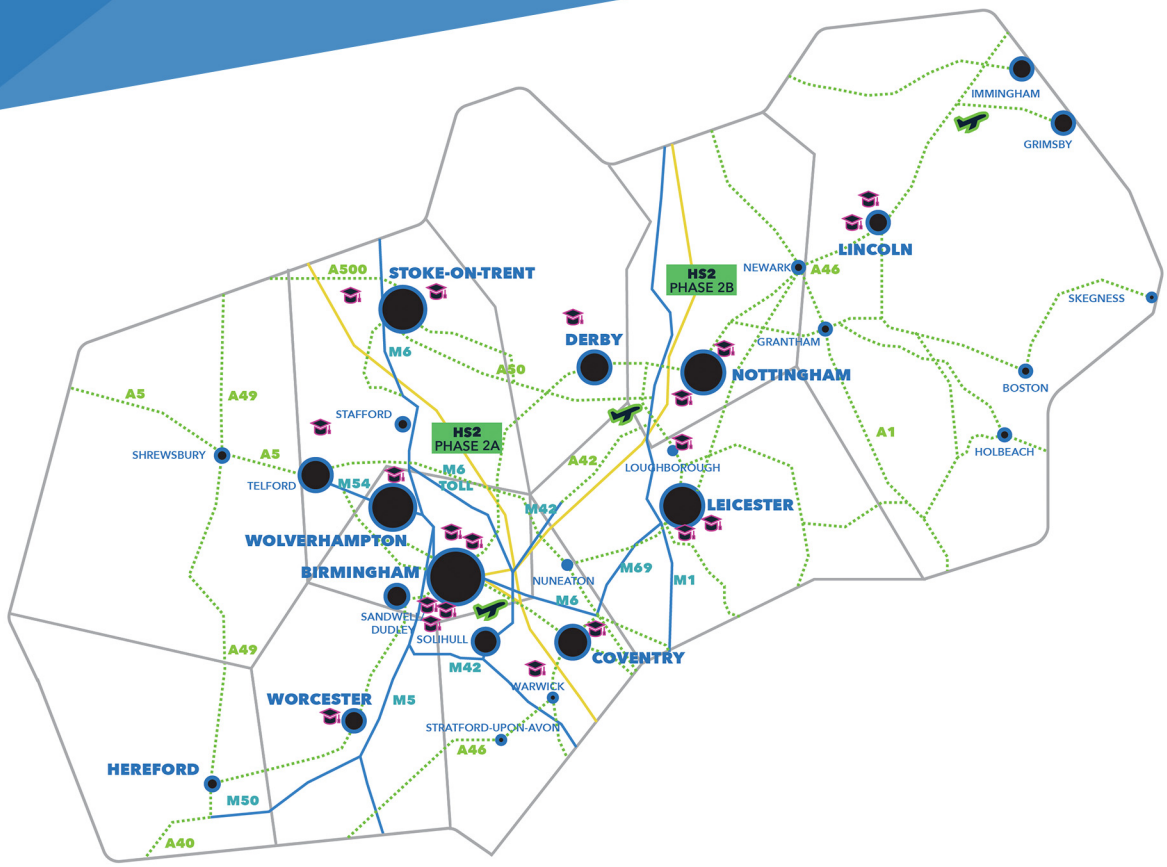

MIDLANDS ENGINE Observatory

MIDLANDS ENGINE SUPPLY RESEARCH REPORT EXECUTIVE SUMMARY

MARCH 2021

1. Systematic Review

Productivity and resilience in the Midlands region – Why the supply chain matters

Since the Global Economic Crisis, the UK has faced a 'productivity puzzle'. Whilst other countries have experienced a productivity slowdown, the decline in the UK has been more dramatic. The key to solving this problem is to bridge the widening gap between firms; large global frontier firms are often more productive whereas non-frontier firms (i.e. small- and medium-sized enterprises (SMEs)) are less productive. This variation completely undermines the productivity improvement at the country and region levels. Compared with other regions, the productivity of the Midlands region is lagging behind as it has the longest tail of low productivity firms.

To improve the regional productivity, the SC plays a critical role in bridging the productivity gap between the large firms and SMEs. This requires firms to focus on improving the productivity of the entire SC, in which everyone's productivity is considered and improved through joint commitments. Following the disruptions of Brexit and COVID-19, the importance of SC resilience has been well recognised (e.g. panic buying during COVID-19 and new Customs processes under the Brexit deal). Having a high level of resilience ensures operational continuity, which, if done effectively, can help firms retain productivity advantages during turbulent times.

Defining supply chain and its value

When considering the value that SCs add to the region at the firm level, a resilient and effective SC can reduce costs, which in turn increases profits and, ultimately, competitive advantage. A resilient, effective SC is also beneficial at a regional level, creating social value through skill development and employment opportunities, attracting more foreign direct investment (FDI) and therefore boosting regional productivity and generating more economic value. To build cooperation between regional and firm levels, a 'regional SC goal' could be established. This could be a regional SC productivity goal, comprised of the aggregated productivity of individual firms across E2E SCs. This goal could be used to enable collaboration and cooperation between firms in the region, to compete through the region's SCs rather than individual firms.

Current state of the regional supply chains

When disruptions occur, an SC is only as strong as its weakest link. This was exemplified by the two major disruptions that affected the Midlands in 2020 – Brexit and Covid-19 – which continue to generate extra costs and reduce market opportunities, with devastating effects for firms with limited resilience. This study identifies that the region currently faces various challenges in both the physical SC network and the way it is being managed (supply chain management (SCM)).

Within the SC network, multiple resource issues were identified which include shortage of skilled labour, lack of SC investment, poor cash flow, early adoption of digital infrastructure, outsourcing to low cost countries, and low variations in customer and supply base.

From the SCM perspective, visibility, integration and sustainability are the key challenges in managing the regional SCs. Poor visibility was caused by limited access to real-time data and underdeveloped digital capabilities. A low level of SC integration was found as most firms are organised by business functions, which creates many silos in the SC that create barriers to forming

integration within and between SC entities. Sustainability issues were caused by trade dependency (increasing carbon footprints) and a linear business model (material reuse and recycling are overlooked).

'Build back better' – The changing nature of manufacturing

To help the Midlands region and its businesses rebound from the current SC disruptions and protect them in the future, a set of recommendations has been provided from both a firm's and a region's perspective.

At firm level, six *SC practices* are proposed to create structural and dynamic flexibility in response to disruptions at different stages.

- Before the disruption occurs, *SC planning* and *visibility* are required to enable effective co-ordination with customers and suppliers to mitigate potential changes that may impact demand or supply.
- During episodes of disruption, *buffer management* (rightsizing capacity, inventory and time) is an approach which could be used to better cope with SC disruption, enabling firms to respond to fluctuating demand or supply more effectively. SC reconfiguration could also be used to develop *supply flexibility* in SCs. Right-shoring (i.e. creating a local supply base) should be considered as a long-term strategy for different approaches to this practice.
- Finally, having *adaptability* (the ability to transform the SC to meet dynamic demands) will empower firms to reconfigure the physical SC network in case of disruption.

Building resilient SCs in the region requires a co-ordinated approach across a range of stakeholders to provide the financial support, skills development, regional SC collaboration and public policies to enable the region's SCs to deliver economic and social value. In all cases this requires stakeholders to work together.

- The region also has a role to play in co-ordinating and leveraging skills development across the region, to create a holistic offering that focuses on SCs and not just firms.
- Skills development can be achieved by an integrated skills development system across the region. Core skillsets, such as SC planning, modern manufacturing management (particularly flow management and lean/agile production) and data analytics, are essential to support the improvement of manufacturing productivity in the region.
- Government support is required to underpin investment in new infrastructure to enable better connectivity, both physically and digitally.
- Financial support from central government needs to be provided to the region through incentives to encourage the development of new technologies, particularly in energy and high-value manufacturing.
- Finally, the biggest opportunity of all comes from the region considering the benefits of being at the forefront of the Circular Economy (CE) (i.e. reducing the consumption of primary materials), and focusing on the opportunities of repair, reuse and remanufacture as well as primary manufacturing.

2. Advanced Manufacturing (including MedTech)

This research study sought to establish a landscape view of the readiness and resilience of five critical supply chains in the Midlands Engine pan region, including Medtech, by deploying the MTC's Supply Chain Readiness Assessment (SCRA) toolkit that is underpinned by the Supply Chain Readiness and Resilience (SCRL-Resilience) methodology. In summary, 'readiness' measures the ability of supply chains to successfully industrialise new products or processes and achieve sector based global performance benchmarks, whilst 'resilience' measures the ability of supply chains to recover from major market disturbances. The five chosen manufacturing sectors were: Aerospace; Automotive; Healthcare; Construction; and Railways. The rationale for selecting those sectors was that they represent a significant range of industrial activities in the Midlands and they also offer a blend between the more traditional engineering sectors and newer sectors that would benefit from the expertise and best practice developed in the advanced manufacturing sectors over the past decades. The approach involved using the SCRA toolkit to interview senior supply chain executives in Original Equipment Manufacturers (OEMs), first tier suppliers who directly serve OEMs (Tier-1) and industry groups. The interviewees are referred to as 'super-users' as they have a senior level understanding of and responsibility for the supply chains in their sector and are thus able to provide an aggregate evaluation of the overall attainment across key capabilities and identify risks and challenges faced by their sectors.

A key finding was that only two of the 10 supply chains assessed are operating at advanced readiness level (Level 3), which is considered as the benchmark of good readiness performance. 80% of the investigated supply chains had met or exceeded the overall readiness Level 2, that denotes 'understanding' of key technologies and the status of preferred supplier, but an overall performance that falls short of achieving advanced practice. Clearly, this low to medium attainment in the readiness assessment of the vast majority of supply chains is a concern as it increases the risk of industrialising products with high innovation content and indicates lack of overall preparedness to achieve competitive operating performance standards. It was also found that Tier-1 companies of all supply chains reviewed were perceived as having higher readiness levels of their key business and technology capabilities when compared to lower Tier supply chain companies. Also, the study showed that current capability development activities in these supply chains are not fully aligned with the key weaknesses identified and hence these supply chains would benefit from customised expert support - via R&D capability enhancement projects or use of consultants - to guide the development of tailored and targeted capability development programs. It is important to stress here that these findings are based on aggregate readiness assessments and focused studies working directly with companies in these supply chains will be needed to verify the findings and proceed with follow on actions.

Based on these findings, the study makes the following recommendations:

Recommendation-1: As 80% of the supply chains assessed were below readiness Level 3 (the required performance benchmark), focused studies are needed to measure capability readiness and resilience of supply chains by working directly with representative groups of companies within each sector. This would help contextualise the findings of this study and develop practical approaches for assisting more supply chains in the Midlands to reach Level 3 readiness, thus reducing risk and increasing competitiveness.

Recommendation-2: Investigate practical ways of reducing readiness gaps in key capabilities between Tier-1s and the other companies in supply chains.

Recommendation-3: Investigate approaches that might best transfer existing know-how and experience from the automotive and aerospace supply chains to healthcare.

Recommendation-4: Strengthen the Innovation and Technology Management capabilities of mainstream supply chains in the Midlands Engine pan region through a combination of OEM/Tier-1 innovation promotion initiatives, educational interventions, targeted innovation R&D efforts and financial/tax incentives by government.

Recommendation-5: A study to investigate the state of Concurrent Engineering – that is, the method of designing and developing products, in which the different stages run simultaneously, rather than consecutively – within companies in the Midlands, with a view to develop practical business-to-business learning and also educational offerings to bridge the measured gap in readiness.

Recommendation-6: Enhance the maturity state of a selected range of operational, sustainability and governance capabilities of the Midlands supply chains and develop the approach for this based on acquiring broader evidence, insights and context.

3. Low Carbon Supply Chains

This research focuses on the network of entities directly involved in the manufacturing and provision of low carbon technologies and services. This network is comprised of numerous businesses and organisations, most notably in the energy and mobility sectors. The report identified 95 entities as being part of the Midlands supply chain network, including small- and medium-sized enterprises (SMEs), large organisations, research-oriented institutes, governmental authorities and consortiums, and funding bodies. It is worth noting that this network is representative of the larger low carbon and environmental goods and services sector; however, the current mapping exercise is limited by the difficulty of capturing micro-companies without an online presence or with out-of-date websites.

R&D capabilities are the basics for significant value

The region possesses a strong R&D and innovation portfolio, with current R&D programmes focusing on areas such as battery developments, software for connected and autonomous vehicle-related (CAV) analysis, sustainable energy sources, and fuel cell technologies. These programmes are supported by universities and organisations that promote public-private collaboration. The Midlands has a strong reputation for engineering and manufacturing excellence; the transition to a low carbon economy will benefit from both inherited manufacturing and R&D capabilities.

Supply chain vulnerabilities: gaps in innovation, unclear regulation and more…

The low carbon regional development faces several vulnerabilities. Although support exists (both financial and technical), companies appear to have difficulty in accessing information about

opportunities in the region. There appear to be gaps in the innovation process in terms of progressing from an R&D stage to the commercialisation stage. Another recurring topic in relation to vulnerabilities is the current regulation framework; lack of clarity in the use of hydrogen, long and complicated licences for electricity and gas supply, and grey areas for the use of sustainable CO2 are some vulnerabilities associated with public policy. In addition, local authorities seem to play a limited role in terms of convening power and aligning incentives.

Focusing on supply chain (SC) issues, there is widespread agreement that the Midlands (and the UK in general) cannot compete on cost with international SCs, and that competitive advantage should be sought through quality and/or technology measures. Additional concerns include the scarcity of Rare Earth Elements (REE) materials and their geographic distribution. Additionally, regional manufacturers continue to lag behind global competitors when it comes to digital maturity.

Brexit and COVID have aggravated the situation, but collaboration is reinforced.

While the circular economy represents a significant opportunity for the low carbon economy by reusing materials, its application is still in its infancy. Batteries and electronics recycling options are limited, and waste management is inefficient, as the majority of waste is incinerated rather than used to generate energy. COVID-19 and Brexit have complicated the SC even further. Following the EU referendum, the UK reported negative results in a critical sector such as vehicle manufacturing, while businesses reported increased trade complexity and fewer opportunities. COVID-19 altered customer demand, necessitated employee restructuring and cash shortages, and impacted innovation pipelines. On the other hand, the pandemic has heightened the importance of collaboration and low carbon initiatives, while Brexit has resulted in a more regional approach to SC strategies.

Looking into the future, resilience can come from different sources

The industry should be able to adapt and change in response to future market demands. Infrastructure enhancements (e.g., designing efficient energy networks capable of meeting anticipated high demand, developing infrastructure to support testing and deployment of new technologies) should be prioritised in this regard. Understanding the consumer and fostering customer confidence in low carbon technologies and services are critical components of the transition to a decarbonised economy. Collaboration and adaptability are also required to build resilience; sharing best practices, designing interoperability among technologies, and embracing digitalisation can all help.

Upgrading skills and redefining current funding opportunities can also help. Because the region is home to a variety of organisations that can assist with both of these aspects, it is critical to improve and/or disseminate information about available mechanisms in an efficient manner. Furthermore, existing companies and infrastructure should be aligned with low carbon SCs. Finally, circular economy principles should be adopted to create new business opportunities and address material scarcity issues.

Different public policies can be used with the same objective: to promote decarbonisation

The report concludes with policy recommendations. In this regard, some examples include the establishment of a local development bank and the implementation of new financing opportunities

(e.g., preferential rate loans, targeted grants for green investments). Appointing a single organisation as the main point of contact to promote information sharing and assist businesses in identifying the best assistance programmes that can fit their needs was a recurring theme. Updating legislation, re-evaluating the tax system (e.g., carbon border tariffs), enacting bans on high-intensity carbon products, and implementing carbon accounting policies can provide a framework for generating customer demand while reducing cash pressure in organisations, particularly during the R&D stages.

4. The Resilience of Advanced Manufacturing Supply Chains Across the Midlands

This sector 'deep dive' report on Advanced Manufacturing in the Midlands sought to assess the supply chain resilience of firms in these sectors in the face of the twin challenges of Brexit and Covid-19. A mixed-methods approach of desktop research, propriety analysis from specialist research input and qualitative data from 12 interviews with senior managers was used to assess the challenges facing the automotive, aerospace and medical technologies sectors (and their suppliers and service providers). These analyses and findings are detailed in the subsequent sections of this report but below we outline the key findings and policy recommendations arising from our research.
Research findings

Both Brexit and the Covid-19 pandemic have posed challenges for businesses in the advanced manufacturing sectors in the Midlands. The impact of both events has been heterogeneous with respondents having adapted in a variety of ways and experiencing quite different outcomes. In terms of pandemic response, there has naturally been a limit to what businesses have been able to do. However, certain commonalities stand out. Our research has highlighted the nature of these and given some insights into potential strategies to overcome them.

Common themes

Respondents shared concerns around skills gaps and potential difficulties in attracting skilled and technical personnel. Likewise, a desire to see improved infrastructure was almost universal, although respondents differed in terms of what they stressed. The initial disruption incurred by Covid-19 heavily affected all manufacturers. Since then, diversification has proved to be key, both in terms of products (perhaps unsurprisingly, the market for medical technologies has experienced a very different pandemic to aerospace) but also in terms of markets.

Those able to take advantage of demand in East Asia (where demand has been much more buoyant) have suffered less.. The situation in Europe (including the UK) has been consistently challenging, whilst that in North America has been changeable but overall lies somewhere between the European and East Asian experience (at least economically). For some companies their exposure to these markets has been "indirect" – i.e. they supply a UK firm which itself sells into certain markets (both export and domestic).

This echoes the more general findings of the academic literature on business robustness and resilience, emphasising the importance of investment in "related variety" . However, this research also highlights the importance of diverse (export) markets and capital investment. Ensuring that firms have the incentives to undertake said diversification and investment and maintain cash flow is clearly of importance, as is an understanding of best practice elsewhere around the globe.

Diverse experiences

In terms of Brexit specifically, the impact has been much more heterogeneous, with a clear gap between our smaller and larger respondents. Some problems related to initial difficulties, of getting used to the new customs regimes:

"…when [the supplier] came to deliver, which was the first week in January, they hadn't got the paperwork and I suddenly realised that yes, it was their responsibility, and they had to get all their papers correct. So, we received that material yesterday. So that's six weeks late. So, I'm not pleased… And we're talking 40,000 pounds worth of materials. So, for a small company, such as ourselves, 40,000 pounds, being late is not good news" (Participant 5).

"…certainly getting sales and product to our customers has slowed down. Because what's been happening is some of the carriers have been held up either at the port or individual mainland EU country's borders, and held for maybe, you know, an extra week or 10 days" (Participant 9).

However, some problems are clearly much more long-term in nature and there are concerns about the introduction of documenting rules-of-origin compliance for the automotive sector post-2022 as well as the introduction of more stringent import-checks. Although the report makes several recommendations for government, including enhanced but targeted infrastructure investment. Recommendations for firms centre on the twin challenges of upskilling and product innovation. In both cases, a closer relationship with the third sector (including universities, FE institutions and others) is important. This will enable enhanced knowledge exchange involving sectors that typically rarely collaborate, alongside working with the public sector where appropriate in ensuring close alignment with strategic economic plans and rapid planning approvals. There are significant actions that can be taken by government (both national and local) to facilitate business growth including tax incentives, improved access to finance and assistance in complying with the new trading relationship. Product delays and lost business are serious challenges for smaller exporters, as is an increase in shipping costs and costs around customs compliance. In contrast, larger firms that have been able to draw on international experience elsewhere have found the transition to the new UK-EU relationship much smoother.

Moving forward

The pandemic has exposed the fragility of the region's supply chains. This research has underscored the importance of diversification, broadly defined – and many forward-looking businesses are already responding by branching out into new products and markets. The challenge for government and other stakeholders is to create an environment that facilitates similar actions more broadly. As such, upskilling of existing workforces, help to mirror best practice elsewhere, interaction between different stakeholder groups (including higher education, the private sector and others) are all important.

This underscores the importance of major "anchor firms" around which innovative smaller firms tend to cluster, which is particularly visible in the West Midlands automotive sector and the East Midlands aerospace sector. Improved transport links and a stable system of technical and academic education will enable these clusters of excellence to grow and thrive, driving productivity growth across the region, which has the highest proportion of manufacturing employment in the UK, and the rest of the country.

Policy Recommendations

- Targeted infrastructure investment in the following areas:

    - Improving inter-urban link transport, especially East-West links within the Midlands Engine in order to benefit fully from agglomeration and cluster effects.
    - Improving intra-urban transport, facilitating access to talent.
    - Addressing "pinch points" between the Midlands and key ports, notably Bristol, on the A14 between the Midlands and Felixstowe, the A34 to Southampton and routes to Liverpool. This has renewed importance post-Brexit considering shifts in firms' transport and logistics strategies.

- Enabling and facilitating forward-looking opportunities in mobility, especially around programming, vehicle connectivity (vehicle-to-X and X-to-vehicle) and electronics. To do so, it is importance to maximally leverage existing expertise in the region, so as to:

    - Facilitate and incentivise (even) greater collaboration between universities, other academic institutions and private companies.
    - Continue and strengthen existing programmes to address key STEM skills-gaps
    - Facilitating a greater shift to life-long learning and flexible, bespoke modular delivery working in tandem with manufacturers. This is likely to build on the Help to Grow scheme and existing KTP frameworks.

- Work to protect existing National Strategic Assets, particularly large "anchor firms", around which an innovation ecosystem has grown up. A collaborative approach between local government, central government, the private sector and HEIs is needed – the so-called "triple helix". Hence, delivering on electrification in the vehicle sector and decarbonisation in aerospace and ensuring the supply-chain ecosystem around these is paramount. This will involve close cooperation with major anchor-firms in order to understand what demand for upstream products is likely to be sustained.

- Further enhance and facilitate access to finance for start-up and scale-up firms. There are barriers in terms of time and information around existing (non-Covid19) schemes.

Firms across advanced manufacturing face challenges in pivoting profitably to a low-carbon future. In automotive, the presence of substantial domestic battery manufacturing is key. Given the importance of proximity for agglomeration economies, there is a strong case for situating at least one such facility in the Midlands.

Recognising the unique challenges for firms in the aerospace manufacturing sector and providing targeted support in order to protect the country and region's world-class skillset.

5. ACURSC – Anti-COVID-19 Capabilities Underpinning Resilient Supply Chains Framework: evidence from the food supply chain in the UK Midlands Engine pan region

The Problem

The COVID-19 pandemic created new pressures for food supply chains globally. For example, the International Monetary Fund's Global Uncertainty Index rose to an historic peak due to the pandemic and remains at a high level. While the food supply chain in the wider Midlands Engine region avoided major disruptions and food shortages during the pandemic, the capability factors underpinning this supply chain resilience have so far been little explored. By understanding and systematizing the main supply chain capabilities which are capable of engendering resilience in the food sector, it will be possible to learn lessons, share best practice, and further strengthen food supply chains both in the Midlands Engine and across the UK as a whole in preparation for future challenges and opportunities.

The main question addressed by this project is: what is the portfolio of supply chain resilience capabilities adopted by members of the food supply chain in the Midlands that allowed food production and distribution chains to remain resilient during the COVID-19 pandemic in the UK?

Approach

The objective of this research was to discover the portfolio of supply chain resilience capability factors adopted by firms in the Midlands food sector to remain resilient during the COVID-19 pandemic. This portfolio of resilience capabilities is herein called 'ACURSC': Anti-COVID-19 Capabilities Underpinning Resilient Supply Chains.

A qualitative study based on interviews with 20 food supply chain professionals and experts in the sector from the Midlands region was undertaken between November 2020 and April 2021. Drawing on a portfolio of the 14 most frequently cited capability factors (Pettit et al., 2014), interview scripts were designed to support discussion with both supply chain professionals and experts in the food sector across the Midlands Engine. The key topics covered were: (a) how these professionals defined supply chain resilience during the pandemic; (b) the main initiatives taken and examples of how they sustained the resilience of the supply chain during the pandemic; and (c) capability gaps, future developments, and expectations from food policy.

Findings

Identifying a Set of Crucial Resilience Capabilities

The top five resilience factors are:

1. Organization: organizational innovation with a strong emphasis on agile and pragmatic Human Resource Management.
2. Anticipation: preparations for a 'no-deal Brexit', adoption of best practices regarding business continuity planning, risk assessment and the supply chain's global exposure.
3. Adaptability: necessary due to dynamic trading and changes in the food market, requiring readiness for an 'every day is Christmas Day' order of demand.
4. Flexibility in Order Fulfilment: rapid shift from 'food to go' and 'food services' to dominant retailers and new markets, such as direct on-line sales to customers.

5. Flexibility in Sourcing: identification of alternative pre-approved, pre-audited new regional suppliers for each input to cope with further global disruptions, focus on essential production inputs, reduced mix of products and regional availability of inputs rather than cost reduction.

ACURSC Framework

The most significant output of this research is the ACURSC portfolio of resilience capability factors (Figure 2). Five capabilities were central in underpinning the resilience of firms in food supply chains during the pandemic, which supported and created synergy with other resilience capabilities, such as capacity, financial strength, dispersion, visibility and collaboration. The most resilient firms possessed particular enabling and facilitating characteristics:

- Understanding new customers' expectations.
- Implementation of management best practices; and firm's size-related resources.
- Proactivity during the early stage of the first wave of the pandemic.

On the Horizon

ACURSC can be useful as a benchmarking and policy tool to support food supply chains in the Midlands Engine in the face of the opportunities and adaptations required by post-pandemic trends and challenges. These include:

- Digital transformation of supply chains, through appropriate digital infrastructure, and understanding of new digitally-enabled consumer habits.
- Net-zero supply chains and green recovery.
- An understanding of relevant factors affecting the competitiveness of the food chain for a post-Brexit Britain: labour and infrastructure to help a digitally enabled net zero recovery post-COVID-19.

How to Build Capacity

Study participants were asked to reflect on how public policy could support the Midlands Engine food supply chain when faced with emergent challenges and opportunities. The most frequent answers were:

- Access to and an ability to learn from supply chain management best practice, including topics such as: demand forecasting during disruptive events; business continuity, and; stress testing of supply chains.
- Access to case studies of successful and resilient supply chains.
- Learning how industries beyond the food sector have adapted and maintained resilience.
- Knowledge about how to address resilience capabilities asymmetries which may arise among members of a supply chain, for instance, when a focal company in a supply chain has a more robust business continuity plan that smaller members of the chain.
- Support and training for organizations in the food chain to build up comprehensive business continuity plans that incorporate possible 'black swan events' and incident recovery. In this context, supply chain risk assessment could monitor updates regarding: Public Health

England Guidance on High Consequence Infectious Diseases (HCID); Lessons from cross-government exercise to test the UK response to pandemics, such as 'Exercise Cygnus' which was a cross-government exercise to stress test the national response to a critical influenza pandemic. The exercise took place over 3 days in October 2016 and involved more than 950 people; Global Risks Report, World Economic Forum; and the 10 Global Health Issues, World Health Organization.

- Discussion forums, workshops, and mechanisms to allow stakeholder engagement on critical elements which could affect the resilience of food supply chains in the Midlands Engine pan region, for example, road capacity, logistics services, warehouses, labour, agriculture capacity, manufacturing, and trends in retail.


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