerships and facilitating networking of tenants
- Presenting, promoting and stimulating innovation for the small business sector,

STRATEGIC ALIGNMENT

The Whitby Business Park Area Action Plan, formulated by Scarborough Borough Council, puts forward a plan for further development of the Whitby Business Park.
The Action plan highlights the need for sustainable development of the business park.

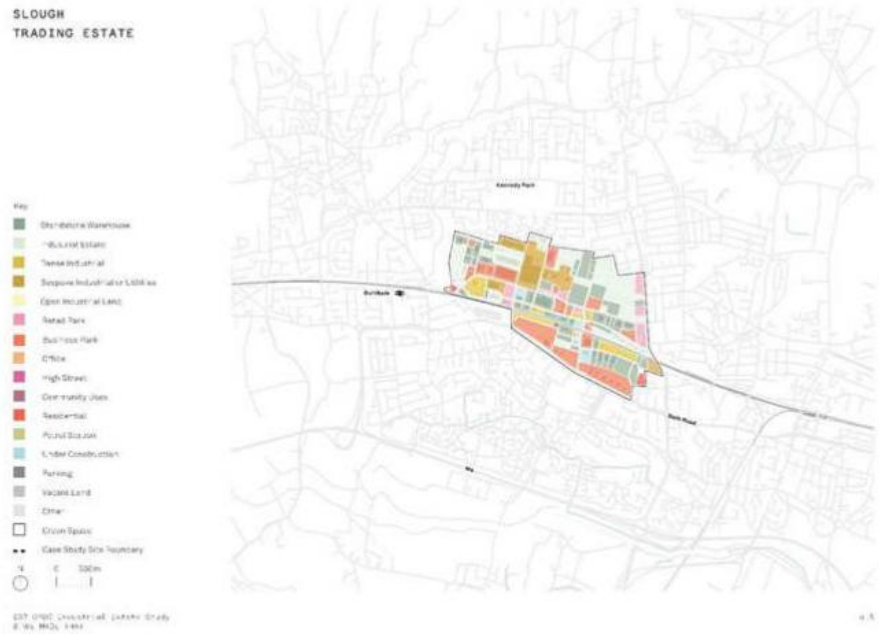
The Cambridgeshire and Peterborough Independent Economic Review in 2018 looked into the Cambridgeshire and Peterborough economic situation and found that Peterborough was in need of more business space. 'Regulatory change to allow conversion of office space into residential units has also had the effect of reducing this space in Peterborough. Now, 53% of the city's commercial property space is given over to retail, compared to only 27% given over to offices. As the city looks to expand its professional services offering, this must be tackled

BEST PRACTICE

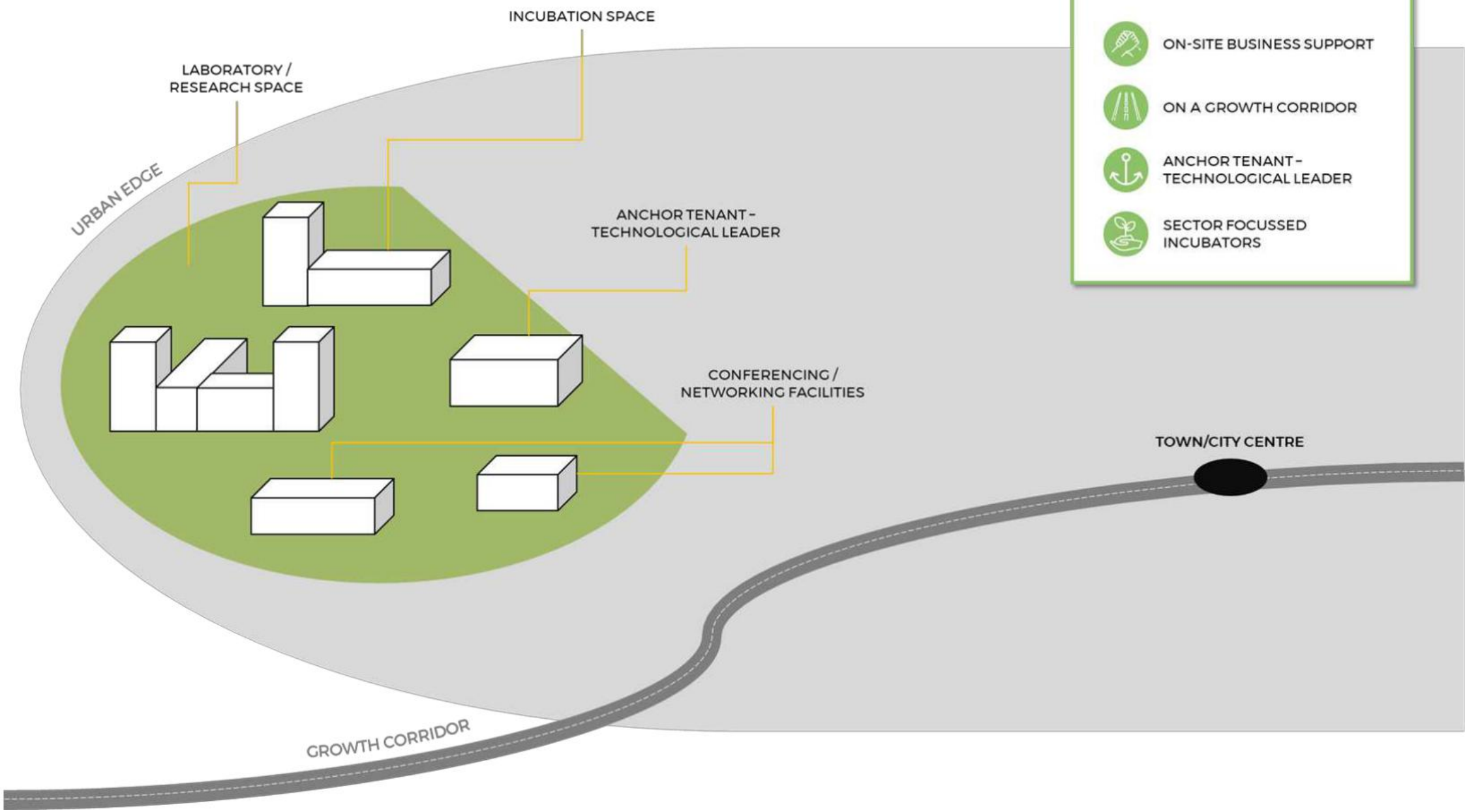
SLOUGH TRADING ESTATE

Slough Trading Estate is the largest business park in single private ownership in Europe, at 197 hectares.

Key Facts:
- Close proximity to M4 corridor, home to a number of hi-tech firms
- 19,000 people employed on site
- 900 businesses
- Key tenants include Fiat, Mars Confectionary, and Virgin Media



WHAT MAKES A GOOD TECHNOLOGY PARK?



KEY CHARACTERISITICS

- ON-SITE BUSINESS SUPPORT
- ON A GROWTH CORRIDOR
- ANCHOR TENANT - TECHNOLOGICAL LEADER
- SECTOR FOCUSSED INCUBATORS

WHAT MAKES A GOOD TECHNOLOGY PARK?

EXPLANATION OF THE DIAGRAM

Amongst the characteristics displayed across the majority of the technology parks that clearly differentiates them from a good quality business park are the following:

- Operate careful tenant selection policies
- Selectively prioritise the newer knowledge-based technology industries
- Engage with the knowledge base (primarily universities and public research organisations)
- Engage cooperatively with other public and private sector entities
- Own and/or operate one or more business incubation schemes
- Provide professional business support and innovation services designed to increase the depth and extent of innovation-led and knowledge based business in their region or locality as well as within their park.

STRATEGIC ALIGNMENT

Department for Business Innovation & Skills

The UK Government's Department for Business Innovation and Skills have produced 'Our Plan for Growth: Science and Innovation', which stresses the importance of Science and Technology Parks in the UK:

- Researchers and business leaders need access to the best expertise and infrastructure wherever it is located. We are supporting innovative clusters by connecting them with partners such as Catapults, Research and Technology Organisations, universities, science campuses and science parks.

UKSPA
BUILDING·TECHNOLOGY·BUSINESS

The mission of UKSPA is to be the authoritative body on the planning, development and the creation of Technology Parks that are facilitating the development and management of innovative, high growth, knowledge-based organisations.

A Technology Park is a business support and technology transfer initiative that:

- Encourages and supports the start up and incubation of innovation-led, high-growth, knowledge-based businesses.
- Provides an environment where larger and international businesses can develop specific and close interactions with a particular centre of knowledge creation for their mutual benefit.
- Has formal and operational links with centres of knowledge creation such as universities, higher education institutes and research organisations.

THEORY & DATA ANALYSIS

900 Estimated 900 technology parks in the world, 300 of which are in Europe

1.5m sq ft 1.5 million sq ft of completed buildings

3600 Roughly 3600 companies are currently tenants at technology parks

57000 An estimated 57000 people are employed within technology parks in the UK

€15m Roughly €15 million per year is invested in professional business support and innovation services

£13 bn Tech companies in Cambridge turn over £13bn per year

BEST PRACTICE

MIRA TECHNOLOGY PARK

Mira Technology Park, in the Midlands is at the heart of the UK's automotive and aerospace industries and encourages development within the transport sector.
The park spans over 340 hectares making it the largest transport technology park in Europe.

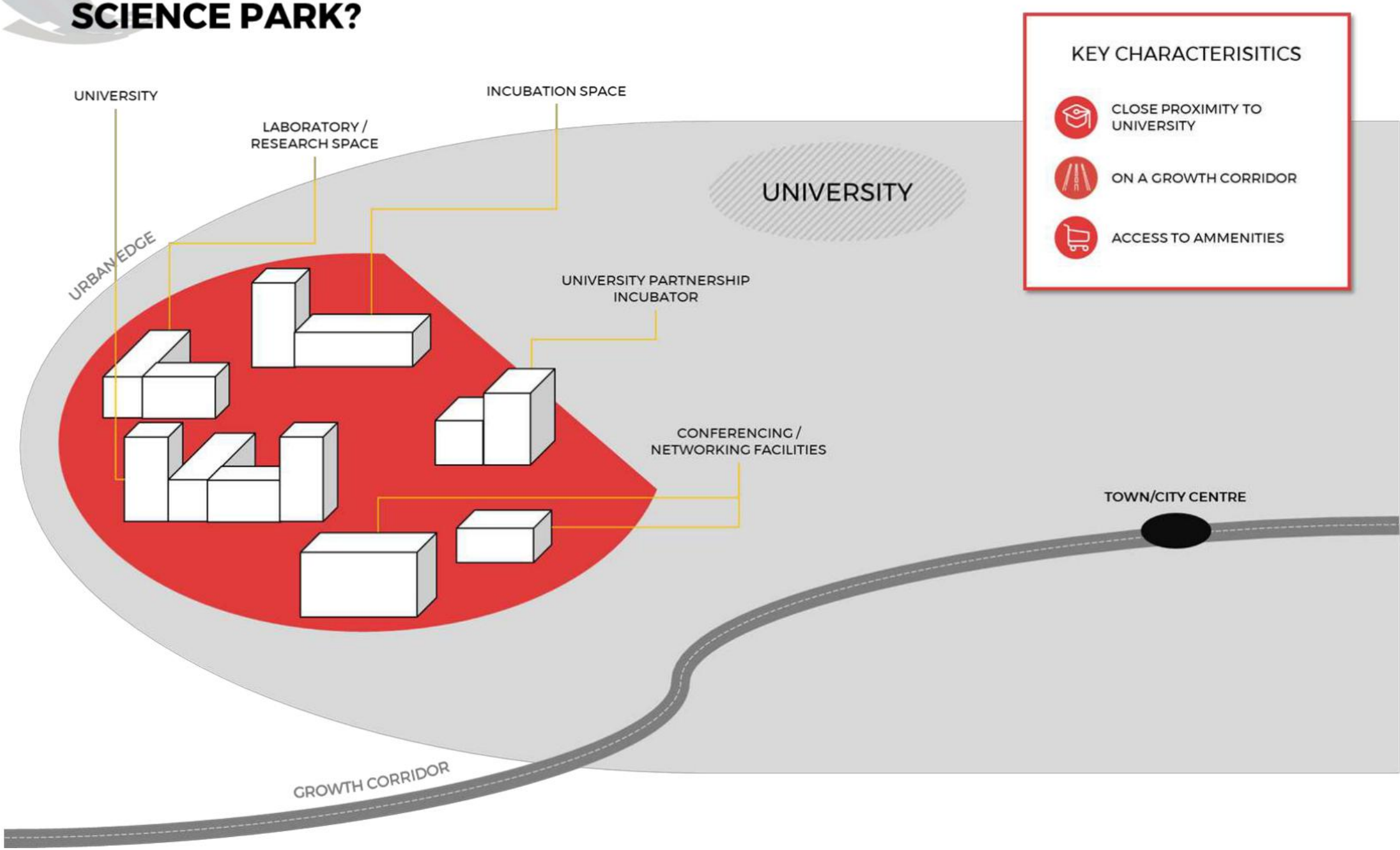
Cranfield University Technology Park

Cranfield University Technology Park combines world-class business support alongside Cranfield University's expertise, skills base and facilities

The Tech Park is home to nearly 60 science, technology and knowledge-based businesses, ranging from start up companies through to internationally recognised brands such as Trafficmaster and Nissan European Technical Centre.

Since its launch, the Tech Park has become a thriving 'Innovation Habitat' offering businesses both exceptional quality office space, alongside the University's distinctive expertise and skills base.

WHAT MAKES A GOOD SCIENCE PARK?



WHAT MAKES A GOOD SCIENCE PARK?

EXPLANATION OF THE DIAGRAM

A Science Park should consist of the following components:

- A Strong science based infrastructure such as Universities, Research and teaching hospitals, Research Institutes and Critical mass.
- Good premises and infrastructure including Incubation spaces, flexibility of space and opportunities for expansion, as well as good communication links.
- A growing Company base with exciting start ups and spin outs, and more established companies to act as 'Role models'
- A culture of Entrepreneurship which encourages innovation and unique solutions to problems.
- Available finance for start ups such as Venture Capital or Business Angels.
- Effective networks such as shared aspirations to clusters, regional trade associations, cross sector collaborations and shared facilities.

STRATEGIC ALIGNMENT

Department for Business Innovation & Skills

The UK Government's Department for Business Innovation and Skills have produced 'Our Plan for Growth: Science and Innovation', which stresses the importance of Science Parks in the UK:

- Researchers and business leaders need access to the best expertise and infrastructure wherever it is located. We are supporting innovative clusters by connecting them with partners such as Catapults, Research and Technology Organisations, universities, science campuses and science parks.

UKSPA
BUILDING·TECHNOLOGY·BUSINESS

The mission of UKSPA is to be the authoritative body on the planning, development and the creation of Science Parks that are facilitating the development and management of innovative, high growth, knowledge-based organisations.

A Science Park is a business support and technology transfer initiative that:

- Encourages and supports the start up and incubation of innovation-led, high-growth, knowledge-based businesses.
- Provides an environment where larger and international businesses can develop specific and close interactions with a particular centre of knowledge creation for their mutual benefit.
- Has formal and operational links with centres of knowledge creation such as universities, higher education institutes and research organisations.

THEORY & DATA ANALYSIS

The International Association of Science Parks defines a Science Park as
"an organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities."

Science Parks are a rapidly growing phenomenon and an increasingly common tool of both national and regional economic development. They are designed to:

- Facilitate the cooperation that generates higher returns on existing investments in R&D and large-scale research facilities
- Meet the special needs of high-tech industries for infrastructure and associated services
- Achieve critical mass in terms of co-located research facilities and staff

BEST PRACTICE

Cambridge Science Park

The Cambridge Science Park (CSP), founded by Trinity College in 1970, is the oldest science park in the UK.

CSP has strong links with the University of Cambridge, and houses over 100 science and technology related businesses, including Huawei, Toshiba, and Bayer.

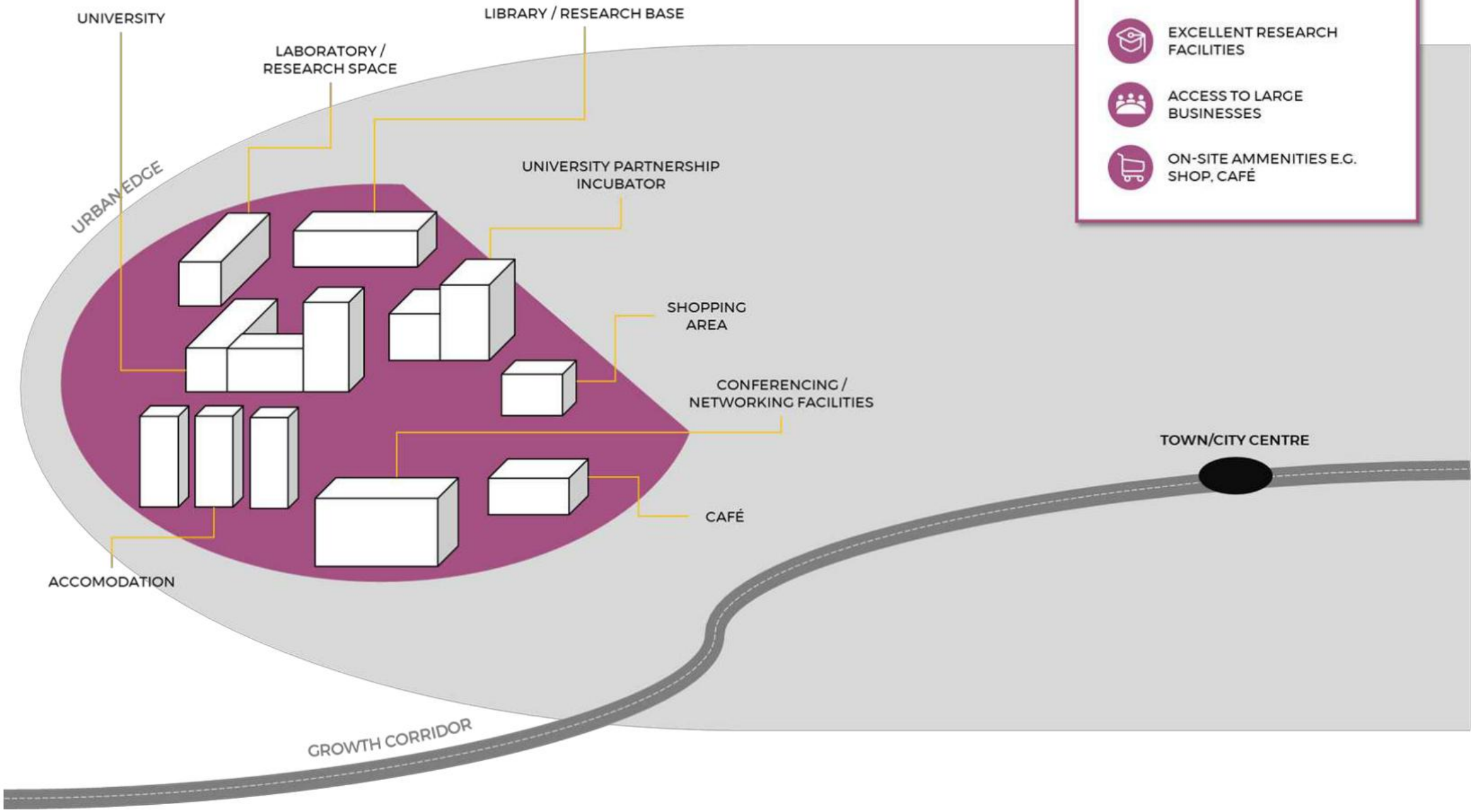
The 152 acre park, located to the north of Cambridge, consists of 57 buildings, and is home to approximately 6,500 employees. 61% of the companies on the site originated in Cambridge.

norwich research park

Norwich Research park houses 3000 scientists and clinicians wo focus their research on food and health.
The unique blend created by a major teaching hospital and a leading university, as well as a global research institute, provides a world class science facility.
By 2030 Norwich Research Park aims to:

- Be recognised globally as a leading research facility
- House a diverse range of companies striving towards global success
- Have created a physical environment that inspires people.

WHAT MAKES A GOOD CAMPUS?



KEY CHARACTERISITICS

- EXCELLENT RESEARCH FACILITIES
- ACCESS TO LARGE BUSINESSES
- ON-SITE AMMENITIES E.G. SHOP, CAFÉ

INFRASTRUCTURE STRENGTHS – GROWTH CORRIDORS

Growth corridors are integrated networks of infrastructure within a geographical area designed to stimulate economic development.

Growth corridors often feature integrated infrastructure, such as highways, railroads and ports, and link cities or towns. Corridors may be created to link manufacturing hubs, areas with high supply and demand, and manufacturers of value-added goods. This gives a greater opportunity for collaboration, supply chains and job creation. As well as benefits for businesses it also creates unique selling points for residents with new housing developments near business and enterprise parks, local facilities and better transport connections.

The location of business and leisure along new developed, or already existing, infrastructure links encourages relocation of start-up or scale up businesses to the area and increases the chance of those working or visiting to make their way to the major cities along the route and at either of the ends of the corridor. This brings greater prosperity to the rural areas that would have otherwise remained unoccupied as well as the larger towns and cities along the route.

Below is a growth corridor map around Cambridgeshire and Peterborough. This shows the opportunities available for the region that can be targeted to encourage increase travel and commute to the region. This in turn boosts the development of supply chains in and around the region and collaboration opportunities with other cities in the East of England and further afield, with specialities that complement the Advanced Manufacturing and Materials sector.

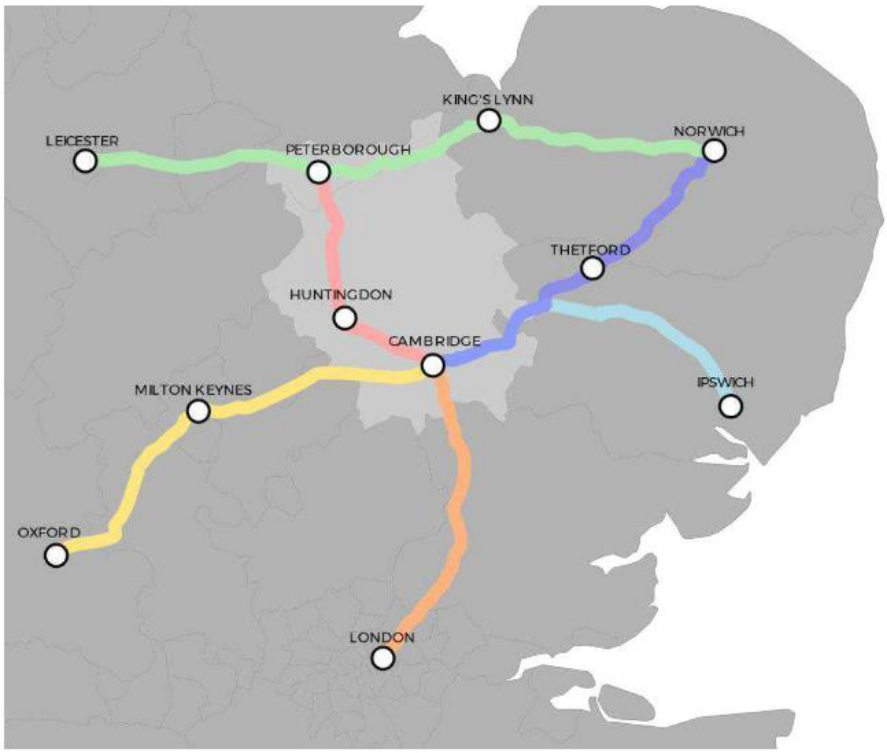


Figure 1 – Growth Corridor map

Growth Corridors is one of the fastest ways to propel the UK economy by providing growth opportunities in regions.

Growth Corridors are the catalyst for further growth in the UK economy, however, there is a need for infrastructure investment in the right places.

Growth Corridors is the best practice for economic growth, allowing different clusters to innovate and collaborate.

Informing people, investors, and the government about Growth Corridors will push the development of other Growth Corridors.

ENGINEERING CORRIDOR (A47)

The Engineering Corridor spans the counties of Suffolk, Norfolk, Cambridgeshire, Northamptonshire, Rutland, and Leicestershire. The corridor comprises of the established engineering hub of the Midlands along with the strong manufacturing and energy sectors of Norfolk.

A47 is known as the engineering corridor it is connecting world class research, engineering, manufacturing, and agriculture from East of England to the Midlands. A47 corridor have 4 world class universities, 181,000 people with knowledge intensive jobs, 865,000 plus of acres of land for business development, 2.3 million population, 17,500 businesses and 50,000 students. The corridor comprises of established engineering hub from the Midlands to the strong manufacturing and energy sector of Norfolk including; engineering and advanced manufacturing, cleantech, agri-tech, biotech and life sciences.

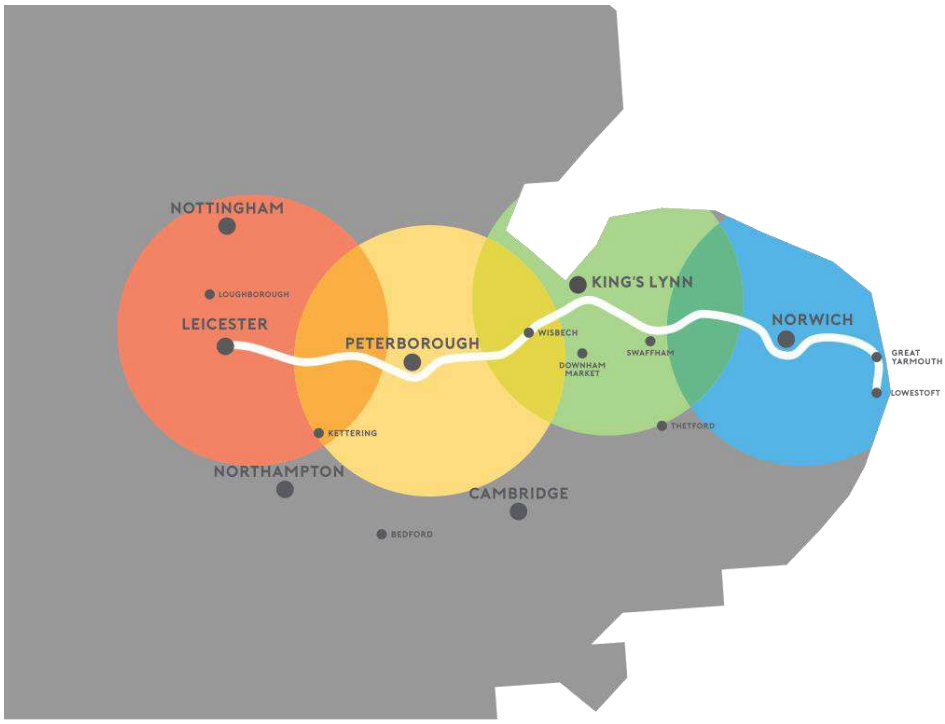


Figure 2 - A47 Engineering Corridor map

DESTINATIONS ALONG THE ROUTE:

Lowestoft and Great Yarmouth are recognised for the growth in the area and the port in the are vital for the offshore energy sector and some parts of the area have Enterprise Zones.

Norwich is the largest economy in East Anglia with Greater Norwich and are the key driver of economic growth across a large part of Norfolk and Suffolk. Its key strengths are in the financial services, business services, health and life science, engineering, and creative industries.

Swaffham and Dereham are in the centre of Norfolk and are predicted to see growth in the coming years. Swaffham has seen a large growth of jobs which is driven by an increase in service sector jobs while Dereham benefits from significant local presence in the finance, insurance, and banking sector due to its proximity to Norwich.

King's Lynn has a population of around 50,000 and providing services to a very large amount of people and businesses. Wisbech is on the border of Norfolk and Cambridgeshire. It is the largest settlement in Fenland and has a population of around 31,000. Key resources of employment include food processing and manufacturing, logistics and storage.

Peterborough is the largest region in the A47 corridor with around 200,000 population. The city's location from Cambridge is within 40 miles which makes it accessible and well-placed to benefit from other significant links. Norwich and Peterborough have developed service-based economies and have retained the market towns along the route and other functions including agricultural industry (A47 Alliance, 2018).

The government is working towards development and engineering corridor along the A47. The Development of the A47 will provide major opportunities to turn former airfields into business parks, housing and economic hubs, which in turn grow the future workforce and ensures that the knowledge economy is available for all people who live there. The development aims to contribute to sustainable growth by supporting employment and residential development opportunities. Reduce congestion-related delay, improving journey time reliability and increase the overall capacity of the A47.

There are about 20 engineering and manufacturing companies from Lowestoft to Great Yarmouth, from there, there is about 585 companies. From Great Yarmouth, A47 connects it to Norwich with about 750 companies. A47 connects Norwich to Dereham, having about 9 companies. Dereham is then connected to Swaftham with about 9 companies in the area and Swaffham is connected to King's Lynn, where there are about 1,320 companies. After King's Lyn, it is connected to Wisbech which is the border of Norfolk and Cambridgeshire. Wisbech have around 20 engineering and manufacturing companies in the area and it connects to Peterborough with about 1,245 companies around the area. A47 ends on Leicester with around 2,175 companies in the area.

KEY LOCATION

A47 corridor key locations are its business hubs and development sites. Business hubs have about six business parks and they are not just business parks, but they thrive and create growth due to an active support in the communities. The six business parks are the following; Hethel Engineering Centre, Norwich Research Park, Mira Technology Park, Nar Ouse Business Park, Loughborough University Science and Enterprise Park, Allia Future Business Centre. There are number of development sites around A47 from Norwich Research Park with 61 acres, Nar Ouse Business Park with 120 acres, Leicester Waterside with 150 acres, Hethel Innovation with 49 acres, Gateway Peterborough with 180 acres, Watermead Business Park with 180 acres, and Beacon Park with 25 acres of land. The business infrastructure around these development sites have big potential to increase number of businesses, create more jobs, boost skills, productivity, and GDP.

Along the growing numbers of business in the corridor, there is a growing number of housing infrastructure and this is driven by the corridor. Peterborough and Leicester in particular have the large-scale development plans in place to support business growth. Lowestoft have 4950 houses, Great Yarmouth with 6300, Norwich with 8900, Sprowston with 7000, Downham Market with 2710, King's Lyn with 7510, Wisbech with 3550, Peterborough with 18,900, and Leicester with 21,000 houses.

KEY STRENGTHS

The A47 Engineering Corridor have their cross-cutting nature that drives improvement across the whole of the growth corridor from automation, digitisation, advanced materials, and industrial biotech.

Automation has been the driving forces in production business since the industrial revolution. Trends in the technology are seeing a wider use and, though lower costs, wider adoption of advanced automated systems. There is a clear trend that more and more businesses are moving from manual to automation in the region.

ATM - https://www.atmautomation.com/

To remain competitive in the growing automation sector, ATM have continued to innovate by creating unique solutions for their products. Most notably they have designed their products with industry 4.0 in mind. By integrating an element of machine intelligence in their systems and work benches they can reduce productions times and increase efficiency.

Digitalisation around this corridor is becoming real and most are aware and are implementing it in their operations. Discussion surrounding Internet of Things (IoT) concepts are technologies impacting the industry are becoming more intense. Using digitisation will lead to lower costs and higher performance in industrial processes and will continue to expand the options to design lower cost and higher value products that will benefit the industry.

PERKINS - https://www.perkins.com/

Peterborough based Perkins Engines recently revealed its latest innovation, SmartCap, a low-cost engine telematics device. The device replaces a standard oil filler cap allowing the user to track engine information and alert the user to when it requires servicing. The cap is also been used as an introduction to Perkins' service and support system.

Advanced materials have allowed businesses to grow their market through reducing weight, increasing strength, and any of which that can be used to outperform competitors' products. Along the A47 corridor, there is an increasing number of businesses focusing in the advanced materials as they see that it delivers competitive advantage in global market by delivering higher value to the end user.

MAGNA PARVA - https://magnaparva.com/

Magna Parva has begun to develop technologies for the future space industry. Its patented in-space manufacturing system aims to provide the capability to build large structures/devices in space which are currently not feasible to launch. These technologies also have a disruptive potential in applications in a range of sectors.

Industrial biotech refers to the use of any naturally occurring, engineered or synthetic living organism within the industrial processes. Underpinning its growth are the fields of technology that can be applied to the improvement, optimisation or brand-new creation of bioprocesses within microorganisms.

AB AGRI - https://www.abagri.com/home

To diversify its portfolio, ab agri began to invest in anaerobic digestion. By developing this market opportunity, the company has been able to provide a solution which has benefitted the environment and its own business. Most recently it has been able to derive addition value through its sister business by directing its waste stream to its AG plant.

CAMBRIDGE PETERBOROUGH CORRIDOR (A14)

A corridor dedicated to linking the north and south of Cambridgeshire and Peterborough. Connecting the research centre of Cambridge University to the manufacturing and engineering clusters of Peterborough invites commercialisation of research. The potential extension of the M11 to meet the A14 eases commutes for those living between the two cities and provides ample opportunities for new business premises.

The new upgrade of A14 is the biggest road upgrade currently in construction in the UK. The upgrade will create an unbroken motorway link between London and Peterborough, this increases safety and improves journeys by encouraging local and long-distance traffic onto the most convenient routes.

There are about 2,659 companies around Cambridgeshire, and it shows that the construction of A14 is essential to the combat the issues that the region is facing. The upgrade will help combat congestion, unlock economic growth, improve connectivity, enhance safety, and create legacy of socio-economic and community benefits.

OXFORD ARC (CAM-MTK-OXF)

Focusing on connecting two of the UK's top universities, Cambridge and Oxford, with the added benefit of passing through Milton Keynes, home to large volumes of science and technology companies. This cluster of high-growth industries has the potential to expand and contribute to economic prosperity in the region and wider country. Plans for this corridor also includes the development of 5 new towns and The Varsity Rail Line, high speed train between Cambridge and Oxford.

The Cambridge-Milton Keynes-Oxford Arc will help create well-designed, well-connected communities and deliver one million new homes and jobs in the area by 2050 from the prediction of National Infrastructure Commission (NIC), whilst restoring the natural environment and the existing Green Belt protections. The plan includes re-opening the Oxford to Cambridge railway that was previously closed and creating an expressway.

The Arc aims to provide interconnectivity with national infrastructure and lead the development of next generation technologies and urban systems design to cater for future mobility and autonomous vehicle. It also will create connected development that promotes economic growth with new jobs and homes that addresses the ageing population, integrating society and loneliness issues.

KEY LOCATIONS

Two of the world-renowned universities in the world is in the Oxford and Cambridge and both have a role to play in attracting and retaining investment. Both universities have the fastest growth year on year in the UK in 2017 in FDI (Foreign Direct Investment). Milton Keynes and Northampton have high performance engineering companies in the areas which makes it important that there is access and mobility around the arc. The arc contains several hubs of investment in innovation, science, and the government is aiming to connect and develop these hubs to create a science and technology powerhouse.

If the plan is approved it will create three major changes including three major infrastructure projects; East West Rail line connecting Oxford with Milton Keynes, Bedford and Cambridge, Oxford-Cambridge Expressway, and build one million new homes in the Arc by 2050.

Oxford and Cambridge are one of the biggest tech hubs in the UK. In Oxford, there are companies such as Oxehealth, Sophos, OxStem, Mind Foundry and EnzBond. Oxford University has launched 24 high-tech firms and raising £52.6 million in seed stage funding. Cambridge is like Oxford and is the second after Oxford in academic research in relation to clinical medicine. Cambridge has about 30,219 people employed in technology and have 353 start-ups created each year between 2011-2015.

KEY STRENGTHS

The Oxford-Cambridge Arc is home to 3.3 million people and currently supports 1.8 million jobs and contributes £90 billion of annual GVA to the UK economy (Asset Publishing, 2018). Oxford and Cambridge universities are the two world's renowned and most internationally recognised centres of learning. There are further eight universities that include world leading specialisms in automotive and aerospace engineering.

The Arc has high-skilled work force and is one of the most productive and fastest growing areas in the UK. Cambridge and Oxford have the most highly qualified work force in the UK, with close to 200 Nobel Prize Winners and Milton Keynes having the highest productivity and is almost higher than the average outside of London.

The Arc holds key and emerging sector concentration such as life science, autonomous vehicles, biotech, aerospace, IT, healthcare, high performance

Oxford Arc will allow interconnectivity between Cambridge, Milton Keynes and Oxford. This caters future mobility and autonomous vehicle.

There is a need for smarter infrastructure to connect people to jobs, businesses, homes, and communities. Infrastructure development promotes economic growth.

Oxford and Cambridge are great leaders of the Growth Corridors, however, connecting them with other regions is essential for further growth.

engineering, artificial intelligence (AI) and other professional services. It is also home of the world-leading technology clusters in Oxfordshire and has the highest concentration of science research facilities and development in Western Europe. The Arc has the highest levels of entrepreneurship in the UK, with a strong presence in prototyping new products and services in areas such as aerospace and automotive technology sectors.

UK Industrial Strategy

Having the right infrastructure will help enhance and ensure growth in the Cambridge, Milton Keynes, and Oxford. Creating better access to each city, opportunities for institutions to collaborate, boost jobs and high-skilled individuals that will increase productivity and economic development.

INNOVATION CORRIDOR (CAM-LON)

With emphasize by London, a global finance and creative tech hub, and Cambridge, a platinum-grade knowledge hub with more patents than anywhere else in the UK, the two regions are uniquely knitted together with cutting-edge clusters of commercial innovation. From advanced technology to bioscience, Cambridge and London are the place of future-proof industry, the driving force of the UK economy.

Innovation Corridor is an ecosystem for international businesses, academics, start-ups, a finance city, law firms and creating a cross-sector that accelerates the economy. The innovation corridor is a highly advanced sci-tech superhighway, that connects networks of supply-chains that reaches beyond the region, nationally and around the globe.

KEY LOCATIONS

The key to this corridor is connectivity and location is everything. Cambridge is 60 miles from London and is linked by M11 motorway and is an hour by train. Cambridge has a great location from being near to London and is networked with international rail and flight linked from Stansted Airport- serving 180 destinations in 38 countries and with London City Airport and St Pancras International, all connecting the two regions with the rest of the world.

The region has key locations it offers to everyone, from Tottenham Hale Centre Development, High Leigh Garden Village, Twenty-five 25, and Harlow Science Park. All these locations are the destination for businesses in science, technology, research, innovation, creative sectors, health care, and residential areas with social space such as restaurants, gyms and an opens space.

Facebook - https://www.facebook.com/

The huge social media network, Facebook has new headquarters in London, making the capital its biggest engineering hub outside the US.

Facebook located its HQ in London as the UK has flourishing entrepreneurial ecosystem and international reputation for engineering excellence which makes its one of the best places to build a tech company.

Innovation Corridors is one of the Growth Corridors fully in place connecting London and Cambridge.

The corridor provides space and networks of supply-chains for all businesses, academics, start-ups and other institution to cross-sector

Innovation corridor is already available in Cambridge and London. Cambridge can learn from London's experience when it comes to scaling up.

As more business and other institution connects together, there should be a great emphasis on leaders of innovation to encourage more organisations to become more innovative.

KEY STRENGTHS

From Cambridge being historic and the birthplace of DNA discovery and place where the first ever computer programme was first invented, and London being the catalyst for Google's DeepMind collaboration with UCL, which is poised to develop new cancer treatment by artificial intelligence.

There are thousands of knowledge-intensive companies that occupy the corridor and together with the state-of-the art labs, the most renowned universities, and have one of the largest biomedical R&D clusters in the world, all helping to create extraordinary potential in the field of bioscience and advanced technology.

Illumina - https://www.illumina.com/

The US giant Illumina operates at the intersection of biology and technology, has its new state-of-the-art HQ in Cambridge.

Cambridge's contribution to the first draft of the human genome helped Illumina's foundation for its sequencing instruments. Making Cambridge the best location for Illumina's R&D and with Cambridge University on the side.

UK Industrial Strategy

Innovation corridors bring together world-class research, business and expertise and entrepreneurial drive all around the UK and worldwide.

Corridors allow businesses and other institutions to have a space to grow and collaborate together to create new products and services.

CAMBRIDGE IPSWICH CORRIDOR (CAM-THT-IPS)

Utilising existing rail and road connections it is possible to link the city of Cambridge with Thetford and Ipswich. This giving easy, commutable access to Thetford Business Park, the University of Suffolk, technology clusters at Astral Park and further afield to East Anglia's Energy clusters on the coast.

Ipswich and Cambridge line offers high quality on all services with more seating capacity, faster journeys between Ipswich and Cambridge, future electrification of the line, half-hour frequency between Ipswich and Cambridge, hourly Sunday frequency. The corridor will allow space for technology companies in the region, transport links between regions, increase workforce, and create new businesses.

Frequent rail service connecting key centres of growth for Ipswich, Cambridge, and Norwich. The line connects seven Suffolk stations: Newmarket, Bury St Edmund, Thurston, Elmswell, Stowmarket, Needham Market and Ipswich with Cambridge. The economic significance of the corridor is that it connects Ipswich and West Suffolk to Cambridge and its thriving economy, where there's regional employment centre specialising in higher education, life-science, pharmaceuticals, computer software development, and its tourism sectors. As well as this benefits Ipswich it also benefits Cambridge.

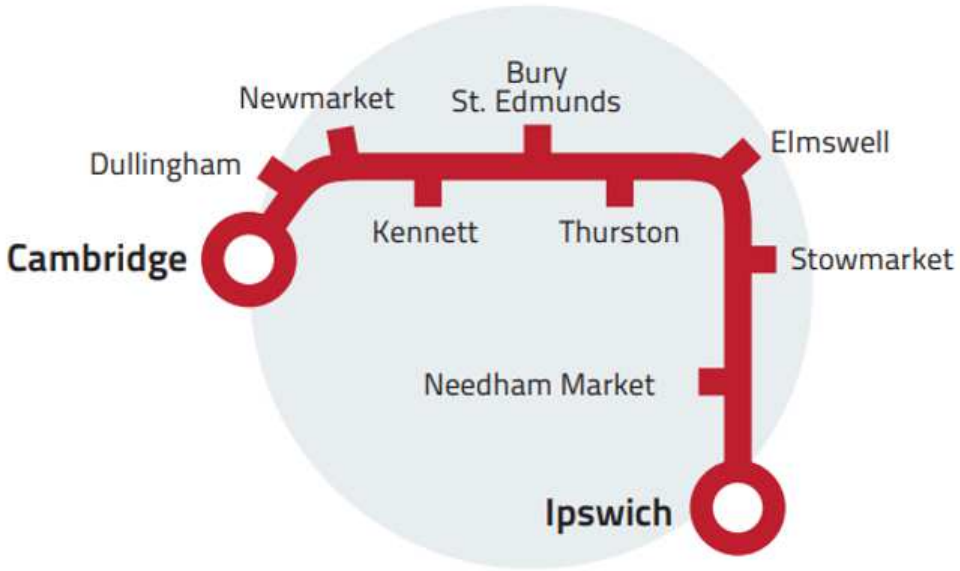


Figure 3 - Ipswich – Cambridge Line

KEY LOCATIONS

Ipswich have 12 business parks, 5 industrial estates, 3 innovation and technology parks such as Claydon Business Park, Adastral Park, and Innovation Martlesham. (Ipswich Gov, 2018). Ipswich economy is growing by 1.7% and Cambridge is growing by 2.2% each year since 2017 (Cambridge Independent, 2017). This figure shows that both regions have strong growth and can be utilised further to increase growth through the creation of rail links.

There are about 8,934 businesses in Ipswich (City Population, 2019) and occupied by 150,334 people, while Cambridge has 123, 867 and 46,059 businesses (Cambridge News, 2018). Based from the figures, there is a gap on Cambridge's population, and this can be filled by Ipswich and West Suffolk, creating more jobs, businesses and increase productivity.

KEY STRENGTHS

It is showed that in 2021, Cambridge number of employee jobs will increase by 38%, although, the population is forecast to grow by only 24% at the same time as the number of employee job increase (Suffolk Gov, 2015). There is a need for Cambridge to look for other ways to bring in more people in the city and creating this link between Cambridge and Ipswich can mitigate the issue. Opening a more frequent service would open opportunities for people living in Suffolk. The link also allows great and talented individuals to come in the Cambridge and the city can continue to grow its economy whilst helping its neighbouring regions. It is also found that half-hour service between Ipswich and Cambridge would generate over £35m in economic and associated benefits.

A study done by Suffolk Council indicated that there are significant wider economic benefits arising from clustering businesses around the rail corridor. As Cambridge and Ipswich both have strong growth it will help improve the connectivity between the two regions and their outback. Two of Cambridge's issues are scale-up of businesses and infrastructure, through the link it creates more accessible infrastructure and gives companies the option to move some of their offices along the corridor to create more space for growth.

TECHNOLOGY CORRIDOR (A11)

The Cambridge Norwich Tech Corridor represents one of the most exciting growth opportunities in the East of England. The Tech Corridor is home to world-leading universities, research. The Cambridge Norwich Tech Corridor represents one of the most exciting growth opportunities in the East of England. The Tech Corridor is home to world-leading universities, research institutes and science parks, complemented by an ecosystem of knowledge-intensive businesses and networks to support innovation through to commercialisation and manufacturing.

KEY LOCATION

Cambridge and Norwich are one of Europe's most exciting growth stories and offers 100km of space and opportunity across Norfolk, Suffolk, and Cambridgeshire for start-ups, growing businesses and investors.

Affordable space to grow and high quality of life make the Tech Corridor the best place to and for disruptive, and businesses to thrive among other businesses that are solving big problem's in the society. The area has great links internationally from Norwich and Stansted airports and port nearby Felixstowe. Excellent transport links that are centred around the upgraded A1 and regular train services to London and beyond.

There are 560 plus acres of land allocated for business development. In the recent year, the Tech Corridor has been attracting investors from its thriving start-up communities in Cambridge, Norwich, Bury St Edmunds and Haverhill. There is space to invest along the corridor from Cambridge Innovation Capital to Anglia Capital Group investing in Cambridge, Norfolk and Suffolk. Further investment in business and science parks should be allocated along the Tech Corridor to meet the needs of the fast-growing tech clusters in the region.

KEY STRENGTHS

The Tech Corridor consists of clusters from Agritech, Agri-food, Genetics & Bio Science, IT, AI, robotics, Digital Sensors & Big Data, Advanced Engineering, Manufacturing & Materials, Life Science, MedTech & Pharma. The corridor is present with the help of following; 2 world-class universities, 55,600 knowledge intensive jobs, 12,000 businesses, 1.09m population and 36,000 students.

Year-on-year employment growth of 9.7% by Life Science firms in the tech corridors over the last five years shows that there are great opportunities ahead and is becoming the forefront of the new era for life sciences and MedTech.

Digital companies in the Tech Corridor have added £1.6b gross value to the UK economy and the corridor is the home of some of the biggest and brightest companies in Artificial intelligence (AI) and deep learning from companies like Amazon, Apple, Microsoft and Samsung. The Corridor's design and manufacturing power, it makes it the perfect place assemble and run sensors, myriad circuits and harvest data.

Vanilla Electronics - http://www.vanillaelectronics.com/

Vanilla Electronics from Thetford built some of the world's most advanced electronic products and offering services from prototyping to testing and maintenance.

They have recognised that there is growing demand for technical service and the needs for flexibility and customers service that large companies could not offer.

Recommendation

Maximise growth corridors to attract inward investment from across the UK and the globe

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SUPPORT

THE JOURNEY OF JOURNEYS

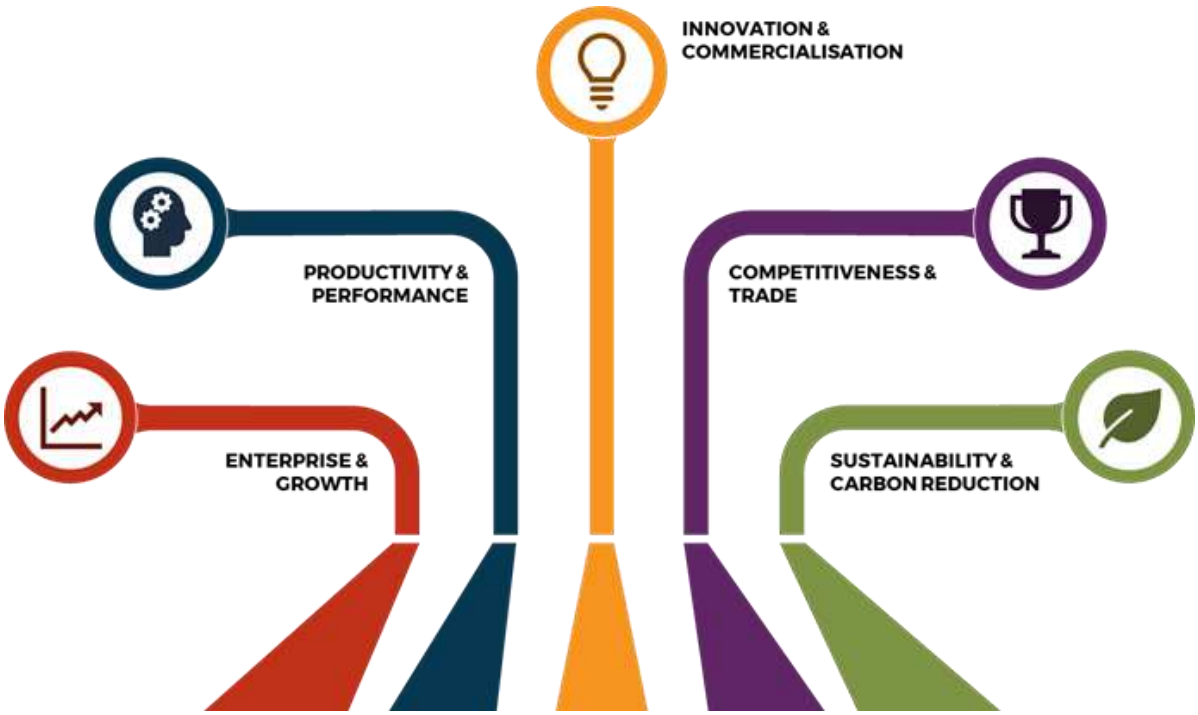


Figure 1 - The Journey of Journeys

SUPPORTING BUSINESSES ON A JOURNEY

The development of Cambridgeshire and Peterborough is directly entwined with the success or failure of the businesses within it. The support for those businesses will determine whether they can grow and prosper, or whether they stagnate and close. The Journey of Journey's is a map of how Cambridgeshire and Peterborough can empower local individuals, businesses, and clusters into starting on a path of continuous and sustained improvement. The five journeys are:

- **Innovation & Commercialisation**
- **Competitiveness & Trade**
- **Productivity & Performance**
- **Sustainability & Carbon Reduction**
- **Enterprise & Growth**

These five areas may not apply to every organisation within Cambridgeshire and Peterborough, but there is a journey to fit the needs of all businesses, and many will benefit from all five.

INNOVATION AND COMMERCIALISATION

The goal of innovation and commercialisation is to support individuals, businesses and clusters to becoming more innovative. Innovation is the key to staying ahead of trends, to staying up to date with new approaches, technologies and attitudes. If a business cannot be innovative, it will be left behind very quickly. Therefore, the Innovation Journey is designed to provide a structured approach to innovation within a business.

COMPETITIVENESS AND TRADE

Established businesses need to remain competitive, they need to stay ahead of the competition and continue to improve and self-assess their strengths and weaknesses. The Competitiveness Journey is designed to help existing business see where they are in the market and see what areas they could move into. By improving a business's

competitiveness, it provides more security and longevity to a business, future gazing to where a business can go is where competitiveness comes into its strengths. Once a business understands where it is, it can find new places to push towards.

PRODUCTIVITY AND PERFORMANCE

Productivity is the heart of any business, in order to make sales there needs to be a product or service, and that cannot be created, sustained or improved without a certain level of productivity. The Productivity Journey provides a path for businesses to follow to improve their level of productivity, not just through producing more product or content, but also by going back to existing processes and making them more efficient. As well as looking ahead to the future of technology and how it can push their business further to stay ahead of the curve.

SUSTAINABILITY AND CARBON REDUCTION

Becoming sustainable is now a requirement of all business, there is a greater expectation of businesses to demonstrate their social responsibility, make active efforts to produce less carbon and in show consideration for the environment. Not all businesses find this easy or naturally, so the Sustainability Journey is a structure for businesses to follow. Moving from simple and accessible changes to attitudes within a business, through to working with researchers to investigate what cutting edge technology could do for their business' carbon budget.

ENTERPRISE AND GROWTH

Growth is crucial to any area, but especially to new businesses. In order to foster new ideas and push those ideas into viable businesses the Enterprise Journey has been designed to incubate ideas within individuals, communities and businesses and then help those ideas grow into a successful and scale-able business model. Growth of start-ups is incredibly important, being able to take an initial product or service and expand it to a functioning business is the key to success. Once a business has established itself it then looks at scaling up, how to develop to business further and carve a significant place for itself in the market. This is the key to longevity for new businesses. Bringing together experts, students, entrepreneurs and existing businesses helps to push more start-ups into existence, and then the Enterprise Journey is designed to support these businesses through to success.

Recommendation

Provide business support throughout the region's key 'make-it' clusters

THE INNOVATION JOURNEY

The UK Industrial strategy is pushing for the UK to become *"the most innovative economy in the world"*. This alone highlights the significant need for effective innovation approaches. The Industrial Strategy also faces challenges like Clean Growth, AI, and Mobility all within "*the foundations of productivity*". Innovation is not required just to fill the desire to become innovative, it is also the only way in which these challenges can be met. New ideas are needed, new approaches are needed, and new collaborations are needed. The UK can become the most innovative economy in the world and Cambridgeshire and Peterborough can be an engine to drive through, by empowering businesses to push innovation forward.

The Innovation Journey exactly addresses that need. Innovation is the **creation of a viable new offering**. It is important to find ways in which innovation can be fostered through a structured approach, as opposed to expecting innovation to happen naturally. It is entirely possible to **generate innovation**, if it is approached in the right way. The Innovation Journey provides a route to follow, tools to enabling innovative thinking and then approaches to take with ideas in order to create action.

Figure 1 – The Innovation Journey Map

WHY? THE INNOVATION JOURNEY

Innovation is the creation of a **viable new offering**, which has three key parts to it.

Innovation is not invention, it may involve invention, but it requires an existing frame to build upon.

Innovations have to earn their keep; they have to provide value to the business.

Innovation is not just offering a new product, it encompasses every part of a business.

What is important about this is it demonstrates how innovation actually adds value to a business. By creating something new that builds upon previous work, it becomes far more **accessible** for businesses. Pushing innovation to have **value** is also vital, innovation is obviously possible without budget constraints, however, it has to be considered in context. What can be afforded and what will actually generate value or income is the number one principle of almost all business. This does not only apply to products either, processes and services also benefit from innovation and are also required to add value to the business. No area of a business is immune to innovation.

IDEA MANAGEMENT

Ideas are where all innovation comes from, it is a starting point for action within a business. So being able to effectively manage ideas is crucial to creating the right environment. Dedication of time by senior staff is what helps synthesise ideas, leaders within businesses have to be available and open to ideas from their workforce. It is also important that the workforce involved in idea creation is a diverse pool to choose from. Ideas may come from any area of the business and may not relate to someone's direct expertise. **Engaging** everyone within a business is the best way to create an open space to put ideas forward and to innovate within. This means there may be a

The Innovation Journey provides structure to achieve innovation in a more reliable and repeatable manner.

Engineering businesses are by definition problem solvers, the Innovation Journey is therefore a fantastic approach for them.

Best practice is to develop a culture of innovation within a company. Allowing people to suggest ideas without judgement or fear.

Leaders need to understand that ideas can come from any area. The Innovation Journey is designed to provide a framework for this.

much higher number of ideas or solutions to a problem than management is typically used to. Part of their challenge is to be able to turn this collection of ideas into action.

By bringing ideas all into one place, it also enables leaders within business to see trends, patterns and potentially build ideas on top of one another. The ability to communicate these ideas may not come naturally to some, and so it's up to management to bring ideas together in a more communicable fashion.

UK Industrial Strategy

In order to become the most innovative economy in the world, businesses need to foster an environment of innovation. The Innovation Journey is the first step towards this, and by working through all areas innovation will start to come naturally to a company.

PROCESS IMPROVEMENT

In order for there to be space to innovate within, a business must have efficient processes in place to ensure the smooth day to day operation. If leaders and managers are spending their time fighting fires, and workers are running at max capacity with inefficient methods there will never be the **mental space** for innovation. This may mean that it is necessary to implement **Lean** strategies within a business. Having a standardised business model or physical process will enable the business to run much more smoothly and provide more free time to leaders and managers. The benefit of having a Lean system in place in a business means that changes are much easier to implement so when innovation does occur, it is far easier to implement, test and collect results from.

PRODUCT INNOVATION

Product innovation is where innovation first comes from. If a particular challenge can be identified by a team, then it becomes possible to innovate a solution. This may not mean a brand-new challenge, or a brand-new product. Often innovation is simply looking at an issue from a different angle, perhaps adding a feature onto a product to open up a whole new use for it. Product innovation is one of the most vital parts of the Innovation Journey, it is where **Minimum Viable Products** (MVPs) are generated. These MVPs can then be tested with real world consumers and feedback created. This information helps to push innovation further and further forward, as each time a new **iteration** of the MVP is released, more information comes back to the business. This means each iteration should be an improvement on the previous and so if a business can keep momentum up it can have maybe ten versions of its product out in a very short time. Ten versions of a product provide ten sets of improvements, ten opportunities to innovate.

MARKET OPPORTUNITIES

Knowing the market in which a business operates in is an important contributing factor to innovation. Innovation must be aimed at the right gap in a market. So, a company needs to have a strong understanding of their area before they can effectively implement an idea. Plus, a company which can see a gap, and innovate for it, stands a much higher chance of success. It is even possible to create an entirely new market by seeing an opportunity and a solvable problem. Any company that has a good understanding of its market is far more capable of implementing its idea. A better understanding of customer needs and wants, as well as the best ways to reach them through marketing campaigns all feeds into the innovation capability of a company.

This Journey addresses the need to innovate, companies need to keep up with trends and with the market.

Innovation does not require significant changes to infrastructure, it builds upon what already exists and pushes it further to it's limit.

Product Innovation best practice is often seen as Design Thinking. This approach focuses intensely on designing the right thing in the right way.

When ideas can come from any department, it opens up opportunities to see who will be future leaders within an area.

OPEN INNOVATION

For a long time, businesses have operated with a silo mentality. Working to forward their business and to keep ideas safe and away from others. **Industry 4.0** doesn't work like this; the new age of industry is about Open Innovation. Open Innovation allows companies to build a **cross sector** knowledge base. The more perspectives a problem has on it the more possibilities for innovation open up, the more potential avenues are available to all parties involved.

Open Innovation processes involve more stakeholders, expand a knowledge base beyond the doors of the business and attempts to transform relationships with suppliers and vendors into strategic partners. The idea is to turn one business into a collection of collaborative partners, all moving towards the same goal. This network approach to business can be incredibly powerful, and by involving all stakeholders in the whole process innovation becomes far more Agile.

UK Industrial Strategy

When a company reaches Open Innovation, it will naturally have a strong business environment. This environment will spread out from the business, as it grows and interacts with more businesses around it the ideas from Open Innovation will spread. This means that whole areas and sectors can become innovative and a prosperous network will form.

Open Innovation allows businesses to accomplish far more in terms of idea generation, when a company moves from 10 managers being innovative to the entire company of 100 employees ideas become commonplace.

Design Thinking is practiced in many design firms around the world. The support and knowledge exists, moving the approach into engineering businesses is a significant opportunity.

Design Thinking best practice is to allow time for each stage, only when prototyping can the process be ramped up in order to iterate further.

If engineers became design thinking engineers then the whole workforce would be empowered to innovate constantly.

HOW? FOLLOWING THE JOURNEY

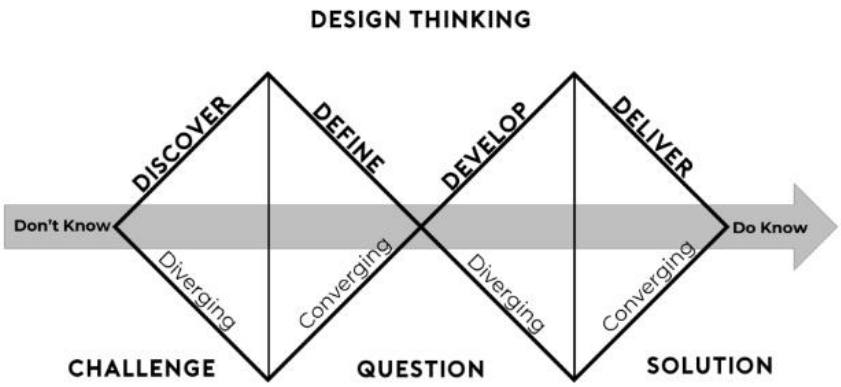


Figure 2 – The Design Thinking Double Diamond Framework

DESIGN THINKING

Design thinking is one approach to innovation. It's a step by process to guide a company through the Innovation Journey, encompassing everything from Idea Management to Open Innovation. It is designed is to push leaders, managers, designers, workers and everyone within a business to focus on finding out what a customer actually wants from a company's product or service. The basic structure is the Double Diamond Framework, where a company **diverges** to gather information, in order to **converge** later and bring it together. Design thinking has been used by product designers for a number of years, but Cambridgeshire and Peterborough have the opportunity to push businesses to use this approach company wide.

DISCOVER

Discovery is the first divergent section. Discovery is where a **challenge** is posed by the company. Specifically, this is not the posing of a problem, the nature of discovery is to find what the problem actually is. Workers and researchers have to

be given time to conduct research. This research is what feeds into every other step of the process and so although it may not show results as quickly as other areas, skipping or shortening it can be fatal.

In order to learn what the customer wants, a business has to speak to the customer. This is best done through interviews, surveys, questionnaires, polls and any other method of discovery. While polls and other mass sourcing methods provide larger scale numbers, interviews provide a **deeper insight** into how the customer thinks of their product or service. Particularly the use of open interviews is the strongest source of new information. A poll can only answer the questions its designer adds, whereas an interview with an actual customer, without constraints, can highlight ideas the customer has to improve something, and it can highlight areas that the customer does not care about. Interviews are useful because their qualitative data helps to feed into the discussions about who a product is being made for.

Nike's Worldwide Network - www.nike.com/

Nike are an international brand, and it is easy for brands this size to be out of touch with customers. So to counter this Nike specifically has researchers directly in contact with customers in every single country it operates in. This means Nike can tailor it's products to every area because it has that direct contact with customers.

DEFINE

Define is the first converging section, this is where Design Thinking has its strengths. By giving people time to do their research and diverge into different areas, it is now possible to pool together a significant variety of information. The goal of Define is to realise what the problem is a company is trying to solve. Does a customer have a different use for their product? Does a service lack one key feature? Only by speaking to customers will it have been possible to find out what the issues they face really are.

The skill in the Define section is to be able to synthesise these ideas together. By mapping every piece of data out, ideas can then be clustered. By engaging everyone in the business it provides different approaches to clustering ideas. They can be done by priority, or by cost, or by available technology. Each area of the business will have its own opinion on what is the most important and what the focus should be. Clustering exercises will eventually bring out the most vital point, and there will be a ***"How Might We...?"*** question that comes out of that. This is the question, the problem, that innovation can solve.

Golden Gate Regional Centre - http://www.ggrc.org/

The Golden Gate Regional Centre (GGRC) provides support to people with developmental disabilities. There is a high drop out rate in the program, after extensive interviewing it was found that the drop out rate was due to months and months of meetings and examinations which were daunting and exhausting for parent and child.

Their solution; hire a Winnebago with every consultant in one place, tour around areas and go directly to those in need. This method enabled **9 consultations in just 2 hours**. Although not scale-able it demonstrated **the research was correct** and enabled the development *of "Hybrid Social Worker 2.0"* a program to enable more contact time with those in need.

DEVELOP

Next is how to turn a question into actual ideas. This is another diverging session, where all ideas are welcome, from all angles, from all parties. There may be a significant number of good ideas that come to the front during this. There will also be some that are unrealistic, the key is to collect everything and then once every possible solution to the problem has been suggested. Only then is it possible to pick out the most innovative and achievable. Once a set of ideas has been created, they then need to be evaluated. Which ideas are new? Which provide the answer to the problem? Which are realistic? Through this process a final set of testable ideas is concluded.

DELIVER

Makassar's Pete Pete Network

Makassar in Indonesia was struggling with congestion and traffic exacerbated by private taxi-vans (Pete Petes). They held a Design Thinking session to come up with potential solutions for the problem. Ideas included turning Pete Petes into school busses, using them as short distance bus hopping services, and creating smart Pete Petes to better serve the city.

Currently Makassar is piloting a Smart Pete Pete network, all because of the idea that came through Design Thinking.

Prototyping is the best way to find out what works. Deliver is all about created real world tests using **Minimum Viable Products** (MVPs). These prototypes have to be **simple** and try to solve one problem at a time. It is also important to make sure that the results can be measured, whether customers actually use the product the way it was intended and whether it actually improves their experience.

As testing continues, features will be dropped and added. This **iteration** process by which products and services are best created allows only value adding features to be kept. It focuses the team on designing a product or service for a customer and on only adding what is necessary. No more time is wasted on unused features.

At the end of this final converging stage a releasable product is created. It now uses innovative solutions to fix actual customer problems and is focused specifically on delivering that to the right customer.

Airbnb's 'Photographers' - https://www.airbnb.co.uk/

Airbnb was on the verge of bankruptcy in 2009. They had plenty of properties but not enough people renting them. They observed that the photos in their ads were not high quality. So the founders bought a camera and went round to each property in New York, introduced themselves as Airbnb's 'official photographers' and took much higher quality photos of the properties. After using the new photos on listings Airbnb started to turn a profit and doubled their income to $400 a week very quickly. This prototyping answered the question that poor photos were preventing sales.

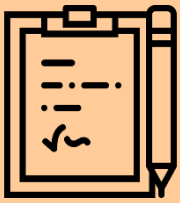
UK Industrial Strategy

Design Thinking is an incredibly empowering approach to innovation. Involving people across a business creates much more open and stronger working environments. It also naturally draws out ideas from people, more ideas means more opportunities to innovate.

CONTINUED LEARNING

At the end of a Design Thinking cycle a product has been developed and created. This is not the end of the process as innovation is a continuous cycle, technology and customer needs are always changing and so it's important to

understand that the Innovation Journey does not end there. It is not an A to B path, but rather an understanding that the Journey does not end, and that improvements through innovation are always possible.



Recommendation

The implementation of an Innovation Journey for Cambridgeshire and Peterborough is needed in order to support businesses as becoming innovative becomes integral to their survival.

THE COMPETITIVENESS JOURNEY

When businesses are competitive it creates economic development, and growth. Competitiveness has an important role in the economic development of a region. It creates wealth, shares resources to the community, increase standards of living and develops the community.

In the UK, 76,000 jobs have created form inward investment *(gov.uk, 2018)*, 21% of businesses trade internationally and these businesses are 20% more productive compared to them that only trade domestically *(ONS, 2018)*. UK is the 8th most competitive country in the world *(WEF, 2018)* and 19% of country's GDP comes from exports *(ONS, 2017)*. 48% of businesses reported that international trade increased their ROI *(UK trade & investment, 2011)* which boost to an increase for the money that are available for product development.

However, there still exists some significant barriers, that prevent businesses growing and competing overseas. These barriers are related to a lack of skills, inability to adopt digital process, not having the right contacts in overseas markets, concern about payment risks or non-tariff barriers, limited global awareness of the UK's strengths and capabilities and finally, altitudinal barriers and market access issues.

WHY? THE COMPETITIVENESS AND TRADE JOURNEY

At the end of this journey the Greater Cambridge and Greater Peterborough based businesses will possess profound knowledge about their organisation and their targeted business environment. They will be in a place, through innovation, to beat their competition and increase their market share both nationally and internationally.

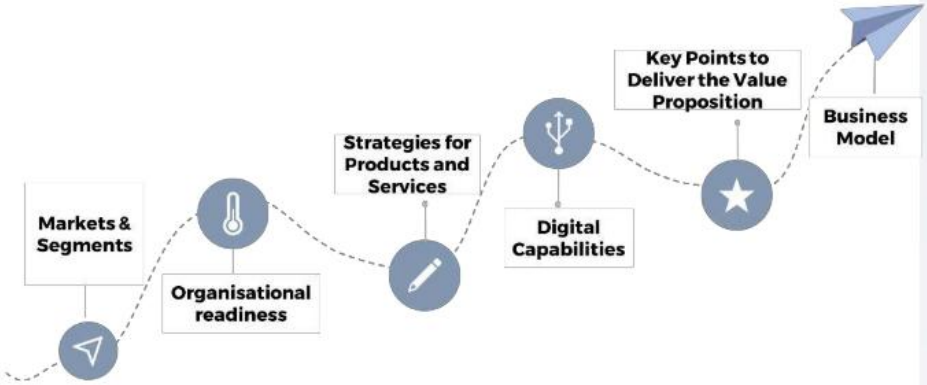


Figure 1-The Competitiveness Journey

The Competitive Journey showcases the route that businesses will take through different steps into shaping the right business model.

The Competitiveness Expedition will benefit businesses but will require support from public bodies and government. The correct advice and guidance must be provided, and necessary funding for investment be made available This journey aligns with strategies published by regional, national and international policy makers.

HOW? THE COMPETITIVENESS AND TRADE JOURNEY

MARKETS AND SEGMENTS

In the first step of the journey, businesses identify their markets and segments. It helps businesses to find niches that they are not well serviced by their competitors and can profitably target and sell to new markets. In addition, they can find and locate new markets where there's potential for growth and expansion.

Germany export rate is 47.24% in 2017, where as the UK export rate is 19%. There is clearly a gap that needs to be filled in.

More and more businesses are exporting overseas and some greatly rely on overseas sales as their revenues. Support, connection, and understanding of the market are some of the key factors for a successful export journey.

Exporting is the best practice when it comes to expanding and scaling a business.

With practice and experience, ambassadors can be created to guide new exporters. Increasing chance of export success and creating leaders in each sector.

Through **Market** and **Segments** the businesses will have the chance to explore new segments for their business in order to expand into them. Finally, they will investigate and take advantage of market distortions.

UK Industrial Strategy

The journey allows businesses to access the right information, advice, and practical assistance. It also connects UK businesses to importers, buyers, suppliers and other networks.

Gnaw – hhtps://www.gnawchocolate.com.uk

Gnaw chocolate is a British company based in the East of England and 80% of the company's turnover comes from exports. They export to more than 20 countries and they have a presence in more than 1,000 stores.

They spotted a gap in the market when they observed that there was demand abroad for healthier alternatives to other chocolate bars. France is the company's biggest customer, but they export among others to USA, South Africa and China.

The company aims to double its turnover from exports next year and they recently secured an £1m deal in Russia.

ORGANISATIONAL READINESS

In the second step of the journey the business owners will have a deeper understanding regarding their company's organisational capacity and potential. In detail, the participants will understand the company's strengths and weaknesses and how they can be used to provide value to the customers. The **Organisational Readiness** step of the journey will also help the participants to get to know their competitors' products and services and their operations in total in order to improve their own business. Tools will be also provided in order to help them to understand their organisational capabilities and adaptability and use this knowledge for improving their business and increase their market share.

Before venturing into exporting, businesses need to make sure that they are competitive enough and are export ready. The Competitiveness and Trade journey includes benchmarking tools to ensure that the business have all the capabilities and capacity to export overseas. This allows the business to know what their strengths and weakness are and help them prepare before they export.

GCGP Economic Plan

The Competitiveness and Trade journey aims to help the business to reach organisational capacity through supporting businesses to effectively plan, budget and provide training. With the journey, businesses can be more confident in export.

STRATEGIES FOR PRODUCTS AND SERVICES

Elaborate a Go-To-Market strategy that addresses each of the targeted markets and help identify the risks their business needs to address. At this stage of the journey the businesses will draw-up an action plan related to their strategy for products and services. More specific their action plan includes their focus to a specific market, their objectives from this strategy, and finally it will include their budgets and their overall plan.

UK Industrial Strategy

The Competitiveness and Trade journey wants to support business to create their strategies by encouraging SMEs to export internationally and increase funding opportunities and support for businesses to scale-up, grow and compete overseas.

Cranswick- https://cranswick.plc.uk/

Cranswick is part of Great British farming heritage, renowned for delivering traditional products of the highest quality.

They export in China and had invested a lot of their time and energy in China to build relationships with its customers. China consumes about half a billion pigs and pork, therefore Cranswick has lots of potential in the market. They also export in United States and have upgraded their production (£60m worth) to meet the needs of customers in the US. The project will be one of the most advanced poultry sites in Europe. It will boost brand awareness and create more jobs and opportunity in East England.

DIGITAL CAPABILITIES

The Digital Capabilities step includes tools that facilitate interactions with suppliers, customers, financial institution and among the team. Additionally, it ensures adaptability to new technologies such as AI into the business or digitalisation to meet the needs of customers, suppliers, stakeholders and employees. Furthermore, it enables new businesses or operating model, such as peer-to-peer product innovation or customer service. In the end of this step businesses can rethink their business strategy in order to improve their customer experience and create a digital business strategy.

KEY POINTS TO DELIVER VALUE PROPOSITION

In order to deliver the right value proposition competitive businesses, a business needs to consider some key points such as: the localisation of products, service levels, quality, branding, and pricing. Competitive businesses must also better understand the customers' behaviours in order to align products and service segment. Finally, the participants in this section of the journey will create a business strategy which will lead to superior value to customers.

Venturing into new markets, businesses needs to adapt their business model to local area in order to attract targeted customers.

Digitalising business is what most are doing, and it is essential for exporters to do the same, to facilitate interactions with its stakeholders.

Delivering value to customers is the best practice, as it ensures that customers are satisfied and increases customer retention.

Creating leaders in different geography can be tricky but finding that person with the knowledge of both local and the company is crucial.

GCGP Economic Plan

The Competitiveness and Trade Journey plans to build on our internationally recognised research and technology base as both of them are key points in order to deliver the Value Proposition

BUSINESS MODEL

The final step of the journey will come to an end with the creation of the most efficient and effective **business model.** The **business model** will be based on the core competencies to deliver the value proposition. In addition, the business model must be agile, more specifically it must be easily adaptable to the needs of their customers and it constantly needs to create value for them. Finally, the model has to include innovation in order to gain and sustain competitive advantage.

GCGP Economic Plan

The Competitiveness and Trade Journey wants to expand the trading volume of exports for goods and services in Cambridgeshire and this can only be achieved by shaping the right business model.

Surfachem- https://surfachem.com

Surfachem is one of the leading industry trends in chemical ingredients distribution. They export in Europe and entered South America in 2014, as part of their wider global expansion.

They entered the market through a joint venture, which gained them virtually instant contacts and local knowledge. The joint venture enabled Surfachem Group to supply, distribute specialty chemicals to Brazil's personal household care and institution and industrial care markets.

Surfachem Brazil is now well established in the market and is now focusing to consolidate and grow its sales positions in its existing overseas operation in Brazil.

Recommendation

For all the reasons that have been demonstrated above, it is important to create and implement a Competitiveness and Trade Journey in Cambridgeshire and Peterborough. To which it is going to help business to compete and succeed internationally. An important part of this journey will be the Ambassadors who are local business owners that have successfully manage to trade abroad. They can guide, support and mentor new, occasional, and frequent exporters.

THE PRODUCTIVITY JOURNEY

There is a need to create a Productivity Journey. The UK has the second lowest productivity of all G7 countries and following the 2008 financial crash has shown some of the worst recovery *(Office for National Statistics, 2016)*. UK businesses need to fill this gap as Industry 4.0 becomes ever prevalent it's important for companies to improve or be left behind. Cambridgeshire and Peterborough could be the example to the rest of the UK on how productivity can be improved in a replicable fashion. Increasing productivity can be a significant barrier to businesses, and when there are so many areas in which to improve on it can be an enormous task to know where to start. The creation of 'The Productivity Journey' addresses this issue, it combines knowledge from manufacturing, software design, managing, services, and product design to create a process by which businesses can move into the modern age of advanced manufacturing and engineering. The Journey provides a structured way to take a business through the process of becoming more productive, meaning productivity can be improved in a focused and driven way. There are five areas, Lean, Agile, Digitise, Automate and Autonomy. By moving through each step in this order it is possible to move from a manual manufacturing plant, to a fully automated and intelligent factory operating at a much high level of efficiency.

This Journey is specifically designed to help businesses understand these steps, and eventually create ambassadors in each area. These experts can them become class leaders in their area and share their knowledge, now from direct experience, with others in the sector.

Figure 1 – The Production Journey Map

WHY? THE PRODUCTIVITY JOURNEY

LEAN

The starting point for many businesses is Lean Thinking. Lean is the action of improving processes with the goal of perfecting basic business activities and reducing waste. Lean specifically is aimed at **increasing value** in a business and **decreasing waste**. Value being what the customer is willing to pay for, and waste being unnecessary use of time, inventory, people and movement. Lean is incredibly valuable as it can reduce the lead time on all projects, save significant amounts of costs through less storage space, less waste, less rework and less down time on machinery. Reducing waste is not an expensive process, in fact reducing waste alleviates many of the costs associated with businesses, which therefore **increases the value** of the product without even making direct changes.

A key part of the Lean approach is standardising processes in order to reduce the amount of time that is lost between steps in manufacturing. There are an enormous number of **tools** to do this, such as 5S, 8Wastes, MoSCoW, Process Mapping, S.M.E.D

Keepsake Theme Quilts - https://tshirtquilts.com/

*A social enterprise company manufacturing quilts employing the deaf. The continuous introduction of new forms for the products meant a large swap over time between projects. This created a bottleneck and slowed down production. Using **Lean Thinking** they reduced the number of forms by **50%**, which increased delivery date fulfilment to **100%**, and made **600** more sales than the previous year.*

Lean can reduce costs by **32%.**

Agile can increase project success by **28%**

73% of businesses could use automation

All businesses want to become more efficient and waste less. Lean and Agile are both possible with nothing but time invested from businesses.

The North East Productivity Alliance ran from 2009 to share best practice for Lean approaches. Saving one company £100,000 a year.

By education and growing ambassadors, sector leaders are created from within the sector itself. Creating experts rather than bringing them in.

and many more. The end result of Lean is to improve the overall efficiency of a space, and to push for continuous improvement in every single area.

UK Industrial Strategy

Lean gives businesses far more freedom to innovate, as it frees up time and resources across the business.

It also enables workers to spend less time on wasteful tasks, empowering them to do more effective work for more of their time.

AGILE

Being Agile is being able to **change direction** quickly, in business that means reducing lead times on projects, and moving away from waterfall approaches to project planning. Agile is a **demand driven** model which segments work into short flexible **'sprints'**. By working in short cycles, it is possible to change the direction of a project before it advances beyond redirection. Two-week sprints, for example, allow focused work for two weeks leading up to a review process whereby the current state of the project is reviewed, analysed and directed towards new goals. Whether that be the next step in the process, or if it is a change in direction.

This way businesses lose the **minimum amount of time** possible. There is no more wastage of time waiting for review, and everyone is aligned to a short-term focused goal. Continuous small achievements over one impossible task enables Agile teams to be in some cases **400% more productive** *(Sutherland, 2015).* Integral to Agile is the incorporation of multi-skilled teams, to avoid handover processes. If the whole team can deliver the whole project, there is nothing 'lost in translation', no bottlenecks of staff time and a full understanding of the whole project delivery model.

UK Industrial Strategy

Agile's short cycles are what makes it so powerful, ideas no longer take months to come through, instead smaller steps are made across weeks and innovation can take place at every single step.

Sprints are also empowering, they give teams more autonomy and more flexibility. Enabling them to make changes that are apparent from doing the work.

Lean is a direct solution to many businesses problems, value creation and waste reduction is a continuous challenge to businesses globally.

Engineering business are project based, so using a project structure such as Agile is the perfect solution to slow project development.

Jeff Johnson pioneered Agile at the FBI and turned a $500 million 10 year project into a $20 million 12 month project.

Leadership is boosted from within. Leaders want to improve the system they are in, but often don't have the exact tools to do it.

DIGITISE

Digitising a company is all about using **data** and **information**. By turning analogue processes digital it is possible to collect data and use that to benefit the process as a whole. Digitising benefits businesses because they have access to far more information than previously, and more information allows more informed decisions. So, managers **empowered** with this information have to rely less on qualitative reports with slow lead times and instead have figures quickly. It becomes far easier to exactly track how changes improve the efficiency and productivity of each process.

Installing sensors on processes allows real time data to be collected as well, so issues can be brought to relevant technicians or management as soon as they arise. Information is powerful and so by collecting information throughout a business it becomes much easier to analyse how efficient the business runs as a whole. This enables the continuous improvement approach highlight in Lean, and it also allows the company to be more Agile as there is no lead time in collecting information.

Lintott Control Systems - https://www.lintottcs.co.uk/i-catalyst/

Manufacturing water treatment systems. Lintott have invested heavily in digital technologies and have created their I-Catalyst system. I-Catalyst is an all encompassing digital delivery system, ***a virtual factory****. Now they can deliver in* ***3 hours*** *instead of* ***3 days****.*

Built into the physical factory they do have is a large number of sensors, and control charts so data can be collected, analysed and used to inform decisions across the company. The physical space of Lintott feeds back into the virtual factory floor. This ***connectivity*** *is what makes them so productive.*

UK Industrial Strategy

Digitising processes is the first step in moving towards a data economy. Being able to collect and share data across business and business to business is incredibly powerful. By collecting real data from all stages it is possible to find issues and therefore solutions. Meaning best practice is much easier to share across a sector.

Agile allows businesses to accomplish often over double the work in half the time. The nature of sprints is designed to push teams to accelerate through a project.

A lot of digital infrastructure already exists as our environment is so digitised to start with. Only a re-purposing of this into business processes is needed.

Digital sensors are already available. Improvements can be made by introducing a standardised practice. Meaning data is more readily shared between businesses.

The world is moving towards digital platforms. So it is integral to push workers to use digital technology to augment their abilities. It is this or be left behind.

AUTOMATE

Moving manual processes towards computer-controlled solutions is the next stage in productivity. This is something that many car manufacturers have already embraced, but it is entirely possible to move this to other areas and processes across businesses. Robotics are now incredibly able and can perform precision takes with repeated consistent outcomes. Which is the key part of moving to autonomy. Robotics and other physical automated systems have a much higher level of consistency of outcome. They can also collect data on themselves in real time, and feed that back into the overall ecosystem of a business. Automation can also be done with software, by removing repetitive tasks like data entry, output creation etc. It can remove the monotony of these tasks and provide more space for workers to undertake deeper analytical tasks.

UK Industrial Strategy

Automation is removing repetitive tasks from the UK workforce. Meaning workers can move away from manual repetition, and start to learn more relevant skills that machines cannot replicate. Workers can have more autonomy themselves as they become higher level experts, instead of working on a single task.

AUTONOMY

The introduction of narrow AI systems can relieve even more work from managers. Allowing a focused AI system to make simple decisions, within the ecosystem built up from digitisation and automation, means that broader concepts and ideas can be given more time by managers. AI can also feed into a Lean system, allowing analysis of previous performance to highlight areas that need improving, or potential bottlenecks within the process. Smarter AI systems can also be used to forecast demand, staffing, stock and other variables that affect the daily operations of a business. This statistical forecasting can then be combined with local managers know how to create more accurate and information predictions of the future.

UK Industrial Strategy

The use of AI directly feeds into the UK's movement towards an AI and Data Economy. R&D is moving towards AI development, so it is integral to the UK economy that businesses embrace this approach.

AI also allows more time for innovation, processes like Design Thinking and Innovation Thinking can be given more time as AI systems can run the day to day.

AI does not replace jobs, it merely augments them. AI is becoming more and more capable, meaning humans can focus more on adding value to a product.

AI is supported heavily in business. Google are class leaders in AI. Allowing AI systems to run day to day operations gives Google workers space to be innovative.

Autonomy improvements are shown in Toyota, by using humans to perfect a process and skill, before turning them autonomous.

Using robotics and AI turns workers into leaders, they become experts in a task and now have a team of robots which they now lead.

HOW? FOLLOWING THE JOURNEY

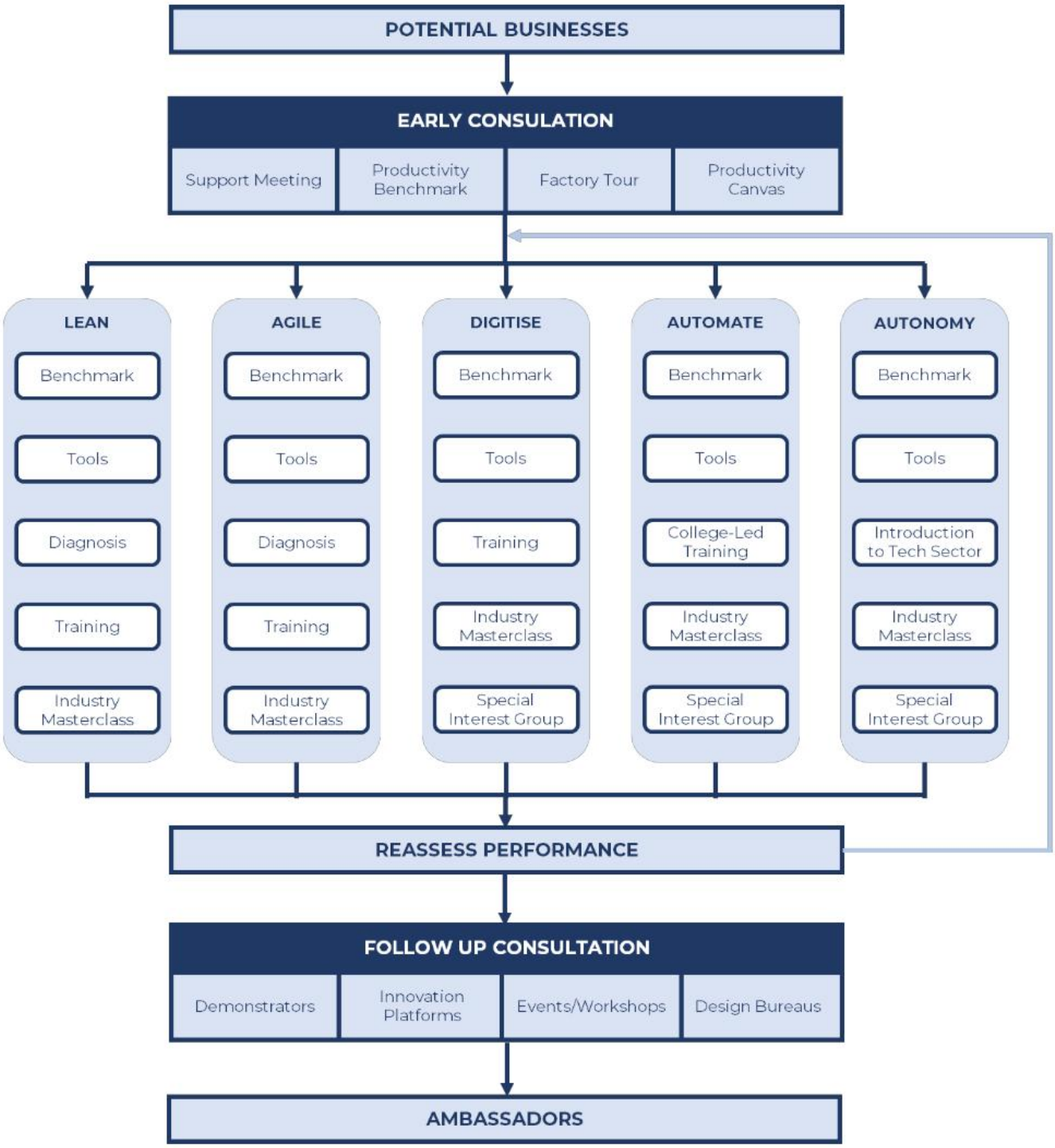


Figure 2 – The Business Pathway

Although the Productivity Journey has five key areas, each area has enormous potential for improvement. Lean is not just increasing value and reducing waste, it is benchmarking, tools, diagnosis, training and industry masterclasses. The Business Pathway highlights the route taken and how they lead onto the creation of productivity ambassadors.

EARLY CONSULTATION

Early consultation is the starting step for every business. Every business will have a different journey and so it's vital to tailor this to what that business actually needs. A business may already have made progress on its journey. A manufacturer implementing Lean across the production line may benefit more from moving to Digitise before they move to Agile project management. Equally a software developer creating AI software will already have Automation, Autonomy and Digitise in place, but their process of project development may not be very Agile and so starting there would be more beneficial to them. One of the most useful starting places is the **benchmark**.

STEP BY STEP

Each of the five areas starts with the vital task of **benchmarking**, this is the realisation of where the business is at, and helps to discover opportunities for improvement. Benchmarking may be a starting point here, but it is also a key component of Reassessing Performance once the five areas have been implemented. Comparing before and after through tools like benchmarking is essential to visually see progress and re-iterate the use of continuous improvement through Lean Thinking.

Tools are also key in the process of embracing the five areas of productivity. The best changes are made when people can follow a structure to make an improvement in their work. This structure becomes a repeatable framework for each department within a business. Tools also create a standardised practice across the business, meaning less pre-training is required for managers and leaders.

Once a business has found opportunity for improvement, and implemented some basic tools, it is then important for leaders within business to learn more about the **theory** and **best practice** within each of the five areas. This can be done through **training courses**, such as Lean Thinking, Agile Thinking and so on.

The key to the Business Pathway is empowering those already within the sector to become experts in these five areas. This is done by equipping them with powerful tools, relevant knowledge and theory, and then encouraging them to test the ideas in their workspace. It's vital they have actual experience of implementing these changes and approaches, only then can they become the experts needed. Once they have a level of experience and expertise they can then become **ambassadors** and help demonstrate what they've learned to the rest of the sector.

CREATING AMBASSADORS

The two goals of the Productivity Journey are to:

- Increase the productivity of a business
- Create Productivity Ambassadors

Each of the steps within the Journey are designed to increase productivity. By tailoring the journey to the business these can be implemented incrementally and intentionally monitored to see their success. Productivity is a measurable metric and so the success of the Productivity Journey can be analysed.

Leaders within businesses who go through the Productivity Journey are ideal candidates for Productivity Ambassadors. These ambassadors will be able to synthesise their learning, both from experience within their business, and from the theory they have studied. The opportunity for ambassadors once they have achieved this level of understanding is that they can become industry leading experts. Able to share best practice across their sector and collaborate with other ambassadors from other sectors to help push UK industry forward as a whole.

Ambassadors will allow cross sector sharing of best practice.

Businesses are keen to bring up and train effective leaders and managers. Becoming a Productivity Ambassador would be a great way to achieve this.

Companies that operate a form of Agile called Scrum designate a Product Owner and a Scrum Master. These are effectively productivity leaders and so there is plenty of scope for companies to use Productivity Ambassadors.

The nature of becoming a Productivity Ambassador is entwined leadership skills. The process of becoming an expert in productivity will instil leadership skills into workers.

UK Industrial Strategy

Ambassadors will become the leaders of productive communities across the UK. They can push for innovation, changes in infrastructure and aid businesses across the country to create more efficient, intelligent and modern business environments.

Recommendation

The implementation of a Productivity Journey for Cambridgeshire and Peterborough is needed in order to support businesses move the UK to the most productive economy.

THE SUSTAINABILITY JOURNEY

The Sustainability Journey fills a need across the UK as a whole. As areas in the UK grow and improve they are going to produce more and more emissions and have an increased effect on the environment. This is an inevitable consequence of growth. The Sustainability Journey is designed to mitigate those side effects of growth by pushing businesses to grow in a sustainable way from the start. By making it part for the targets of growth, it becomes a manageable aspect. This Journey helps to fill the knowledge gap that many companies are facing.

To date, the UK has met its carbon budget goals, it is also on track to achieve its second and third goals (by 2022). The fourth period (2023-27), however, is not currently predicted to be achieved *(The CCC, 2019)*. This is important, because although targets are being met currently, it highlights that the past does not necessarily predict the future. As the UK economy changes drastically, through Brexit, through economic growth and industry 4.0, it will be incredibly important to continually push for sustainability to be incorporated in all growth strategies.

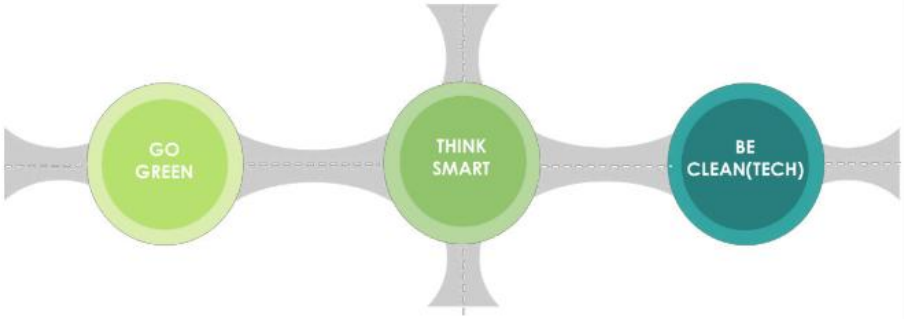


Figure 1 – The Sustainability Journey Map

WHY? THE SUSTAINABILITY JOURNEY

GO GREEN

Go Green is the simplest step in the Sustainability Journey, it does not require new technology, or new expertise or necessarily an external expert. It is all about using knowledge that most of us possess and aiming to reduce a company's carbon footprint through simple means.

The key benefits of the Go Green strategy are **cost reduction** and **simplicity**. By **reducing waste** across the company, it is possible to save a significant amount of running costs. The start of the Sustainability Journey is incredibly accessible and provides benefits very quickly. One large aspect of Go Green is changing staff attitudes. This is as simple as pushing staff to ask themselves what they can do in their day to day activities to save energy, and to save waste. **Simple actions** add up quickly, turning lights off, turning machines off when not in use, recycling paper and plastics, incorporating recycled materials into daily use, removing single use plastics from the business. These are all low scale actions, but spread across a company of 100 people or more it has a significant impact, both on that company's effect on the environment, and on saving costs.

The Sustainability Journey allows continued economic growth, without sacrificing sustainability.

Businesses have an obligation to consider social responsibility. This Journey is a structured path to that.

Best practice is seen through transparency of sustainability standards and targets.

This Journey helps to create leaders for sustainability from within companies, empowering them with knowledge and experience.

Valeo - https://www.valeo.com

Valeo are an international automotive parts manufacturer. They are rated as one of the top five most sustainable companies in the world. Since 2009 they have focused on making each component they manufacturer more sustainable. From focusing heavily on R&D they have reduced energy consumption by 28% and reduced water use by 46% over the past 10 years.

UK Industrial Strategy

One of the Grand Challenges for the UK right now is clean growth. How can the UK economy keep growing without damaging progression towards climate goals. Growth is traditionally carbon expensive, but by incorporating sustainability into growth strategy it is possible to grow cleanly.

THINK SMART

Think Smart is aiming to help organisations implement digital tools to improve their internal processes, become more efficient and more productive. This is done by bringing together knowledge across the sector to find best practices. Within Think Smart there are various tools to achieve this, but the overall goal is to think more deeply about what the business is doing, how that aligns with it's goals, and how to fit sustainability into a **growth plan**. Think Smart is where knowledge should be shared across businesses and across sectors. Instead of each business struggling with its own issues, the goal of Think Smart is to push a series of **mapping** exercises, so businesses know where the problems are, and then use that to come together with others from other sectors. This highlights cross sector issues, and allows businesses to work together to solve a problem as a **collective**. Meaning not only are contacts made between businesses in similar situations, it also allows more effective **innovation**, using **different perspectives** to solve one problem that maybe affect five or six businesses at a time. This is a huge opportunity for collaborative learning amongst businesses.

The innovation that comes with Think Smart approaches is important, it acts as a way of highlighting opportunities for the business to go towards. So not only are problems solved and sustainable solutions found, but it also brings businesses closer to new **opportunities** in their sector.

UK Industrial Strategy

Creating a data economy is the natural progression for the UK in the 21st Century. Using smart technology not only increases available data for businesses, but also helps to improve sustainability. More information means more opportunities to increase efficiency or use technology to improve processes.

The Sustainability Journey addresses the need to match government sustainability targets, businesses will be held accountable if they do not show progress towards this.

Infrastructure for Go Green already exists, it is designed to be simplistic so it can be implemented quickly.

Improvements can be made in the complexity of the issues addressed. Companies Go Green but do not often move into Be Clean(tech)

The goal of this Journey is to improve the current workforce. To enable them to expand their skillset and grow within their position.

BE CLEAN(TECH)

The most advanced stage of the Sustainability Journey is Be Clean(tech). This is the **future gazing** branch of the Journey. By looking forward towards what is possible within clean technology, businesses can find places to become **class leaders** in an area. They can move from trying to keep up with sustainable practice and opportunity, to leading a sector from the front, driving new innovation and new practices forwards. This can be done with the most cutting edge research, by using knowledge intensive collaboration, where businesses work with academics and researchers to invent new solutions to recurrant problems. Using processes like design thinking, a business can focus on what it really is their customer wants them to deliver, and combine that with what they've learnt so far on the Sustainability Journey. Implemented with ideas from collaborations with researchers, in order to provide the most **innovative** and **sustainable solutions** to problems.

Adams - http://adnams.co.uk/

A brewery based in Southwold, Adnams are a perfect example of what a demonstrator company can be. As well switching to 100% renewable energy, reducing carbon emissions by 48% and reducing glass manufacturing emissions by 21%. Adnams also demonstrate the Be Clean(tech) mentality. Since installing an innovative water recycling system they've reduced their need for freshwater cooling by 90%

UK Industrial Strategy

The innovation within the clean tech sector is enormous, from battery storage solutions to solar roads there are already a large number of businesses pushing to innovate new solutions to problems facing UK industry. Be Clean(tech) helps to support this push to become the world's most innovative economy.

HOW? FOLLOWING THE JOURNEY

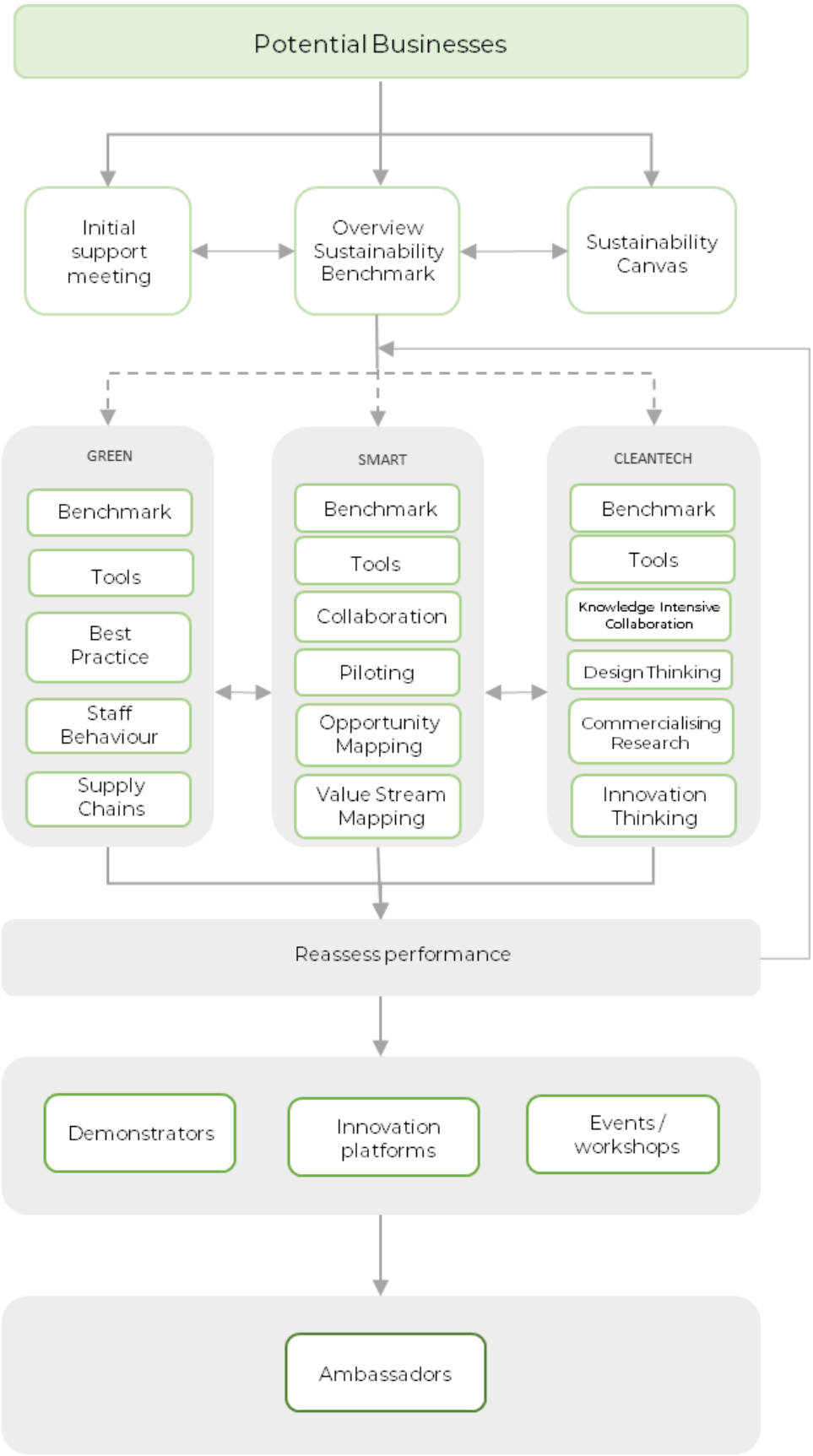


Figure 2 – The Business Pathway

The Business Pathway demonstrates the depth possible in each area of the Sustainability Journey. Go Green, for example, is not as simple as pushing employees to change their actions. It is also about sharing this mentality with suppliers involved in the chain. The Business Pathway is important because it demonstrates the need for continuous improvement. Tackling all three areas is not a linear process, it is a continuing cycle of change that should be considered regularly.

BENCHMARKING

Benchmarking is the key step in the cycle of any Journey. Knowing where a business starts from is crucial to know where is has made progress to. By conducting an initial **Sustainability Benchmark,** it gives both the business and its support team useful information for which to inform the rest of the Journey.

In each area of the Sustainability Journey benchmarking is the starting point. In order to know how to go forwards, a business needs to know where it is.

In Go Green benchmarking is all about seeing where a company currently has **waste** and **inefficiencies**. Where workers are forced to act in non-sustainable ways because of the system or because of the supply chain.

In Think Smart, benchmarking is finding where a business is using **digital assets** to its advantage, and where there are gaps in the system. Benchmarking also feeds into highlighting opportunities for **collaboration**. If a business finds a particular hole, then that is a perfect place to start when working with other companies.

Be Clean(tech) also starts with benchmarking, the goal here is to find space in the business that would benefit most from **intensive innovation** sessions, or from bringing in outside researchers to inform on the most cutting-edge technological solutions. Benchmarking also feeds immediately into the earlier stages of Design Thinking, providing in house research into where the business could take a new angle.

During the concurrent cycles of the Sustainability Journey it is also important to continue to use benchmarking. Each time a company assesses itself it should find it has improved, this then becomes a tangible metric that can be used to show how a business is pushing itself to become more sustainable.

STEP BY STEP

Once a business has shown interest in the Sustainability Journey and completed its first benchmarking session it is then possible to move on to other tools like, the Sustainability Canvas, providing a structured way to consider how sustainability feeds into every area of the business. The Sustainability Journey is designed to provide this **structure** throughout, although businesses are capable of becoming sustainable, following the Sustainability Journey gives a constant **framework** for each step along the path. This mean that sustainability can be achieved in a replicable way, and in a much **shorter time frame**.

Tools are one of these structured devices. They guide leaders within business through a framework to either highlight issues / opportunities, or to help them see clearer the goal. There are also different types of tools, some a more localised and structured, having small groups of leaders analyse particular areas of the business. Whilst others are far more open and collaborative, for example, bringing together researchers for Knowledge Intensive Collaboration, or training a team in how to use Design Thinking to solve their product design issues.

Benchmarking by it's nature highlights successes and failures within a business. This insight is invaluable for forward progression.

Engineering businesses all want to make processes more efficient. The nature of becoming more sustainable also tackles a lot of inefficiencies within businesses.

The Sustainability Journey is designed to help business discover a best practice, or even create their own.

Leaders in engineering businesses are already capable of making these changes. What this Journey does is provide a framework to focus that attention one step at a time.

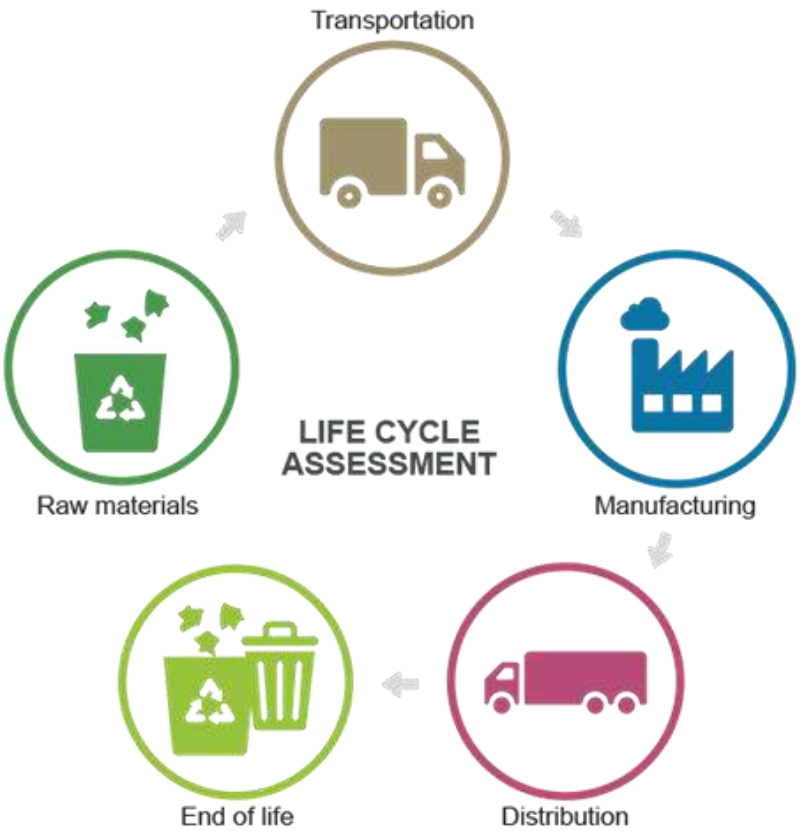


Figure 3 – Life Cycle Analysis Framework

Life Cycle Analysis is one tool that feeds directly into Be Clean(tech), it is about the consideration of the full life cycle of a product. Building on the Greening Supply Chains tool used in Go Green, it is then possible to go one step further and consider the life of a product even after sold. This is the kind of approach that **pushes businesses forward** rapidly into becoming a Sustainable Demonstrator. A business which considers every stage of its product life is clearly a **sector leader**.

Creating Demonstrators and Ambassadors

Sustainability Demonstrators are created when a company has achieved significant progress in becoming more sustainable. This may take two or even three cycles through the Sustainability Journey, but once they are Demonstrators, they then effectively become a **live case study** for other businesses to turn to. So, when a business earlier in its Journey reaches Cross Sector Collaboration, it will be possible to bring Demonstrators in to feed into the **collaboration** with their ideas direct from experience. Demonstrators also have a lot of experience to bring into Knowledge Intensive Collaboration sessions. Their direct experience is invaluable when working with researchers and innovators.

Individuals from within Demonstrator companies may then become Ambassadors, a strong leader from a sustainable business who has experienced much of the Sustainability Journey. These are people with a strong purpose and drive to push sustainability forwards. They are ideal to go into other businesses, other sectors, and academia to be a source of ideas, solutions and information all from **experience**. They can work with other Demonstrator companies to pull out Ambassadors from within them and eventually a team of cross sector Sustainable Ambassadors can be developed. These Ambassadors would become an example of what is possible when businesses are given some structured route to follow to sustainability.

Recommendation

The implementation of a Sustainability Journey for Cambridgeshire and Peterborough is needed in order to support businesses clean growth needs.

THE ENTERPRISE JOURNEY

A healthy economy requires small businesses to grow and be sustainable, as when small businesses are healthy and flourishing, the community-at-large benefits and prospers too. Having a strong network of successful small businesses will help economic development in Cambridgeshire and Peterborough.

Entrepreneurs have an important role in economic development of a country and region. They create wealth and share resources to the community through job creation, increase standard of living and community development. In the UK, there are 5.7 million SMEs in 2018 and 99.3% accounts for small business in private sector and 99.8% were SMEs. The Total employment in SMEs was 16.3 million and 60% of all private sector employment in the UK. In 2017, there was nearly 660,00 companies established, up from 608,000 in 2015 *(Parliament UK, 2017)* and in Cambridgeshire and Peterborough recorded 6,384 *(Cambridgeshire Live, 2017).*

As the region continues to increase its start-up rate, the issues now facing the region are low growth, and capacity to scale up. Nationally the region is not the only one suffering, British start-up ventures also have difficulty scaling up and suffers from a 'high mortality' rate based on one report produced by University of Cambridge. Stating that only one in two start-ups survive their third anniversary. With 5.5 million SMEs in 2016 reported that nearly 96 percent were "micro-size" businesses have less than 10 employees and only 33,000 businesses transition into SMEs with over 50 employees *(Information Age website, 2018).*

The enterprise journey is especially designed to help all levels of communities be more encouraged into venturing into entrepreneurship. Having step by step guidance on this journey, start-ups can have the tools, experience, and mentors to help them grow and scale-up.

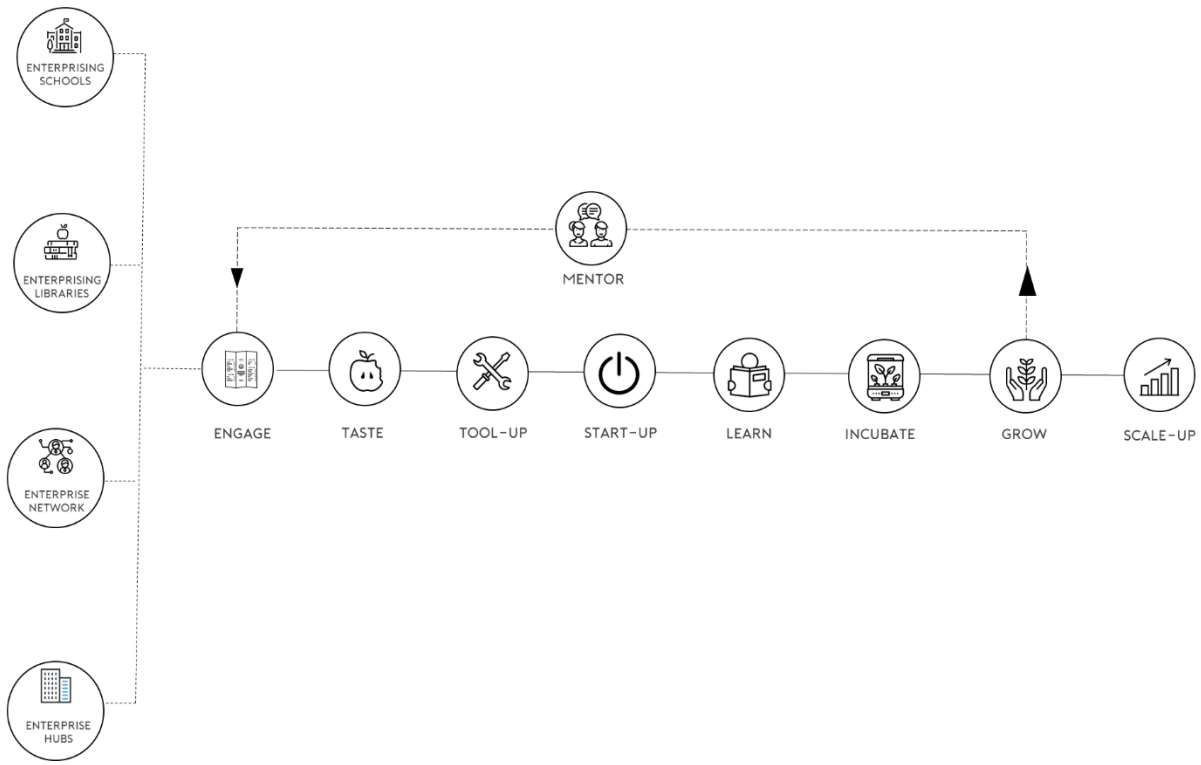


Figure 1 – The Enterprise Journey

WHY? THE ENTERPRISE JOURNEY

ENGAGE

Engaging with the communities can foster great entrepreneurs and later, start-ups into multinational companies. There are different ways to engage with communities: schools, libraries, local events, churches, and social media are all possible avenues of outreach.

Cambridgeshire and Peterborough have a high concentration of start-ups. Businesses. In Greater Cambridge and areas around it feel untouched by the economic success. Cambridgeshire and Peterborough must engage in all areas in order to create inclusion and connectivity. Doing this, can make local residents feel part of the community and help them to improve their locality, thus, making the community as one and making support available for each other. Engaging with the community with opportunities like starting up a business programme, can lead the programme to be more known around all areas and encourage local residents to take part.

TASTE

Promoting engagement in communities opens different opportunities that may not be known before, and giving local residents a taste of what it feels like to start a business may inspire them to set up their own. Having an open community allows everyone to know that there is help and support available for them. This can lessen the burden of creating a business.

Giving local residents a taster session about how to start a business, turning their ideas into a business, or how to become more innovative can ignite local residents and local businesses into creating a business or becoming more innovative with their products and services.

Taster or drop-in session can be organised around the communities like libraries, schools, local events, colleges, sector hubs, growth hubs, and community halls. Giving people the flexibility of the location and time is also important, as it will allow people to work around their schedule and stop by to see what help they can receive.

TOOL-UP

Providing local residents and businesses with the skills and tools they need to start a business or improve their business are essential ingredients to ensure high probability of success.

ACTIVATE

Start-ups have a high-risk expedition and very often fail for many reasons. The most common reasons are; lack of experience, no clear value proposition, reaching customers in the wrong way, and not targeting the right customers.

Activate is about shaping and transforming ideas into successful start-ups. This can be achieved by applying lean thinking into the start-up process. Activate **minimizes the risks** by proving the concepts in advance, shapes the **right value proposition** and targets the **right customers**. This can be achieved with the use of **Minimum Viable Products (MVP)** in order to test the business' proposition, addressing the right customers and shaping a tailored value proposition for customer's needs. In addition, the use of tools such as business model canvas enables the creation of a business plan. In the final step of Activate, participants have a deep knowledge of all their different aspects of their business and will be able to kick start their venture and improve chances of success.

Activate can drive start-up's customer from 0- 4m and this was what Dropbox used to get their users from **100,000 to 4m**.

The Government and private sector are concerned about growth rate of start-ups and scale up. Activate and Accelerate can be implemented from the beginning to ensure success rate.

Activate best practice has been demonstrated by GE and P&G which was originated by Toyota.

By educating and encouraging communities about enterprise, entrepreneurs and mentors can be created to help the community back.

Zappos - https://www.leanstartup.co/

Founder of Zappos, Nick Swinmurn took the less travelled method of starting a business and he used this method without knowing he is doing it. His hypothesis was that customers are willing to buy shoes online and he tested his ***minimum viable product*** *directly to customers and people took interest in this online retail business.*

His experiment provided a clear and quantifiable outcome that made Zappos worth $1.2 billion and was bought by Amazon in 2009.

ACCELERATE

After setting up a business and successfully running the business operation, there will be periods of time where start-ups can stagnate, and this can be due to many reasons. With Accelerate it takes medium-to-high growth businesses through a journey whereby best practices can be shared and tools for success can be provided. Accelerate can help businesses optimise their internal management system through providing tools and building blocks for promoting high growth, increasing productivity, lean manufacturing and scaling-up.

DevilishlyHandsomeProduction- https://www.digitalgreenwich.com

Devilishly Handsome Production is creative video production and digital media company founded in 2007. DHP Studios used Accelerator programme to gain understanding of data, analytics and site traffic. Through the programme and formed connection through which they can develop future opportunities.

They have benefited on the programme and are exploring market opportunities. They are currently developing application for the architectural and real estate market.

SCALE-UP

Many businesses have the ambition to scale from a high-potential business to become a high-performing world competitor. To be able to achieve this ambition the business needs to address all the infrastructure needs of the business. The Scale-up programme can turn businesses to rapid and exponential growth though providing tailored package of support, set up and run R&D projects in collaboration with researchers. Provide understanding and support of grant funding, seed capital and venture capital.

START-UP

With the right tools, skills and guidance, aspiring entrepreneurs can create their start-up company. Start-Ups are important for a community's economy as they are the primary source of job creation. Moreover, business dynamics is an important factor for productivity growth.

Cambridgeshire and Peterborough are in the 4th quartile for producing start-ups in the UK *(Enterprise Research Centre, 2018).* This reflects that there are more start-ups being produced than ever, however, start-ups have a high risk of failing and if not supported and guided from the beginning there is a high chance of failure. Through programs like Activate, start-ups can create the right products or services that customers will purchase, thus, increasing chance of success.

LEARN

Provide a variety of learning options to allow businesses to grow by offering bespoke one to one support for entrepreneurs, funding or connecting start-ups with institution for collaboration, have mentors to guide, and support entrepreneurs on their journey. Through this, it will enable businesses to have the confidence to make the right decisions. Giving businesses the chance to learn more about the different opportunities for scaling-up, innovation, and productivity, this training will enable businesses to think of long-term goals and not just short-term goals.

INCUBATE

Incubator's main purpose is to help start-ups at a very early stage grow and increase chances of survival. Businesses in Cambridgeshire and Peterborough have difficultly scaling up and most start-ups are being acquired by international companies. By incubating start-ups at their early stage, it can minimise the risk of being acquired later, as they will have the right infrastructure, experience, funding, mentors and connections.

Incubators create a space where every entrepreneur can connect with others and create a community of start-ups, where everyone supports and advises each other. Incubation provides an environment for open learning, taking risks, flexibility and collaborations. It also gives access to resources, knowledge and experience for entrepreneurs.

GROW

Every start-up wants to grow and scale their business-like other companies, but it does not come easily, it's a long process and can take years for growth to be seen. To grow means a lot of improvement to the business and growing then becomes a journey. The Accelerate program helps businesses accelerate growth through optimising internal management systems, increasing productivity, creating new connections, seeding investment and collaborating with different industries. All this is good for idea generation and problem solving through innovation.

SCALE-UP

As stated earlier that there are issues that Cambridgeshire and Peterborough are facing. Based from those figures, is clearly mismatch between the level of support offered by the national, regional, and local entrepreneurial bodies. The UK has the right conditions for starting up, but it has yet to establish itself as a growth hub.

Many start-ups and SMEs, even if they are in the growing in the process, have decided to sell the business to its competitors or other bigger corporations. The entrepreneurs decide to sell their businesses either because they lost orientation, or because they don't have access to the funding and the infrastructure to evolve. This acquisition, especially for tech businesses, very often means immediate relocation of the company's operations and headquarters. Acquisition such as this has a negative impact in the local community's economic growth. A **Scale-Up** program could work to fight this, as it will support these organisations and give them the tools and the infrastructure to lead their organisations and consequently the local economy in a high growth journey.

Scale-up programmes in the region will help tackle the issue of limited growth in Cambridgeshire and Peterborough. Through the programme, businesses can increase growth and secure themselves from being acquired by bigger companies. The programme is structured to refresh business management knowledge, identify market growth opportunities and investment readiness in order to sustain and grow the businesses in a changing economy.

Enterprise Journey ensures that all levels of the community are engaged, and that resources and mentorship are provided to increase chance of survival and success.

Barclays Scale –Up UK programme: Run with the Cambridge Judge Business School, providing bespoke coaching and peer-learning opportunities to businesses who want to scale-up

Scale-up best practice allows businesses to grow and expand the company without having to sell it.

By providing an enterprise journey to start-ups, they can be better equipped with the challenges and problems they will face later in their journey.

CentriLogic- https://bershirebusinesshuh.co.uk

CentriLogic is a Canadian IT company that have gone through the scale-up process as they needed space and equipment to scale-up.

With the help of the scale-up, they are now continuing the company's growth by increasing their presence in Germany and Hong Kong. They are now enjoying ***20% growth year-on year.***

UK Industrial Strategy

Accelerator and Scale-up programmes enhances a business structure by looking into its internal management system and see where things can be improved on to help with the company's growth.

Both programmes, also provides resources and mentoring for businesses which are key to business growth.

HOW? FOLLOWING THE JOURNEY

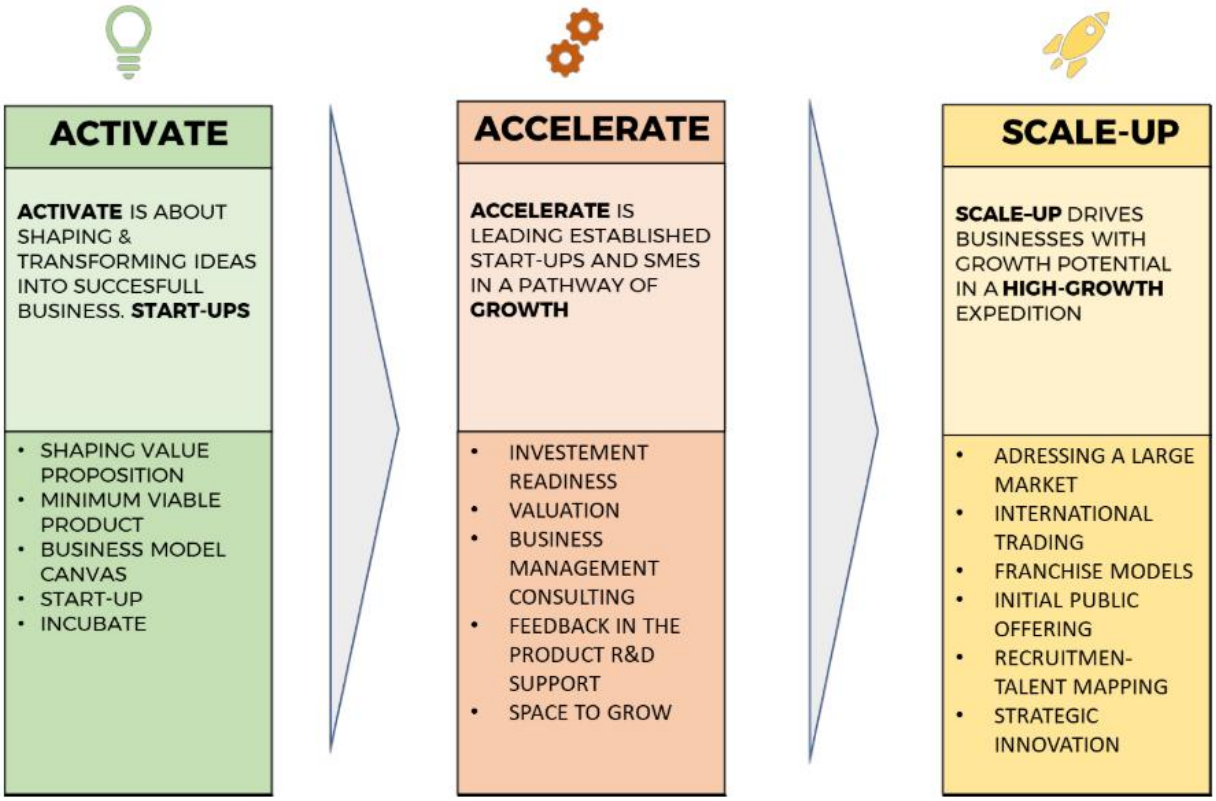


Figure 2 – The Enterprise pathway

The Enterprise Pathway has been designed to showcase the Enterprise Journey from starting up, to growth, to the scaling-up of the business. The creation of Enterprise Pathway combines knowledge from creating start-ups,

supporting them to grow through workshops, training and connecting them to the right people to further support them. By moving start-ups through each step it is possible for them to start, grow to a level they can handle, and to scale the business in order to compete with competitors.

This pathway is especially designed to help start-ups understand these steps and eventually drive growth and scale up the business. Through this, eventually Enterprise Ambassadors can be created to guide and support aspiring entrepreneurs on their own journey.

ACTIVATE

Start-ups are high-risk, due to the entrepreneur's lack of experience, funding, connections or understanding of its customers. Consequently, the creation of an **Activate** program is vital for an area's entrepreneurial and economic growth. Incorporating activate at an early stage can help entrepreneurs test their MVP to its potential customers and see if there is an interest or a real business out of it. This ensures that entrepreneurs save time and resources before fully investing their resources and time. It ensures that there is value being created for customers and therefore increase interest from potential customers.

The business model canvas gives start-ups the bigger picture of the business from its products/services' value proposition, infrastructure, customers, and finances. The business model canvas is the pinnacle when it comes for start-ups as it helps start-ups come up with new ideas easily as they are ordered categorically, it's a great way to brainstorm with the team, helps in tracking the flow of the work and customer feedback can be segregated, and alteration is easier. Using the canvas and having a well-motivated team whose objectives are clear will reach great heights.

Incubation is set up to reduce the chances of failure of early stage start-ups. Incubation creates a sustainable environment and strong entrepreneurial support infrastructure and enables young innovators and entrepreneurs find the necessary support and resources to build a successful start-up. There are other elements of incubation that helps start-ups like space, design, network facilities, partnership, service providers and consultants. All of these add up to create an ecosystem that will help start-up get established and grow.

ACCELERATE

Established Start-Ups and SMEs must face market imperfections and they usually operate in very competitive business environments. In order, to survive these businesses need to grow. They need to expand their customer list and their trading volume as well to adopt an agile strategy, otherwise the competition will overtake them, and market trends will leave them behind.

Accelerate is all about accelerating growth within the company. Ensuring that the business is investment ready, however, business also need to make sure that they understand all the possible sources of funds and what is appropriate for the business at the current state, and ensure that the management team can execute the overall growth strategy. There is a lot of funding available to businesses from loans, grants, Venture Capital (VC), Angel investors, Kickstarter, family and friends. When the right type or mix of funding is decided, they must also make sure that they understand which funders or investors are best placed to provide the capital needed, because if the investor does not align to what the company's values or culture, there might be conflicts when it comes to decision making or setting goals for the company.

As the company grows, the team, and operation becomes bigger and complicated, entrepreneurs need to be able to handle the operation side as well as grow the company. Companies who are struggling to manage should both accept they need help and seek business management consultants to help them learn and understand how they can manage both activities without compromising one. This allows a company to focus on what is important, its growth.

When a company is accelerating, they usually need space to grow and foster. Accelerate offers businesses a place where they can grow and do their own R&D for products or services. Accelerate also offers collaboration with different institution such as academia, research and business parks. This will provide the resources and experience needed to improve their products or services in a cheaper form.

UK Industrial Strategy

The Enterprising Journey includes creating space to grow, network and a place to get support and advice. With the journey going around in all areas of the community, it means more people are better informed about the opportunities available to them.

SCALE-UP

The training courses give the ability to organisations to asses and enter large markets. In detail, through the program organisations acquire profound knowledge and support on how they can trade nationally as well an international level. Through **Scale-Up,** companies are introduced to the concept of franchise models; a way to fund their business while they retain control of it. In addition, **Scale-Up** prepares the participants to meet venture capitalists who want to invest in their business and connects them. However, businesses need to be very careful on VCs, as when they invest, they usually want their investment back after a few years, and if the business are not able to provide the investment back to investors, they can force the company to sell. Having a strategy and plan will help reduce the chances of this happening.

Scaling-up can also mean entering new markets or product development. Entering a new market can be done in two different ways. First entering a new market and creating new products or services for it and second is entering a new location, country or region. The business has the choice on what strategy they want to go for, and this will depend on the resources, capabilities and infrastructure of the business to what level they can target for.

Scaling-up the business will mean that they need to recruit more people to handle more of the business operations. Businesses needs to recruit people who can do the job and ensure that these people align to the company's values and culture, in order to make sure that the company's best interest is at the heart of the business. The Scale-up programme helps businesses on how to deal with the recruitment process and ensures that they hire the right people for the job. Talent mapping is one of the tools the programme uses for recruitment. The tool is hugely beneficial for organisations, particularly at a time when career paths are becoming more unpredictable and interdisciplinary. Organisations who use this tool are the ones that go the extra mile to frame their development plans and ensure a robust succession plan is in place should any key talent leave the business. Businesses needs enough space to grow and develop, whether it is on an industrial estate, a business park, or a science/technology park. With scale-up programme it helps business find the most appropriate space for the businesses to grow.

For companies who are scaling up they need to have a process for strategic innovation in place. In order to reinvent or redesign their corporate strategy to drive growth, generate value for the business and its customers and create competitive advantage. Businesses do not necessarily need to make changes on its goods and services, or its technologies, but it often refers to innovation projects that occur at the executive level. This type of innovation is essential for companies to adapt to the speed of technological change.

Using theory, case studies, tools and specialist support businesses can structure their organisation in the most effective and efficient way and keep their vision and their mission clear to all the members regardless their size.

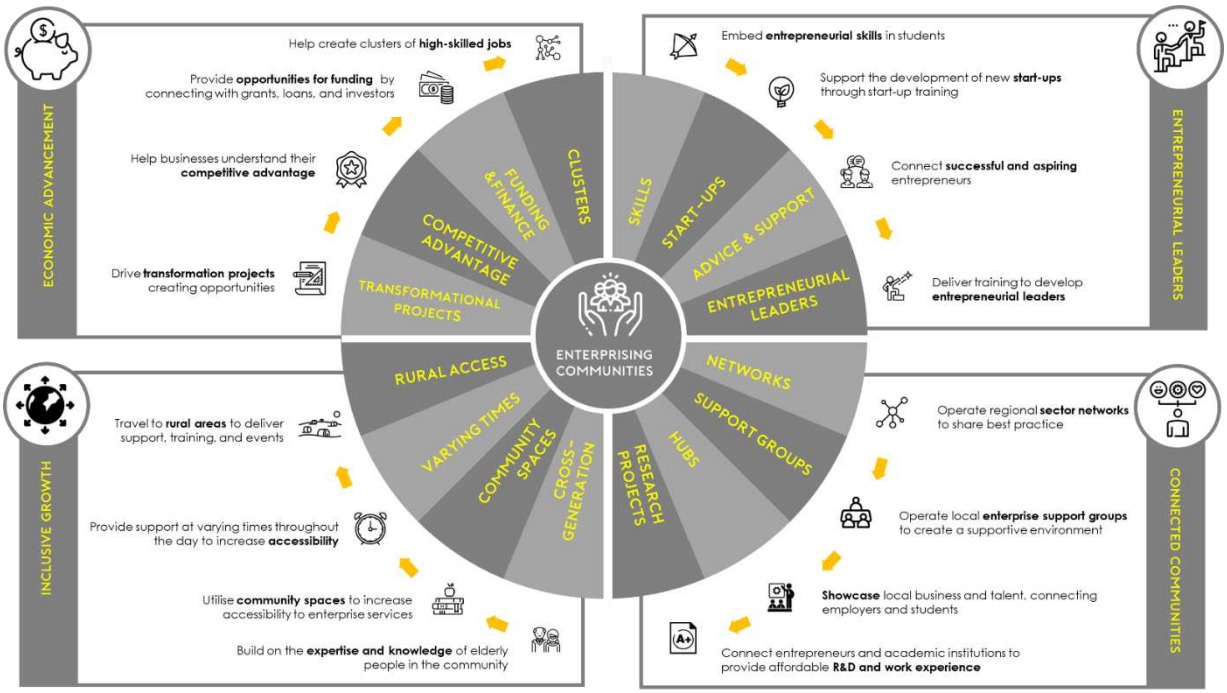


Figure 3 – The Enterprising Strategy

The Enterprise Journey and The Enterprise Pathway are both important, adding to The Enterprising Strategy. The Enterprising Strategy is all about looking at the bigger picture and how they all inter-connect to each other, thus, creating a cycle. The first stage (Entrepreneurial Leaders) is embedding entrepreneurial skills to students at an early stage with the support and developing their ideas into business through training and support to become entrepreneurial leaders. Connected Communities provides entrepreneurs with a supportive environment where they can flourish and showcase in their local communities. It is about connecting entrepreneurs with academic institutions for collaboration and affordable R&D for the business. Inclusive Growth is inclusive growth of the community and utilising the resources already available to increase accessibility of enterprise services. Economic Advancement is the final stage and concerns economic advancement and how business can grow and scale up to provide new opportunities within the community and the region.

Using this, The Enterprise Journey and The Enterprise Pathway will help combat the issues that Cambridgeshire and Peterborough are facing. Additionally, it can increase more entrepreneurs and start-ups with higher success rate, thus, reflecting it back to the region's economic development.

Recommendation

Incubate ideas and support businesses to startup through specific AMM incubation and acceleration programs

Recommendation

Grow existing businesses through scale-up and expansion funding and support journeys

Reference:

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THE HETHEL INNOVATION TRAINING MODEL

The Hethel Innovation (HIL) Training Model is unique in the way it can be personalised depending on the level of those requiring the training. You can start anywhere along the journey, provided that it is the appropriate level for you and the skills you already have. The way this is done is within the overarching training theme (E.g. Innovation, Lean, Agile etc.) there are four mini-programmes. These are:

- Thinking
- Practitioner
- Champion
- Director

Within these four mini-programmes are four sessions, each following the structure of Theory, Case Study, Activity and Tool (TCAT). By following this structure, we are ensuring attendees are getting the background knowledge the require, case studies to prove the theory works, activities to complete in the session to solidify the theory and tools they can take back to their business to put the theory into action. By setting sessions out this way you create opportunities for attendees to use their knowledge via simple tools in their own business setting.

One of the key principles of the HIL Training model is that sessions are led by facilitators, not teachers. Attendees learn best by sharing experiences and working on activities with each other, rather than directly from the trainer. Ideas and lessons remain much stronger in a student's mind if they experience something themselves, rather than have it lectured to them. This is why we ensure that theory takes up less than a quarter of each session. Lessons are simple and backed up by the case studies, discussion is encouraged, and facilitators engage with each attendee to ensure they are getting the most they can from the session. It is common that in sessions small groups will form when attendees have challenges or opportunities in common, it is the facilitator's job to both encourage the collaborative effort of attendees but also ensure that these ideas are being shared with the rest of the group.

The most effective training comes from bringing together a diverse group of people. By having different ideas, businesses and approaches in the room it helps to facilitate longer lasting effects from the training, and more unique experiences are shared. Though certain training programmes are bound to attract specific sectors (Lean, for example, is likely to attract engineers and manufacturers) HIL does not specify who training programmes are aimed at. The idea is that anyone can attend these sessions whether they are already in a business, looking to start their own or seeking to commercialise a research product. We find that by encouraging members from across the business journey you are able to encourage a more creative discussion and attendees learn from others as well as from the training.

Levels of Training

Thinking

Thinking helps learners take their first steps into a new topic. This is to introduce theory and help learners think of the potential impact this could have in their organisation. Part of Thinking is establishing relationships, best done by group learning activities. This is done as early as possible in training as experience of other situations is one the most valuable opportunities in training. Thinking is where ideas are first introduced. Different theories and approaches to a problem can be demonstrated and discussed. HIL ensure that multiple approaches are used in order to provide examples that will suit any type of business present, this is especially important when someone who provides a service, rather than a product, is present.

The goal of Thinking is to equip learners with a foundational understanding and some tools to return to their organisations with. There is still much more to learn, but Thinking sessions create an interest in an individual and then that can expand into an interest across a business. Tools provide an excellent way of connecting with the wider business through an individual who attends the training. Often when an individual takes a tool back other members of the organisation will become interested and you are able to link with other staff members, encouraging them to start their training journey.

CLOSING THE SKILLS GAP

- Providing training to all positions in a business
- Creating a more well-rounded staff/talent pool
- Encouraging collaboration between local businesses
- Sharing best practice throughout the sector

Businesses want to develop leaders, and they want to develop skills in those leaders. Many of the programs offered by Hethel Innovation directly address skill gaps in businesses. The aim is to provide new skills and approaches whilst enabling workers to become equipped leaders.

Thinking sessions can be for anyone, at any level of business, including those who aren't involved with business but are looking to start their own. It is critical not to turn anyone away from these training sessions due to experience level and as a result you will get a good mixture of people from different 'levels' whether that be sales, shop floor, marketing or management. Do not assume those at a management level to know the basic theory, but if they do, they are able to attend the higher level mini-programmes such as Champion and start there instead.

Practitioner

Practitioners have more direct experience now, they've studied the Thinking course and have seen various cases studies and hopefully used some basic tools. This training is based on experience, Practitioners come into sessions with their own real-world problems to address. Practitioners are ready to learn in the sessions, and then return back to their organisations and actively tackle problems they have talked through during these sessions. The role of the facilitator in these sessions is to promote conversation between the attendees in order to gain advice and ideas from all members in the room to solve individual's challenges.

The key to this mini-programme is the expectation that the attendees will go back to their own organisations and report back what they have learned. At this point in their training journey they are serious about their learning and truly believe, hopefully after experiencing it in the Thinking series, that what they are learning can make a purposeful impact on their businesses. It is more common for those attending the Practitioner course are higher level business people but as with all courses this will not always be the case. Often younger members of staff with be enthusiastic about improving both their individual skills and taking them back to their colleagues.

Champion

Champions become trainers in their own right, having experienced large amounts of theory and case studies, as well as having actively implemented new approaches in their business with success. Champions are equipped with a collection of tools and real-world experience. They can then use this knowledge to train others within their organisation, in order to push the organisation as a whole towards implementing change. Champions begin to create their own team thinkers.

The key different in the Champion programme is the switch from case studies to consultancy projects. Though case studies are still used we recognise at this point most attendees will have the working knowledge of the tools we have already given to them and those they have used in their own businesses. Instead of providing them with more theory this time we give them experience. By using consultancy-style training with real-world problems being faced by local or national organisations they are able to put their learning to the test in an environment different to their own businesses.

Director

Directors approach training from a much higher level. Those who reach this level now consider a larger level strategic approach to their relevant training course. They can help advance the theory, and work with other directors in order to develop new tools and approaches. Creating events to bring directors together allows a lot of expertise to be together in one place at one time. Best practice sharing becomes commonplace amongst directors.

UK Industrial Strategy

Strong business environments need effective leadership. For managers to become effective leaders they need to have the relevant training that enables them to lead. Using the HIL training model provides both knowledge and experience to students.

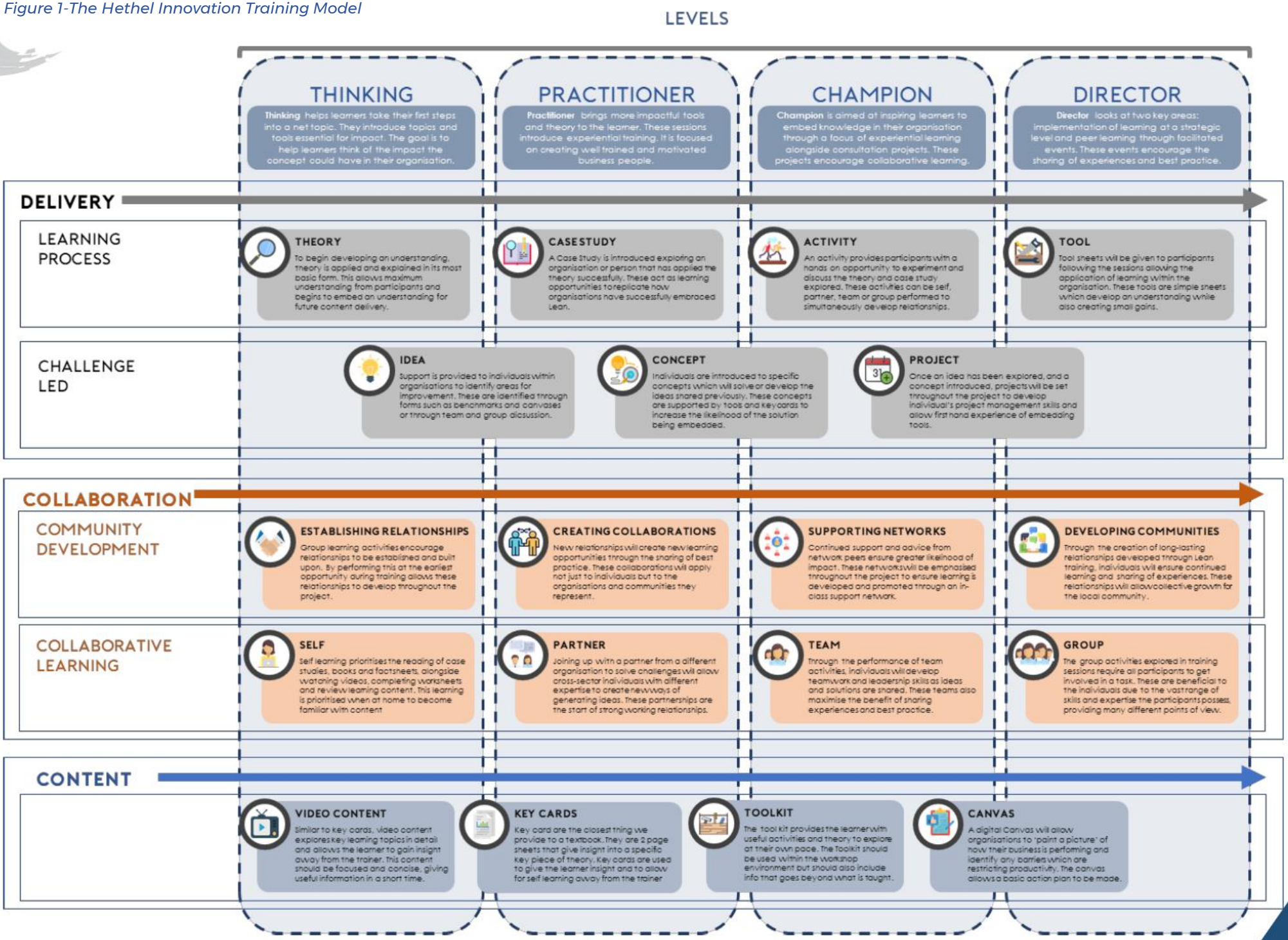
PRUCE NEWMAN INTERVENTION

A staff member from Norfolk mechanical engineering company Pruce Newman attended Lean Thinking training in July 2018. On completing the course, they took their tool kit back to the business where it was shown to the Managing Director.

The MD of Pruce Newman has science asked HIL to perform a Lean intervention within the business to improve productivity through 5S and other tools given in the training sessions.

The HIL training model is specifically designed to bring attendees through the journey to becoming leaders. By equipping people with skills and experience the training model empowers learners to take on leadership roles back in their organisations.

Figure 1-The Hethel Innovation Training Model



APPROACHES

THEORY

To begin actively understanding a topic, theory is first covered. Learning theory helps to provide a background on which all other learning can be built upon. This foundation is vital in order to expand into other areas within the training. Understanding does not entirely come from theory, but it helps to introduce a topic, and equips learners with a set of knowledge and skills to fall back on, should all else fail. Theory is also important to make learners feel empowered, they will be unable to return to their businesses and deliver training or tools if they feel they don't understand why they are beneficial.

The introduction of theory is usually done at the beginning of a session with minimal detail, the most basic form of what attendees need to know. This is supplemented with questions and discussion points in order to attendees to make connections and build on the theory with their own experiences and thoughts. Understanding of theory often changes for each person due to cultural, social and other factors so the discussion of understanding is vital, it provides viewpoints from across the board in order to inform other attendee's learning process.

Theory takes up the lowest percentage of HIL training. By introducing the basics and allowing participants to build on that slowly throughout the sessions using discussion and activities it means no one is left behind due to others benefiting from potential prior knowledge.

CASE STUDY

Case study allows application of the theory. Theory is not always self-explanatory, but the case studies for each area are designed to be supporting material. An effective case study will explain the theory alongside real world examples. These examples are incredibly powerful as there are only a finite number of problems a business can face.

Case studies are often positive examples of how a business or individual has applied the theory being learnt successfully, they are used to inspire as well as support learning. HIL training often uses local examples and SMEs to prove that anyone can apply this theory, not just big-name companies. In the higher programmes (Practitioner onwards), case studies can be learning points, examples of where a company is failing to succeed and could use the theory being learnt to improve themselves. There are usually given as discussion points where attendees are asking what the challenge is and how it could be tackled. This encourages active thinking and also triggers leadership qualities, supporting the participant to go back and make changes in their own business where they may see similar challenges.

ACTIVITY

Activities are used across the programmes to connect the theory and case studies with real-world experience. Activities can be done individually or in pairs or teams. Often it is encouraged that activities are done in groups rather than alone as it simultaneously engages attendees with each other. We know that cross-collaboration is key to solving challenges and having varied responses and characters contributing to conversation often creates threads that would never have been explored individually.

Activities in the later programmes often focus on challenges being faced in the individual's business (though emphasis still remains on solving as a group) or in other businesses, this is what forms part of the challenge-led consultancy projects in the Champion programme. However, these will still be theory related so as to not confuse activities as tools.

TOOL

Tools are what HIL training provides as a physical take away from training sessions. The idea is as a person moves through the training programme and up the levels towards Director, they will increase their tool box, giving them a resource to go back to when challenges are faced in the future.

As HIL training caters mainly for SMEs and local businesses we understand how important it is to provide tools that can implement small changes in a business or

The TCAT approach used here will allow training providers to deliver a standardised process across training sessions. Once established, it will be the method that is sought out by participants.

There is little required infrastructure from businesses. As time allotted for training usually exists within businesses. It means that using that time to deliver more focused and replicable training sessions is possible.

HIL training programs have already demonstrated that the TCAT approach is a powerful tool as trainers are no longer teaching directly but facilitating through the content and other attendees.

individual's mindset. All tools are presented on maximum two sheets of paper with easy to follow instructions and can be manipulated depending on the type of business using it.

UK Industrial Strategy

To create the world's most innovative economy leaders and workers in businesses need to have modern skills and modern approaches. Much of the world now practices very new approaches to business and so it's important that training reflects this. To create a well-trained workforce an engaging and effective training model is needed.

Recommendation

Deliver training that promotes the creation of champions and directors within businesses, by learning from HIL Training Model.

SKILLS

HOW DO WE CREATE A SKILLS SUPPLY CHAIN?

EXPOSURE TO STEM

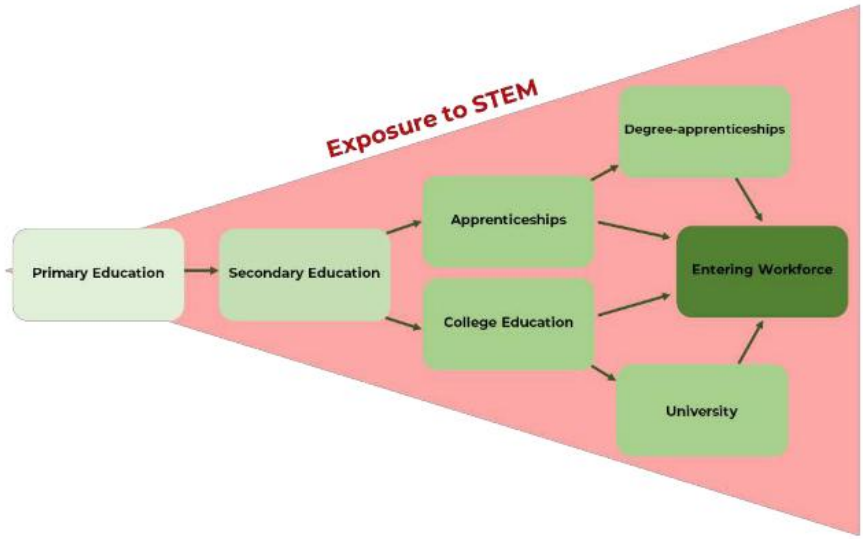


Figure 1-Opportunities for STEM Exposure

Across the whole of the skills supply chain it is important that all groups are exposed to STEM subjects. Traditionally, direct interaction with STEM subjects may be limited to secondary education, or in some cases solely aged 16+. In order to fill the gaps in the supply chain exposure to STEM needs to be expanded across all ages and groups. Figure 1 demonstrates the opportunities for STEM interaction highlighted in this report. STEM subjects need to be embraced across the entire education journey of young people. Injecting them later in their studies makes them much harder to access as they can often become more exclusive as choices in education become more focused.

Primary education is one of the largest gaps in STEM subjects. Due to the structure of the curriculum some areas of STEM can be missed out or covered only on the surface. This can also be because teachers feel ill-equipped to teach some STEM subjects, or that the school does not have the right equipment. Programs like Primary Engineer are good examples of how to empower primary schools to teach STEM skills.

Secondary education is the start of many students STEM journey. There are skills gaps here as subjects in schools are limited to sciences and maths. The expansion into more specific technologies, and into engineering skills could create a more rounded STEM education. This is not always possible within curriculum constraints, but it is possible to run school or year wide events such as challenges or hackathons. A good relationship with local businesses helps to enable these activities within schools.

Over sixteen education presents a lot of options for young people, colleges, sixth forms and apprenticeships are all possible options. So, it is important that all provide useful and relevant STEM options. The choice to take STEM options at this age is dependent on the relationship students have with STEM subjects from earlier years. There are many options at this point, but if there has not been a foundation of the possibilities of STEM in their lives then the awareness of STEM may not be present.

As STEM exposure starts late in education, there is an opportunity to expand it to younger groups aiming to inspire them further.

AMM businesses need STEM graduates, through degrees, college or apprenticeships. An increase in STEM interaction across age groups will enable more to study STEM skills later.

The Dual VET system used across Europe has demonstrated that integrating STEM experience into schooling does work.

Educating young people in both STEM subjects and leadership skills is a valuable investment. Having just one does not enable effectiveness once in the workplace.

WHERE CAN STEM SKILLS BE INTRODUCED?

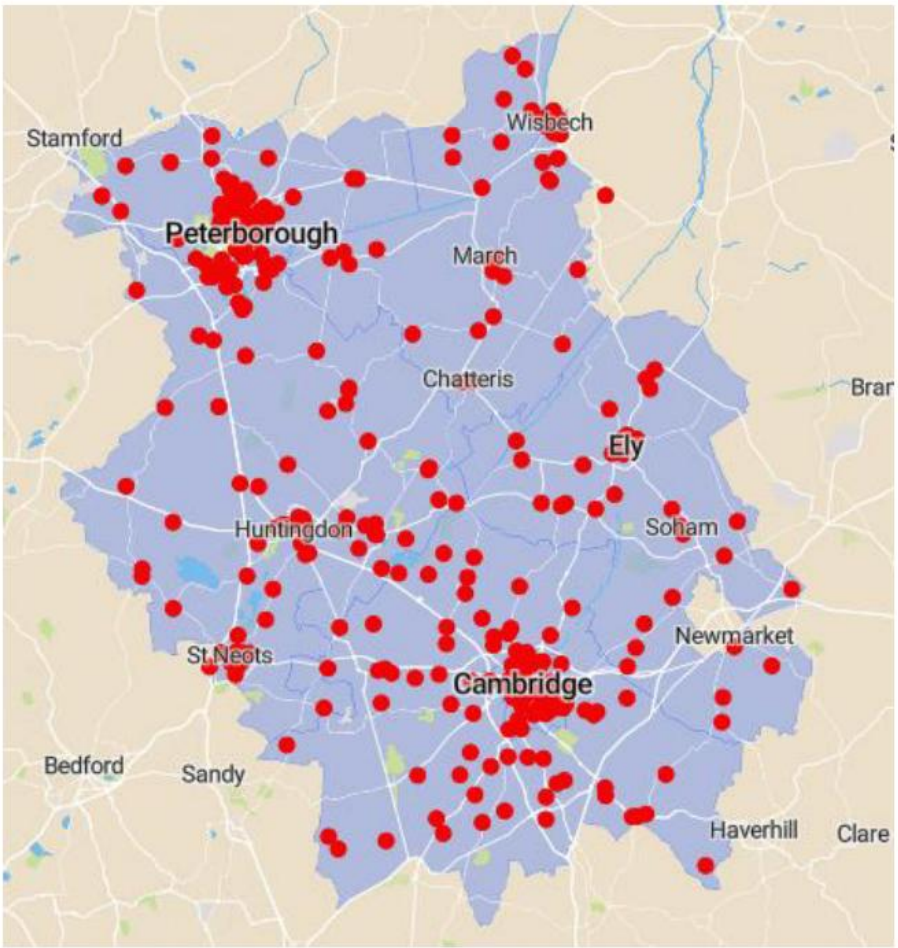


Figure 2-Primary School Locations in Cambridgeshire and Peterborough

Primary Schools are the starting place for STEM exposure. Involving younger groups in STEM activities is the key to starting people on a STEM journey. There are over 300 primary schools across Cambridgeshire and Peterborough and so there are over 300 locations in which STEM activities can be brought directly to primary school students. There is a concentration of primary schools within Cambridge and Peterborough as cities. It is worth noting that there is a good spread of primary schools outside of the main urban areas of Cambridgeshire and Peterborough. This distribution means that projects that intentionally engage with rural primary schools will still have a large area of coverage across the region.

The distribution of primary schools across the region highlight the amount of interception points that are available to STEM projects.

Infrastructure does not effectively exist to bring businesses into schools. Most operate through alternate projects currently, this is an opportunity to bring businesses and schools directly together.

In the UK Primary Engineer is a great example of the level of outreach that is possible with primary schools.

Involving teachers directly in the collaboration with STEM businesses is the most effective way to ensure there are leaders for these projects.

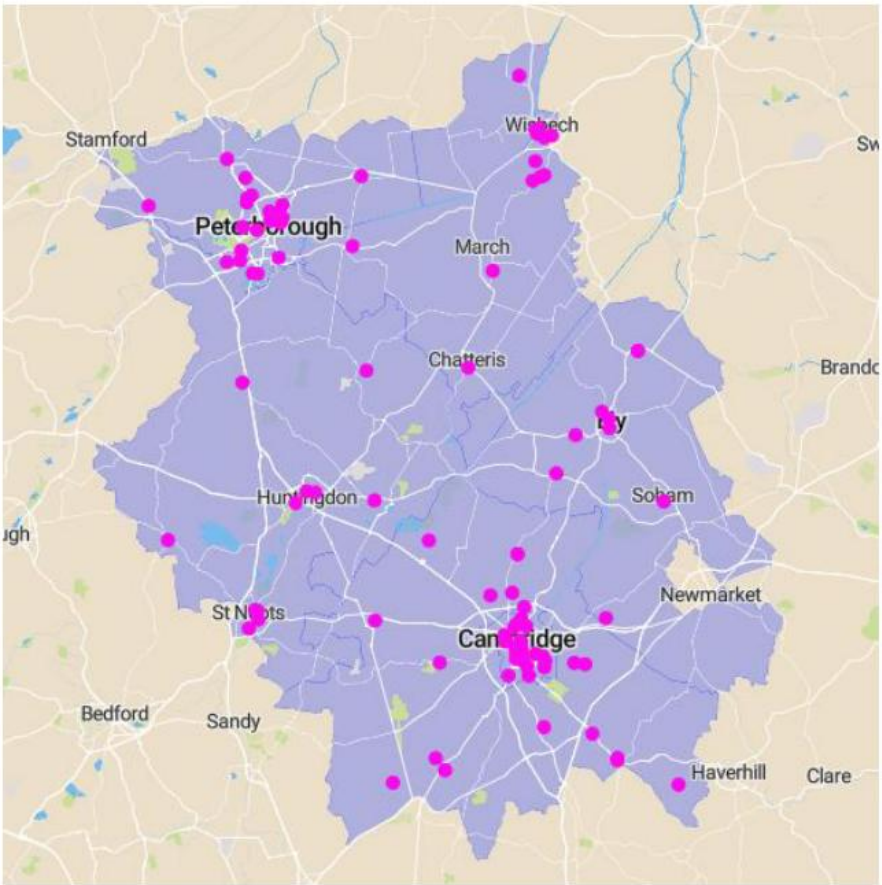


Figure 3-Secondary School Locations in Cambridgeshire and Peterborough

Secondary schools are more clustered than Primary schools, again with concentrations in Cambridge and Peterborough. Across more rural areas there are far less. Almost one third of all the primary schools. Secondary schools have larger capacities, so smaller overall numbers are expected, however, the sheet concentration in the urban areas means that connecting rural residents with STEM subjects is more difficult. Each of these secondary schools will have hundreds of students, so each program the brings STEM into the school can affect hundreds of students at once.

The distribution of secondary and over 16 educational facilities shows the difficulty in connecting businesses to schools due to a high concentration in cities.

Currently there is not enough support for businesses to communicate with schools. A more efficient and collaborative platform is needed.

Many approaches have been shown to work between businesses and schools. These can be improved by the creation of a standardised approach across the region.

Leadership in businesses exists, it's important to enable leaders in business to connect with leaders in education.

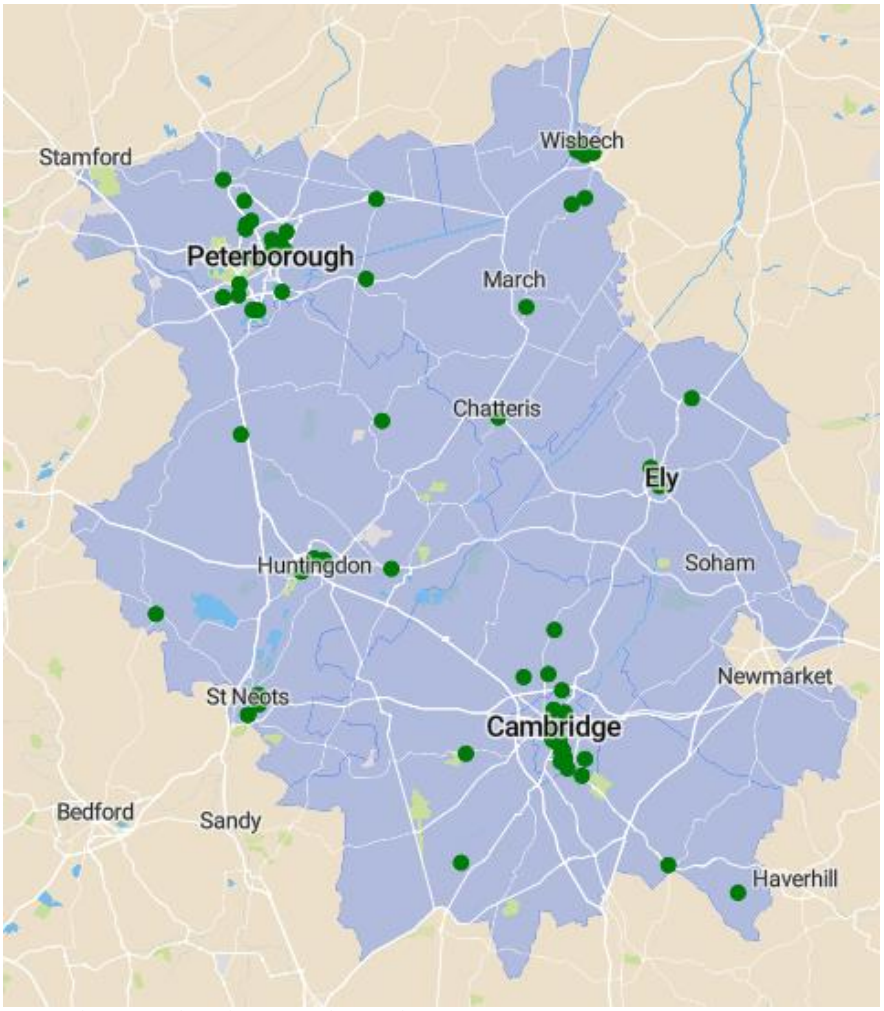


Figure 4-Over 16 Education Locations in Cambridgeshire and Peterborough

Over 16 education distribution has a similar resemblance to secondary, concentration in cities and very low levels of available facilities in rural areas.

Social mobility is also a large factor in rural areas of Cambridgeshire and Peterborough. The ability to move in order to access opportunities affects many of those living outside of urban areas. The distribution of secondary schools alone highlights the issues of connectivity that the region faces. Secondary schools in rural areas between Cambridge and Peterborough, in March for example, will find it more difficult to engage with activities occurring in the city. The same goes for primary schools, the lack of social mobility means that schools need to have STEM brought to them in order to truly engage the local population.

BUILDING AN EFFECTIVE SKILLS SUPPLY CHAIN

To build an effect skills supply chain a large amount of work is needed to bring areas together and increase social mobility. The following sections address examples of what can be done using STEM outreach and STEM programs to increase the number of students taking STEM subjects throughout their educational careers.

STEM PROGRAM

THE NEED FOR STEM SKILLS

2.4 million STEM jobs in the UK are predicted to go unfilled this year. This demonstrates the significant gap in STEM programs, and the potential opportunity for Cambridgeshire and Peterborough to become a STEM Leader. STEM apprentices provide huge returns on investment, £27 returned for every £1 invested, and STEM graduates earn over 10% more than non-STEM students. So, STEM subjects are unfilled, even though there is higher earning potential available for STEM graduates. This lack of enthusiasm for STEM subjects often comes from school, with 41% of adults wishing they had felt more inspired by STEM subjects at school. An effective program could push more inspiration and opportunity, creating a more sustainable network of STEM focused students.

This will impact the future heavily, 142,000 STEM jobs are predicted to be created before 2023, so now is the opportune time to implement an effective program.

The data shows that there is a large gap for STEM skills in the UK. This means there is an opportunity for Cambridgeshire and Peterborough to lead the way in establishing a successful program to promote STEM subjects.

This will accomplish a STEM hub across Cambridgeshire and Peterborough.

THE STEM PROGRAM STRUCTURE

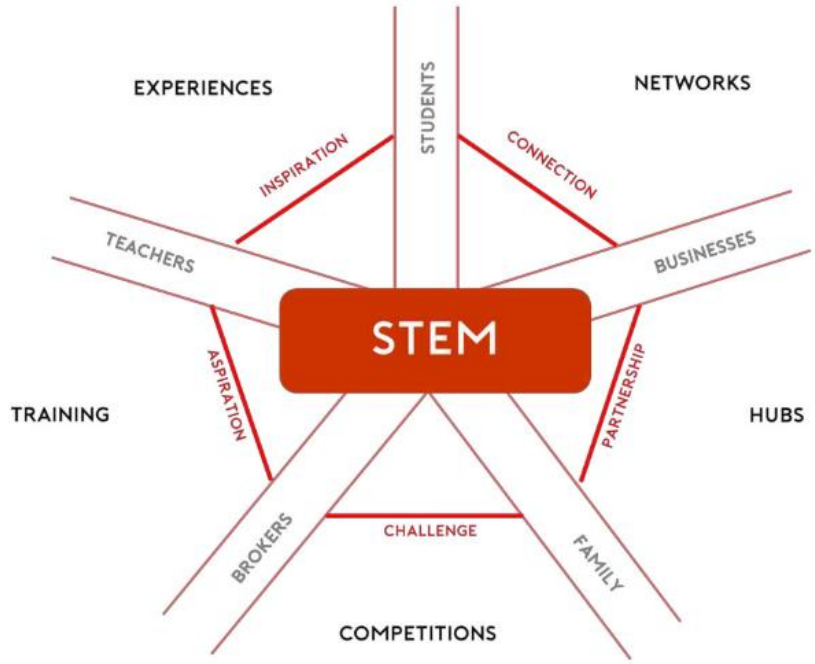


Figure 1-The STEM Program

The STEM program is an opportunity to bring more young people into STEM subjects. It combines, education, businesses, experience, competitions and partnerships to demonstrate the potential of STEM subjects.

STEM businesses are in need of STEM graduates. This need is predicted to grow, as businesses grow they need more qualified staff. Plus as new technology develops new skills will be required, and new companies will form around the need of these skills. There is enormous potential for the next generation of STEM students to take advantage of the growing sector.

PEOPLE

At the heart of any program is people. In the STEM Program the key people are students, family, teachers, businesses and brokers. Without people a program cannot work and it's important to involve all parties in promoting STEM. The future of STEM subjects is dependent on students becoming interested in them. This is not a simple process, students need to be prepared and guided towards them, accessibility is crucial in order to have STEM uptake at a younger age.

This is where teachers become a source of inspiration, for students. Teachers are one of the first potential connections with STEM subjects for students. Inspiring students

to pursue STEM subjects is an opportunity to set up students for a life of STEM interest. Teachers can demonstrate the variety available to students, that STEM subjects cover an incredibly broad and diverse area. Teachers are effectively a gateway for students, they are a vehicle to enable students to come into contact with STEM subjects. In many students' lives, teachers are also role models, by having teachers who not only teach in STEM subjects, but also have experience in them, it becomes far easier to inspire students to follow STEM pathways. A role model who has had a successful STEM career can have an enormous impact on the way a student thinks about a subject.

Businesses are another key connection for students in STEM programs, connecting with businesses enables students to see the commercial side of STEM. Learning about the different STEM roles even within one company highlights all the potential areas a student can move into. A lack of interest in STEM subjects does not always come from a gap in education, it can also come from a lack of awareness of possibilities. By interacting directly with businesses, students can learn that STEM subjects are not just engineering roles, they can include non-engineering businesses, or can even specialise in one niche area within a large STEM company.

Family also has strong influence on the development of STEM subjects in young people. Again, setting an example of STEM careers can be an important part of creating an interest. Parents who work in STEM subjects are prime examples of direct interaction that students can have with real world role models. Even if parents are not personally invested in STEM subjects it's important that they have an awareness of the potential of STEM for their children. Educating parents can have just as strong an impact as working with young people directly. Family also has a strong influence on aspiration and the desire to attain higher paid career paths. By pushing their children to aim much higher than perhaps they first thought, parents can directly influence whether students will even consider STEM subjects.

Brokers are the people who can bring this all together. They are able to provide a platform in which students and parents can meet and potentially work with businesses supported by their teachers. Providing the best possible framework for this is vital, and so brokers can become key facilitators in the choices that students make.

People are the heart of the STEM Program, and what is most important is the fact that each group has to be brought together and has to work together. Only by seeing the potential that STEM has to offer will students take an interest, and it is up to businesses and brokers to highlight that. Parents and teachers can directly influence the educational choices that young people make, and they too need to be aware of what is available to themselves and to the students. The STEM Program is a collaborative approach to supporting the growth of STEM subjects.

UK Industrial Strategy

The need to improve earning power in the UK can be directly filled by STEM subjects. STEM graduates earn 10% more on average so creating more STEM opportunities for young people means greater earning power is more available to them. This in turn would feed into more prosperous communities.

ACTIVITIES

Whilst people are the foundation of any program like The STEM Program, there needs to be a means by which people communicate and collaborate. Activities are built into the STEM Program and help to bring together each group.

First of all, students need to be aware of the variety of opportunities within STEM, this can be facilitated by teachers through different experiences. Visiting STEM businesses, attending conferences, going to workshops, having businesses come into schools, and

By bringing students to the fore front of STEM subjects new leaders will be created. Inspiring young people to move into STEM areas will naturally produce new leaders. As they study the latest courses on the latest technologies, systems and approaches. They will become industry experts and will naturally fall into leadership roles, either within STEM businesses or into more communicative roles such as teacher or consulting.

Leadership is in place, STEM businesses want STEM students. Demand exists, but there is not enough supply. The STEM Program aims to develop a system that fills that supply. Once there is a supply of STEM students there are leaders ready to take them on board and help promote them to become effective future workforce members.

taking part in hackathons are all potential ways in which teachers and students can be involved in the promotion of STEM subjects. Experiences directly link with inspiration in students, exposing them to new ideas and the potential that is available in STEM subjects.

Businesses can keep retention of students through the establishment of networks. Experiences can help push the possibility of STEM to students, and then those who are interested can join networks established by businesses. These networks can then further help growth by pushing the expansion of the network, creating new experiences to directly interact with students and raising the profile of STEM in schools. Hubs can also help to bring groups together, focusing STEM subjects in a particular area can help to create hotspots. Enterprise parks can be concentrated areas of STEM businesses, and these can then connect with local schools who can potentially become mini-hubs.

Brokers can help to connect students, businesses, teachers and parents by implementing competitions. Events like hackathons and challenges posed by a business can be a great opportunity for students to explore the more niche or more extreme areas of STEM. This can expand further into training possibilities, instead of standard training, brokers can help to enable teachers to deliver more inspiring training. Creating challenges or additional courses within schools can again help to demonstrate the wide potential that is available to students in STEM.

UK Industrial Strategy

By establishing more active networks, hubs, training programs, competitions and experiences that will help to feed into a more robust education to employment infrastructure across the UK.

GOALS OF THE STEM PROGRAM

The STEM Program aims to bring stakeholders together in order to promote STEM accessibility. STEM subjects are the future of advanced manufacturing in the UK, and so skills are desperately needed in order to continue growth in this area. Cambridgeshire and Peterborough have an opportunity to be a leader in this area, using the STEM Program it will be possible to grow the number of people taking up STEM subjects. What is key is the way in which people are brought together, using hubs, networks, training, competitions and experiences, different parties can interact with each other more frequently and be exposed more to STEM.

THE FUTURE OF SKILLED LABOUR

The global economy is changing as technology changes. If individuals entering the workforce of the future do have skills that reflect this changing economy, then they will be left behind. In order for individuals to have the right skills, public bodies, businesses and educational institutions need to have plans in place to effectively equip students.

SKILLS SHIFT: AUTOMATION AND THE FUTURE OF THE WORKFORCE

The McKinsey Global Institute generated a report on how they predict that future workforces will change by 2030. One of the key focuses of the report is how automation will have a direct impact on physical and manual jobs, and basic cognitive work.

Basic manual jobs are predicted to fall by 14% by 2030 *(McKinsey and Company, 2018)*. Particularly in general equipment operation, and in inspecting. This is because of the undertaking of automation and automatic processes within businesses. Robotics technology already has had an impact on physical processes in manufacturing, many mass-produced items are mass-produced by robots. As the technology naturally grows it will become cheaper and more accessible and so smaller and smaller organisations will be able to afford automation. This will naturally push manual labour away from human operation as more companies embrace automation.

Basic cognitive processes will also be removed as AI functionality improves. The need for those with basic literacy, and numeracy skills will fall. Basic cognitive function falling by 15% on the whole. As AI improves it will become more capable to run basic operations within a business, meaning that lower skilled workers will become obsolete.

Against this backdrop of falling lower skilled work requirements, there becomes an opportunity for more advanced and creative skills. Higher cognitive function roles are expected to increase by 8%, social and emotional skills by 24% and technological skills by 55%. Although the fall in lower skilled jobs seems negative, it's worth observing that increases in other areas suggest an increase of 8% overall skilled work required. The market will grow, but it will also re-organise in the process. Past market shifts have been incremental changes, but the potential for companies to completely overall their businesses with fully automated systems means that the coming skill shift will be far more rapid. Again, to balance that, it means that the opportunity to grow will be available very quickly and it's possible for the right group to capitalise on the shift well in advance. A market predicted to change in this way is an opportunity for Cambridgeshire and Peterborough.

UK Industrial Strategy

One of the key challenges facing industry jobs right now is the increased use of AI. Being aware of this means that is possible to mitigate the negatives, and embrace the positives.

DEVELOPING A FUTURE PROOF WORKFORCE

The expected shifts in the future of skilled manufacturing mean that a response from the future workforce is needed. Cambridgeshire and Peterborough can be the first to enable a region wide approach to upgrading the workforce.

WORKING ALONGSIDE ROBOTICS

Although the price of robotics has fallen and their accessibility increased, it does not mean that human interaction is not needed in the manufacturing chain. Humans are still required to program, maintain, monitor and upgrade robots working on the line. This is reflected in the change in required skills in the McKinsey report. The predicted

The need to prepare for a skill change is apparent. Technology will continue to advance and so it's important to keep skills up to date with modern advancements.

Businesses will soon be in need of newly skilled workers. There will be a change in the way businesses operate and so it is in their interest to invest in modern skills.

Companies that have a culture of continuous professional development are best positioned to be future proof.

Newly skilled workers have a much easier pathway to leadership. With modern skills they will naturally lead workforces in new approaches.

increase in technological knowledge of 55% demonstrates how many opportunities there will be to work alongside robotic technology. This does, however, mean that newer skills will be needed. Those working in jobs that are able to be automated now need to be upskilled in order to work effectively with robotics when the time comes. It is an opportunity for both the individual and the business to upgrade the way its processes run.

Even though around 80% of all production actions can be automated, fewer than 5% of jobs can be entirely automated *(McKinsey and Company, 2017)*. This means that workforces won't necessarily lose jobs, but instead will have more time to work on higher functioning tasks. This again means that there is a potential for retraining needs for current workforce members. In order to enable them to effectively work alongside robotics. It is likely that there will be increased job satisfaction as manual repetitive tasks are replaced by more creative, social and emotional tasks. As well as reducing costs through automation, workers who are moved away from repetitive tasks have the potential to be happier.

Retraining will be the cornerstone of continuing development for businesses in Cambridgeshire and Peterborough. Technology now develops so quickly that retraining programs with businesses need to become a routine action, to enable the work force to stay on top of current technology.

Recommendation

A framework for the support of retraining programs within manufacturing businesses needs to be established.

HIGH LEVEL SKILLS

As well as a workforce that needs upskilling to match the changing economy. There also needs to be a shift in the skills that are learnt by students preparing to enter the workforce. Businesses will be looking to bring in apprentices and graduates who have advanced manufacturing skills, for example, West Suffolk College currently runs a 12-week CNC course which then links directly to local businesses. They can then come in and meet all the latest graduates. This means both sides benefit, business get direct access to newly qualified skilled workers, and the graduates can walk into business looking for their particular advanced skill.

With a predicted increase of 8% in higher cognitive skills, 24% in social and emotional skills and 55% in technological skills, there is a new focus for manufacturing graduates to aim for. Skills are no longer needed in manual tasks, instead manufacturers will increasingly need intelligent, sociable and technological graduates.

Recommendation

The implementation and support of future gazing advanced manufacturing courses across Cambridgeshire and Peterborough's school, colleges and universities.

SHORT COURSE ENTRY TO WORK

The Department of Work and Pensions (DWP) has begun working across East Anglia to bring more skilled education opportunities to more people. The Thetford Partnership Action Group was set up to help find new opportunities to get the unemployed into work. In particular their collaboration with West Suffolk College, Warren Services and Haas Machinery and Technology has been a notable success. This pilot program has been designed to provide skills to unskilled, and employment to the unemployed. A twelve-week course was designed to provide students the skills to

Raising teachers' confidence in STEM subjects will allow more teachers to inspire younger students.

Connecting with schools benefits businesses as businesses can be a more connected part of the local community.

Primary Engineer is the leading example of the kind of program that can be developed by focusing on STEM skills in schools.

Inspiring young people is a key investment in creating the future workforce. They will be the workers who are entering the workforce as newly skilled technicians in the future.

become CNC operators and setters. The course was aimed at those without qualifications, the only pre-requisite was basic literacy, numeracy and a desire to learn.

The DWP has also been working with Net Matters, who are piloting an eight-week course which provides skills in web technology. The course delivers modules which are tailored to the student. To provide them with the essentials in order to get into the industry. Many graduates of this course are already working in highly skilled roles.

Short courses like these offer alternative solutions to the gap in the skills supply chain. It is not always necessary to attend degree level qualifications in order to get into skilled work.

Recommendation

Providing support for skilled short courses across the region will help to allow less qualified people to gain access to employment in skilled jobs.

EARLY DEVELOPMENT

STEM subjects do not need to be developed at college or university, it is also important to highlight the possibilities of STEM to younger students. Programs like Primary Engineer are perfect examples of how to effectively inspire young students with STEM subjects.

PRIMARY ENGINEERING

Primary Engineer is a company that aims to bridge the gap between industry and education. They bring primary school students a collection of STEM activities and programs in order to demonstrate the potential that STEM has. They also help to educate and train teachers in STEM skills so that they become more confident in the delivery of subjects outside of Primary Engineer's programs.

Creating better equipped teaching staff allows better engagement for students at all levels. Teachers who are not confident in STEM subjects themselves, will find it much harder to deliver effective inspiration to pupils. This lack of confidence from some teachers will knock onto the students. Programs like Primary Engineer are poised well to improve the overall STEM understanding amongst teacher staff, which directly impacts how the students experience the subjects.

There are other approaches to inspiring engineering at a primary school age. Programs like Liquid Enterprises Trailblazers program deliver STEM based activity days to North Norfolk primary schools. The program has now been delivered to 386 students across North Norfolk. This programme is designed to promote STEM subjects across North Norfolk primary schools, to help fill the skills gap.

One off events can also help to raise the profile and possibilities of STEM subjects, holding hackathons can provide students with the opportunity to work on a unique, cutting edge problem for a defined amount of time. These focused efforts on problem solving helps to demonstrate the variety that is available in STEM subjects and the way in which STEM subjects are used in the real world.

Recommendation

The implementation of CPD courses for primary teachers to greater develop confidence in STEM skill subjects.

APPRENTICESHIPS

Apprenticeships have long been the approach to generating skilled workers with direct experience. They allow on the job training and promote vocational skills within individuals, relying less on an overall education. They also provide employment from the get-go, as apprentices are paid workers, who are also developing their skills. Manufacturing has always been reliant on apprentices, this means that there is a well-established relationship between apprentice providers and businesses.

The gap in the skills supply chain spans different levels of skills. Through degrees, apprenticeships and degree-apprenticeships this gap can easily be filled.

Businesses benefit significantly from having apprentices. Their costs are reduced and they are then able to effectively train new employees for a limited fee.

iMET already demonstrate the possibility of creating effective courses for apprentices. This approach can be expanded across Cambridgeshire and Peterborough

All levels of training help to develop the future workforce. Apprenticeships and their counterparts are an ideal way to use Blended Learning.

Cambridgeshire and Peterborough can easily capitalise on this relationship and grow it to become a strong part of the skills supply chain.

Apprenticeships are a cost-effective way for a business to bring in new people and new skills. Smaller employers can have 100% of an apprentice's wage funded by the government, and most other employers can have 90% funded. It's been shown that employing an apprentice can boost and organisation's productivity by £850 a month *(Centre of Economics and Business Research)*. Not only do they save money for a company, they also create more turnover. This is a very appealing option for employers and can be a powerful tool to move more people into apprenticeships.

iMET specifically has the goal of creating 160,000 new jobs by 2025 *(iMET, 2018)*. Establishments like iMET in Huntingdon can be leaders in the design and implementation of new future gazing apprenticeship. Support for new apprentices comes from the government's 2016 Apprenticeship Levy Fund, creating 3 million new apprentices by 2020.

Apprenticeships are not limited to traditional manufacturing roles; Marshall Aerospace's Aero Academy also provides apprenticeships on Aerospace Engineering. The potential for apprenticeships to feed into the skills supply chain is not limited to lower level skills, apprentices on courses like Aerospace Engineering will be equipped with incredibly advanced knowledge and practical experience.

There are also an increasing number of degree-apprenticeships. Students can spend three to six years earning a salary whilst completing their bachelor's degree. Accessibility is also easier as university fees are currently covered by the government. This increases the appeal of degree-apprenticeships significantly. Degree-apprenticeships can also be the next step for apprentices once they are qualified. Enabling continued professional development whilst remaining active in the workforce.

Educators and businesses can promote the uptake of apprenticeships. Collaboration is essential between the two, by coming together businesses can tell educators what skills they need and then college and universities can help to design courses that fill that skill gap. The skills supply chain can be closed effectively by providing a platform for schools and companies to communicate through.

UK Industrial Strategy

Good jobs rely on good training. Good training relies on good infrastructure to support it. Degrees, apprenticeships, college qualifications and degree-apprenticeships are all possible avenues to a skilled workforce. Creating this skilled workforce to fill the gap in the skills supply chain is necessary for manufacturing businesses to survive.

Recommendation

Prepare for the future workforce, developing Industry 4.0, productivity, innovation, and entrepreneurial skills

DEVELOPING LOCAL LEADERS

WHY ARE LOCAL LEADERS NEEDED?

Local leaders are needed in order to drive Cambridgeshire and Peterborough forward. The proximity of Cambridgeshire and Peterborough to London means that accessibility to and from London is very high. This connectivity actually harms leadership in the region because many leaders are not locals, they may even commute from London to the area. This separation means there is a lack of personal investment from leaders in local companies and the local economy. The development of leadership from within Cambridgeshire and Peterborough is vital to create management that wants the success of the region.

Leadership is the driving force of any business, the ability to make key decisions, implement active changes and push workers to improve and grow comes directly from leadership. Looking back to the Productivity Journey, for example, it is the implementation of Lean Ambassadors that allows continuous change to occur. It is difficult for individual workers to implement effective change, they have to go through the chain of command within a business. If effective leaders can be developed in the first place, then an entire organisation can be transformed very quickly.

BLENDED LEARNING

Cranfield University is a world class development space for leaders. Leadership at Cranfield follows a blended learning model, combining classroom learning with practical learning.

Figure 1-The Cranfield Learning Model

The Cranfield Model has led to Cranfield's Management MSc being ranked number one in the UK and number seven in the world *(The Economist, 2017).* Blended learning is a more innovative approach to degree qualifications. Classroom learning helps to connect with theories and case studies together. It raises common issues and common solutions and provide its learners with tools with which they can approach problems. This theoretical side is incredibly important, in particular it helps learners to feel confident in their ability to lead. If nothing else, they have a good background knowledge of leadership and have learnt about other problems in other businesses. This cross over is the start of any individual's learning.

Practical sessions are equally as important, most people retain information through experiences. These experiences are effectively stories with which they have learnt a lesson. They are case studies that affect their own life. Placing a manager fresh from a degree course into a leadership role means they have little else to draw from other than theory, and this can make it difficult for managers to really connect with their place of work and even the individual worker. By empowering learners with practical experience, they then have their own experience to draw from as well as the learned theory. Practical experience pushes students to use their training and allows them to

The implementation of a local leaders program across Cambridgeshire and Peterborough will help to create a new stream of skilled leaders in the region.

Cranfield have been class leaders in this field by building on 25 years of continuous development.

Instilling new leaders across businesses will enable continuous future training. Each year of successful leader implementation will help to demonstrate what is possible and so demand for leaders from Blended Learning courses will increase year upon year.

turn theory into reality. Not only does this reinforce the approaches they've learned, but also helps to highlight what tools work with what groups, and how to actually interact with a working team.

This approach also has benefits for businesses. It enables new managers to effectively *"hit the ground running"*, having relevant experience reduces adjustment times for new workers. It also enables a higher level of resilience in leaders, before they are employed full time. This resilience will reduce lead times on new projects, improve the speed at which changes are made and enable leaders more effectively manage diverse teams.

UK Industrial Strategy

Developing more equipped leaders impacts both individuals and businesses. Leaders who are more confident and equipped can lead more effectively, gaining more job satisfaction. It also means businesses can prosper with well trained management.

THE DUAL VET SYSTEM

Many countries across Europe are now beginning to implement a Dual VET system. Dual Vocational Educational Training focuses on the combination of vocational schools and company programs. The power of the Dual VET system comes from its chain of stakeholders, ensuring that all levels of government are involved in the overseeing of the delivery of Dual VET projects. Higher government controls the availability of funding for Dual VET, as well as the promotion of it across large areas, and across sectors. Germany and Austria have implemented a set of national standards that are to be met by Dual VET providers, this approach from higher government also helps to focus training in specific areas. If electrical engineer numbers are low, then government can focus funding, standards and approval of Dual VET projects in this area.

Employers, unions and chambers of industry are also key stakeholders. They see the need for skills development in particular areas. Employers in particular can see where it is possible to fit in training into their work environment. This is important as a business must have the capacity to take learners on board. Unions and chambers are involved in the recognition of courses, chambers can present official qualifications for businesses as a seal of approval for Dual VET delivery, and unions can help businesses to achieve this standard by bringing together best practice from across the network.

Vocational training is best held under real work conditions, and so it is the responsibility of the training company to ensure that students are exposed to the most up to date approaches and practices. On top of the vocational training, there also needs to be vocational schooling. Filling the gap in the theoretical side of a student's training. This is similar to the blended learning approach used by Cranfield. Where classroom theory time is shared with practical in business experience. This is the core of both Dual VET and Blended Learning.

The Dual VET system is another approach to combining classroom learning with real experience. It also provides a framework which highlights the necessity of collaboration with governing bodies. This enablement from funders, governments, unions and chambers can be incredibly powerful in getting projects running quickly.

MAKING BLENDED LEARNING REALITY

In order for Cambridgeshire and Peterborough to develop leaders to a high standard, blended learning needs to be embraced across the region. This means that STEM educators and STEM businesses need to come together to promote a blended learning approach.

Using the STEM Program, it will be possible to have teachers, students, businesses, parents, brokers and family members in one room. This is the start of a proactive discussion to push educators and businesses to come together and move education

Creating educational systems that focus heavily on leadership helps to address the need to create a higher level workforce across Cambridgeshire and Peterborough.

Business want skilled leaders, promoting internally allows them to use people who have the skills and experience and then train them in leadership. Instead, businesses could be provided with workers who have experience and leadership skills from the start.

The success of Dual VET approaches across Germany, Spain, Portugal and Austria demonstrates the capacity for change in educational systems. Unemployment in both German and Austria is at an all-time low because of this approach.

to involve businesses further and move business to involve education further. Only through this collaborative approach is blended learning possible.

UK Industrial Strategy

Blended learning helps to create effective leaders. If the UK economy is filled with effective leaders, then the UK will naturally become a more prosperous place to establish a business. As a higher level of leader is widely available it will mean that all businesses will be able to upgrade their management with ease.

The creation of a Blended Learning Platform will allow a centralised point for all stakeholders to revolve around. A consistent platform, which can be managed by brokers, would provide the connections and tools that each group across the STEM Program needs. Effectively a team of brokers would be able to bring together local businesses with local colleges and universities. Empowering them to create an approach to learning that provides both theoretical knowledge and real-world experience. This combined approach to learning means that leaders will not only have relevant experience to help them get jobs, but also to enable them to lead and manage effectively as soon as they enter the workforce. This platform needs to be supported by local governments in order to ensure it is consistent across each sector and area of the region. The availability of funding and guidance from governing bodies is powerful resource for platforms to have.

Recommendation

Establish the Blended Learning Platform to create skilled leaders across Cambridgeshire and Peterborough's STEM educators and STEM businesses.

CREATING A SKILLS SUPPLY CHAIN

Leaders are required to move any business forward. It is also important that leaders are trained well and have relevant, active experience. Leaders may come from in company promotions, taking those who have the skills from years working on the shop floor and turning them into effective leaders. This works for the company, and for the region as it promotes local people to more powerful positions. To solve the lack of personal local investment from managers who do not have a vested interest in the region internal promotion is a good option.

By using a Blended Learning approach, it would become possible for businesses to hire new leaders and managers from outside of the business, confident with the knowledge that they have relevant experience already. Especially as those managers will have been in the business getting to know it, the employees and the sector in general. They will have a far more personal investment in the region.

The level at which employees can enter the market is a strong reflection on the development of a region. Focusing on lower level skills is important to help move people into jobs, however, there is also the need to push those with the right abilities into higher positions within businesses. These two streams of entry into the workforce complement each other, and help to ensure that fresh skilled workers are joining businesses across the chain of command.

HOW DO WE DEVELOP LEADERSHIP IN ADVANCED MANUFACTURING?

Cranfield and Dual VET have both demonstrated that it is possible to use blended learning to create high levels of skills knowledge and high leadership ability. These models are effective in delivering strong leaders to the market. How can Cambridgeshire and Peterborough emulate this success across the whole region?

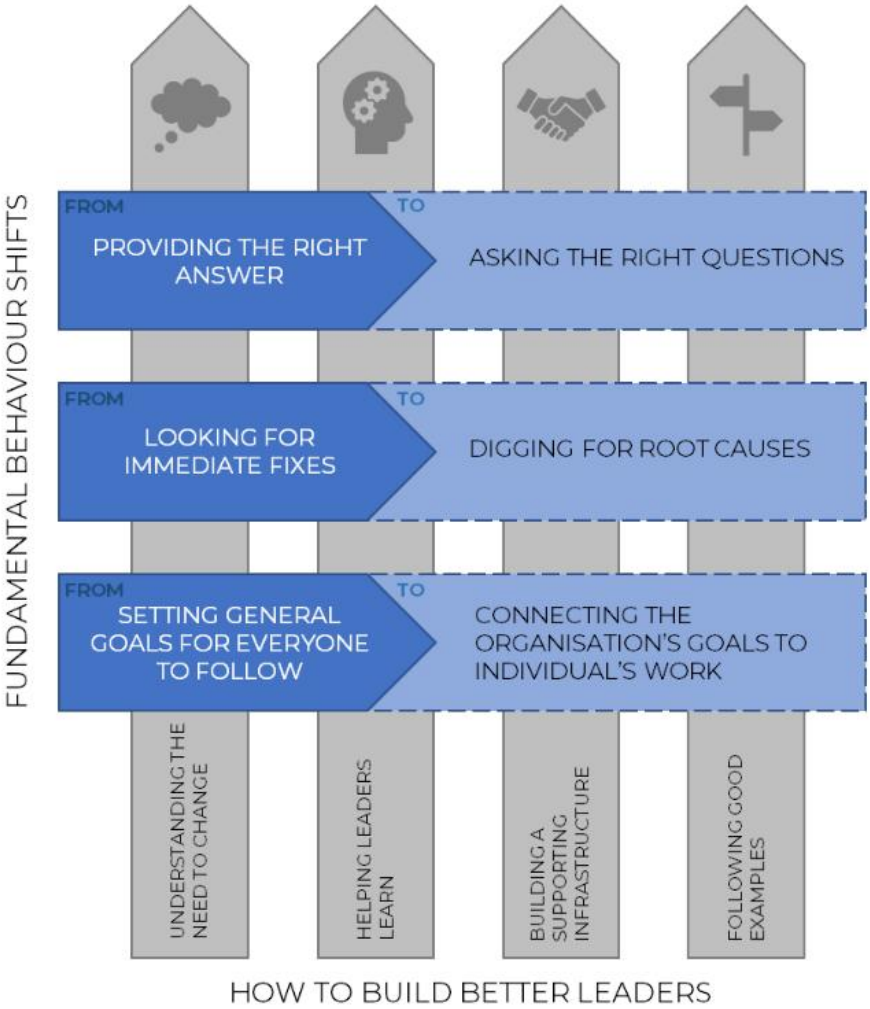


Figure 2-How to Build Better Leaders

TRANSFORMING FUNDAMENTAL BEHAVIOURS

ASKING THE RIGHT QUESTIONS

The traditional approach to leaders being a source of answers for their workers. This creates a culture of reliance on that leader, effectively a bottleneck of knowledge and decision making. Businesses that operate like this can easily grind to a halt should their manager be away.

The new approach for managers is to start asking the right questions. This is an approach used in schools by teachers. Providing the answer to a question teaches the students nothing, other than the answer. By asking a question that pushes people to think about something deeper, or from a different angle there is more chance that people will reach their own conclusions. Learning from experience, as already discussed, is the best way to solidify knowledge. Leaders can enable this process by instead be a source of effective coaching, rather than a source of answers.

This approach will empower leaders with specific tools in mind when dealing with day to day tasks. The potential for transformation of worker / management relations is significant.

Infrastructure to support leaders with these new approaches needs to be created. An effective and connected network needs to be established to share best practice, advice and help to grow the movement.

Approaches like asking the right questions has been well established in schools. This does not mean it is not applicable to management, many staff are learning from their leaders and so approaches can be replicated.

These three pillars will be the foundation of new leaders. It will be a new approach that will increase the ability of workforces across the region. Those workforces will eventually become the next leaders and so the investment is vital.

DIGGING FOR ROOT CAUSES

Another behaviour that is easy to fall into as a leader is looking for immediate fixes. Solving problems just on the surface does not prevent future recurrences of the same issue. It is the equivalent of treating a symptom over an illness. Having to treat the same issues over and over again is a form of waste within a business, of time, resources and often money.

To combat that an approach focusing on root causes can be taken. By digging deeper into the reasons why something happened it allows a greater unpacking of the problem. More information on the problem provides more possibilities for solutions. One possible approach is to use the 5 Whys tool. By asking why each issue in a chain of event occurred it becomes much easier to reach the root cause and solve that.

CONNECTING THE ORGANISATION'S GOALS TO INDIVIDUAL'S WORK

The final pillar of leadership is moving away from setting general goals for everyone to follow, to connecting the organisations goals to the individual. Traditional approaches are to have goals for the business as a whole and have everyone align to and work towards those goals. Now that more and more business models are becoming multi-disciplinary and cross sector, it is harder and harder to have every department align with overarching goals. They can become very separated from what the company as a whole wants, and it is hard to push these wide and sometime significantly large goals onto the individual.

By linking the overarching goals of a company to what an individual does a lot more empowerment is created. Instead of asking for increased revenue overall, perhaps there are smaller goals for specifically the software development team that if achieved, would lead to an overall increase of revenue anyway. This relationship between the individual and the company's goals is vital to make every employee feel that their contributions are moving the organisation forward.

SUPPORTING BUSINESSES TO GROW THEIR LEADERS

In order for businesses to undergo these changes and adaptations there is a need to provide business support. To start with leaders must know that they need to change. If there is no want from a leader or manger to improve how they approach work, then it is difficult to implement change. Once a leader has the desire to learn, they themselves need to be given appropriate training. This is where Blended Learning can help to either train new leaders or upskill current ones. A strong support infrastructure to enable leaders to learn theory and then test that theory at work is vital. Creating networks of leaders facing similar challenges is a great way to create a community amongst business leaders. This support network allows the sharing of best practice and allow leaders to keep one another on track. As best practice develops the businesses that are taking this new approach will become case studies for the future leaders who want to change their approach to managing and so the network can grow across the region.

UK Industrial Strategy

An established network of leadership, as well as a standardised approach to leading will allow Cambridgeshire and Peterborough to become a prosperous place in which to grow a business. To be known for strong leadership is a significant challenge, but if achieved it will put the whole region ahead of it's competitors.

Recommendation

Establish a network of early adopter leaders who want to innovate their approach to management. Use this network to reach out to businesses across the region to improve their approaches.

Appendices

Appendix 1: List of Consulted Parties

1. Alex Broome - Barclays
2. Barry Weller - Mitsubishi Electric
3. Chris Evans - Mitsubishi Electric
4. Chris Marsh - Venture Risks
5. Chris Woodward - Enterprise Europe Network
6. Christopher Wilkinson – Marshalls
7. David Cleevely – Cambridge Wireless
8. David Newis - SolidSolutions
9. Dawn Fitt - Wes- Womens Engineering Society
10. Derek Jones – Babraham
11. Domonic Mace - Williams Refrigeration
12. Dr Megan Ronayne - eef
13. Elliot Parkin-Webb - SolidSolutions
14. Gordon Brady and Israel Foster - Bedfordshire university
15. Gordon Riseley - photofabrication ltd
16. Hendrik Pavel - Enterprise Europe Network
17. Janina Den Boer - A4plus
18. Jo Sainsbury – iMET
19. John Davies (The Initiative)
20. John Molloy – Regional Development Manager for NPL
21. John Stenhouse – CPCA
22. Justin Coote - Rockwell Automation
23. Keith Panks - Williams Refrigeration
24. Ken Lewis - Manton engineering ltd
25. Kevin Clark - Action Coach
26. Les Mitchell - Pitkin Ruddock
27. Lewis Mynard - Mitsubishi Electric
28. Linn Clabburn - Cambridge Norwich Tech Corridor
29. Martin Guildford - Lloyds Bank Eastern Region – Manufacturing
30. Martin Lawrence, Martin and Austen – Metal Craft
31. Michael Michaledis - Williams Refrigeration
32. Neil Thurston - Optima Metal Services
33. Nicholas Cox – The Manufacturer
34. Nick Oliver - Nick Oliver Associates
35. Nigel Smith - Tensor ltd
36. Paul Holt – Photocentric
37. Paul Bennett - Rockwell Automation
38. Paul Judge - Mitsubishi Electric
39. Peter Cheese - theproductshop
40. Peter Robinson - RWE Generation ltd
41. Phil Hall - BDO
42. Rachel Day - Bosch Rexroth ltd
43. Rebecca Tarbox and Liz Tillet - Marshall Aerospace Academy
44. Robert Driver - Institute for Manufacturing
45. Samantha East - Greenwoods Solicitors
46. Sean Kilgallen - Bosch Rexroth ltd
47. Simon Lubbock - Natwest
48. Simone Gubbins – TWI
49. Simone Robinson -Institute of Directors
50. Sophie Kerry - Greenwoods Solicitors
51. Gordan and David - St Neots – Masterplan
52. Steve Clarke – CPCA
53. Steve Hales – Huxley Bertrum
54. Steve Maryniak - Ipeco ltd)
55. Steve Palmer - WLP
56. Steve Robinson - theproductshop
57. Steve Wild - A4plus
58. Stewart McTavish – IdeaSpace
59. Thomas Wakeley - Natwest
60. Tim Goram-Smith - BDO
61. Tom Hennessey – Opportunity Peterborough
62. Tom Collison - Collison Associates
63. Tony Moscrop - Dufaylite Developments ltd
64. Tony West – UCP
65. William Haire – EOE Agricultural Society