National Resilience Strategy – call for evidence

To view the call document go to:

Submitted on 27 September 2021. Please note that we did not respond to every question within the call.

Questions in this Call for Evidence focus on six broad thematic areas:

1. Risk and Resilience: Strengthening our ability to manage an evolving risk landscape depends on improving our ability to both predict and adapt to identified and unexpected challenges.
2. Responsibilities and Accountability: It is fundamentally important that all those involved in building resilience have a clear understanding of when, where and how to apply tools, processes and relationships effectively.
3. Partnerships: Resilience is not solely a government or public sector responsibility. Other parts of society play an essential role in building our collective resilience.
4. Community: A whole-of-society approach will be central to strengthening the UK’s resilience, with a revived effort to inform and empower all parts of society who can make a contribution.
5. Investment: The challenge of where to place investment in the risk cycle is one that affects the public and private sectors alike. As government, individuals and businesses, we face choices around what, and how much, to invest.
6. Resilience in an Interconnected World: UK resilience is closely entwined with the wider global context. Challenges and opportunities are frequently experienced on a global scale.

Looking thorough the strategy call document, we believe Connected Everything is best placed to respond to:

- Questions on Vision and Principles:
- Questions on Partnerships: Critical National Infrastructure (CNI) owners and operators:
- Questions on Investment:
- Questions on Resilience in an Interconnected World

We do not have to respond to all the section of the call document and questions.

Questions on Vision and Principles:

1. Do you agree with the proposed vision of the Resilience Strategy? Is there anything you would add, amend, or remove?

At Connected Everything, we welcome the initiative to strengthen the resilience of the UK economy and develop the UK’s capability to adapt to uncertainty, to proactively address risks and withstand adversity. A significant change to how resilience shall be managed going forward is the increasing digitisation of the UK and global economies. However, the use of digitisation to increase resilience is overlooked within the proposed vision and wider National Resilience Strategy. We strongly believe that future UK economic resilience will be achieved by encouraging UK businesses to adopt existing and emerging digital technologies (e.g., robotics, artificial intelligence, internet of things and additive manufacturing). Examples of how digitisation will enable a resilient UK include:

- Support green recovery and more sustainable forms of production in line with net-zero directives.
- Implement intelligent (AI-supported) supply chain forecasting to flexibly adjust production according to changes in demand.
- Facilitate reshoring through increased automation.
- Employ workforce and visitor management solutions to ensure health and safety.
Due to the importance of digitalisation in creating a resilient UK, we feel this should be highlighted in the vision of the Resilience Strategy.

2. Do you agree with the principles laid out for the strategy? Is there anything you would add, amend, or remove?

N/A

Questions on Partnerships: Critical National Infrastructure (CNI) owners and operators:

1. Do you think that the resilience of CNI can be further improved? If so, how?

1. Transparency and data sharing

- Transparency and data sharing within the value chain and between CNI owners and operators will enhance resilience by enabling the sharing of assets and resources. This will allow the CNI to work together to respond faster to disruptions, as well as, to increase UK productivity by exploiting underutilised resources.
  - In the UK and Europe, only 63% of journeys carry a useful load and average vehicle utilisation is under 60%. While co-loading can increase the UK freight industry efficiency and reduce its environmental impact, the associated logistics makes it highly complex to implement.
  - An example of this is the Connected Everything funded feasibility study conducted by the University of Cambridge, which demonstrates the benefits of data sharing to enable freight co-loading.
  - This work investigates the use of artificial intelligence to develop a distributed, multi-agent software system that automates solution search and optimisation.
  - This would reduce the number of journeys required, minimising reliance on HGV drivers.
  - Find out more at: https://connectedeverythingmedia.files.wordpress.com/2020/04/agentchat.pdf

2. Traceability

- Traceability (the ability to trace and track food, and food ingredients through the supply chain) is also critical in improving resilience in food sectors, as it monitors food quality and safety management.
- Emerging digital technologies that deliver decentralized systems, such as blockchain, could improve traceability in the global production ecosystem.
- Recommend additional funding in these areas within “Manufacturing the Future”, EPSRC Theme, with a focus on their application to increase resilience.

2. Do you think the introduction of appropriate statutory resilience standards would improve the security and resilience of CNI operators? Why? a. How would such standards define the necessary levels of service provision? b. Are there any risks associated with implementing such standards?

N/A

3. What do you think is the most effective way to test and assure the resilience of CNI? a. To what extent do you think regulators should play a role in testing the resilience of CNI systems and operators?

N/A
4. During an emergency, what do you think should be the role of the operators of CNI in ensuring continued provision of essential services (e.g. water, electricity, public transport)? a. How can the Government support CNI owners or operators during an emergency?

1. Fund research to investigate repurposing assets

- Manufacturing is vital to national resilience as manufacturing supplies the vital products and services (food and drink, pharmaceuticals, health care products, etc.) that the UK relies on for daily life.
- During emergencies manufacturing assets can be repurposed to produce key products in heavy demand and short supply to support the national infrastructure.
  - For example, at the start of the pandemic distillers switched production from gin to hand sanitiser. This led to society benefit by providing access to a key product to combat the spread of COVID, but also provided a revenue stream for distillers who experienced a decrease in demand for their traditional products.
  - Going forward, the Government should develop guidance for manufacturers on which manufacturing assets may be repurposed to manufacturing key products in times of emergency.
- More complex products, such as ventilators, can also be made at short notice using digital technologies such as digital design, augmented reality and 3d printing to support rapid prototyping.
  - For example, augmented reality (AR) proved to be a key enabling technology in helping a consortium of manufacturers switch their production lines to making ventilators.
  - Another example, includes engineers at the University of Nottingham that designed a PPE face shield with CE approval for 3D printing at scale for healthcare workers to use in the fight against COVID-19.
  - Activities would not have not been possible without funding schemes for digital manufacturing technologies.

Wider critical sectors

5. What role, if any, does your business or sector play in national resilience?

- Connected Everything is a network for academics, industry and policymakers that aims to support the digitisation of the UK manufacturing sector. As such, we support national resilience by forming cross-sectoral partnerships to support knowledge creation and exchange to speed up digitisation.
- We recognise that partnerships are important to achieving resilience and should be valued during normal times and not just for emergencies.
- Connected Everything II: Accelerating Digital Manufacturing Research Collaboration and Innovation [EP/S036113/1]

6. What are the risks that your business is most concerned about?

1. Skills shortage

- Digitisation will be key to building a resilient UK economy; however, this is currently impeded by the lack of digital skills within the UK workforce.
- The Learning & Work Institute's research reveals that 70% of young people expect employers to invest in teaching them digital skills on the job, but only half of the employers surveyed in the study are able to provide that training.
- Innovation Monitor: Bouncing Back Smarter (2020) by Make UK found that digital skills in the most common barrier to digitalisation.
- NESTA, a think-tank, found data-driven skills shortages cost the UK economy £2bn annually.
2. Labour shortages

- A number of sectors are currently complaining about labour shortages (i.e., agriculture, food processing, transportation, and hospitality), which is impacting the UK ability to produce key products or services.

3. Availability of key resources and materials

- The UK imports almost all its copper, ferrous metals, lead, zinc, rubber, and raw cotton; most of its tin, raw wool, hides and skins, and many other raw materials; and about one-third of its food.
- The manufacturing industry in the UK is facing growing resilience and productivity challenges due to the supply and price volatility of raw materials.

7. What information, tools or guidance could the Government provide to help your business better assess or prepare for these types of risk?

1. Digital skills guidance

- Government should make it easier for SMEs to engage with digitalisation. Example means to do this include:
  - Fund interdisciplinary networks, like Connected Everything, that work to engage SMEs with world-leading research.
  - The Government should consult with industry and universities to develop a digital skills “toolkit” that can advise employers and employees which skills they need to develop and signpost training opportunities.
  - Additional, government should produce a roadmap on how to introduce digital technologies and skills to businesses with a focus on increasing resilience and sustainability.
  - Host a platform of case studies to educate the industry on the benefits of digital skills to industry.

2. Invest in automation

- Investment in automation can help address the labour skills shortage. Example of research in this area:
  - Agriculture: Lincoln Agri-Robotics https://lar.lincoln.ac.uk/research/

3. Supply chain strategies

- Research is required for the development of mitigation strategies to reduce the risk of supply disruption during future periods of supply chain instability.
- Capability mapping studies are required to provide guidance on material substitutions in the case of shortages.
- One solution is to encourage the transition towards a circular economy that can improve supply chain resilience, by keeping materials in the economy for longer and reducing losses through exports or waste.
- To reduce the dependency on imports, circular economy technologies can be used to recycle materials into new products:
  - For example, replacing wood imports by manufacturing garden furniture out of industrial and consumer waste https://www.madeindesign.co.uk/eco-design/circular-economy.html.
- Government should promote Industrial Symbiosis as a framework to enable the UK to shift from a linear to a circular economy. Industrial symbiosis is the use by one company or sector of under-
utilised resources broadly defined (including waste, by-products, residues, energy, water, logistics, capacity, expertise, equipment and materials) from another, with the result of keeping resources in productive use for longer.

- One of the earliest examples of industrial symbiosis on a large scale in Europe is the Kalundborg industrial park in Denmark. It brings together an increasing number of partners that are currently exchanging 20 resources, as diverse as biomass, gypsum, and steam.

8. What is your business’ approach to building resilience in any key supply chains that your business is part of?

N/A

9. How useful have vehicles such as Local Enterprise Partnerships, Growth Hubs and other local business support services been strengthening your organisations’ resilience? Why?

N/A

Academic and research organisations

10. What can the Government do to make collaboration between academic and research organisations more effective?

11. Are there areas where the role of research in building national resilience can be expanded?

- Government should work with researchers to increase the impact of funded research projects. Examples include
  - Connected Everything II: Accelerating Digital Manufacturing Research Collaboration and Innovation [EP/S036113/1]
  - Resilient Path Coordination in Connected Vehicle Systems [EP/S015493/1]
  - Digital twins for improved dynamic design [EP/R006768/1]
  - Manufacturing the future: Manufacture of Shaped MOF-Polymer Products for Healthcare Applications [EP/V008498/1]
  - Re-Distributed Manufacturing and the Resilient, Sustainable City [EP/M01777X/1]
  - Enhancing recognition of the contribution of engineering and physical sciences to achieving a resilient nation [EP/R02412X/1]
  - Energy Resilient Manufacturing 2: Small is Beautiful Phase 2 [EP/P012272/1]
  - Cloud manufacturing – towards resilient and scalable high value manufacturing [EP/K014161/1]
  - Transfer Learning for Robust, Resilient and Transferable Cyber Manufacturing Systems [EP/S001387/1]
  - Resilient remanufacturing networks: forecasting, informatics and holons [EP/P008925/1]

Questions on Investment:

1. How does your organisation invest in your approach to the risks outlined in this document? Is your investment focussed on particular stages of the risk lifecycle (for example, on prevention)?

N/A

2. Has the COVID-19 pandemic impacted the way your organisation is investing, or will invest, in preparing for these risks? If so, how?
Connected Everything industry members, especially SMEs, have reported diverting investment away from research and development caused by the uncertainty during the pandemic.

However, with the lifting of COVID restrictions, there is an increasing interest in investing in digital manufacturing technologies with a focus on increasing resilience.

3. Are there models of successful resilience investment? If so, to what extent could they be adopted in the UK?

1. Investment in digital technologies

   • Ventilator challenge: investing in augmented reality (AR) proved to be a key enabling technology in helping a consortium of manufacturers switch their production lines to making ventilators.

2. National manufacturing sites

   • Develop a national manufacturing site to respond to critical UK needs during emergencies.
   • Inspired by Nightingale Hospitals, but for manufacturing.
   • Catapults already have mini-production sites that could be expanded to support. Eg AMRC, MTC.

3. National investment

   • EU - The Recovery and Resilience Facility
   • The Recovery and Resilience Facility directly invests makes €723.8 billion to make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions.

4. Are there examples of where investment (whether by the Government, by businesses or by individuals) has driven improvements in resilience?

   • Made Smarter case studies - https://www.madesmarter.uk/resources/case-study/
   • EPSRC Grants relating to resilience
     o Connected Everything II: Accelerating Digital Manufacturing Research Collaboration and Innovation [EP/S036113/1]
     o Resilient Path Coordination in Connected Vehicle Systems [EP/S015493/1]
     o Digital twins for improved dynamic design [EP/R006768/1]
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Questions on Resilience in an Interconnected World

1. Where do you see the UK’s resilience strengths?

1. Manufacturing adaptability and flexibility
   - The innovation and creativity within the UK manufacturing research and business community to repurpose manufacturing assets in response to emergencies. Examples include:
     - Augmented reality (AR) proved to be a key enabling technology in helping a consortium of manufacturers switch their production lines to making ventilators.
     - Engineers at the University of Nottingham designed a PPE face shield with CE approval for 3D printing at scale for healthcare workers to use in the fight against COVID-19.

2. Are there any approaches taken by other countries to resilience that you think the UK could learn from?

1. EU - The Recovery and Resilience Facility
   - The Recovery and Resilience Facility directly invests makes €723.8 billion to make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions.

2. Community Resources Network Ireland
   - The network aims to promote community-based, sustainable waste management as a practical and effective way of tackling Ireland’s growing waste problem.
   - Members handle around 28,000 tonnes of goods saving more than 222,000 tonnes of carbon every year

3. Investing in digital technologies
   - Japan is doubling down on support for automation in a bid to reshore manufacturing and support greater supply chain resilience.
   - South Korea has pledged to roll out AI and 5G services, echoing previous commitments to expand AI and telecommunications infrastructure.
   - Singapore’s existing “Go Digital” programme is being promoted to help businesses embrace digitalisation to overcome the challenges posed by the Covid-19 pandemic.
   - Germany has established a €2 billion fund for start-ups and a €130 billion stimulus package, including additional loans and support for SMEs.
   - China has announced a new plan to leverage digital technologies to resume production and support recovery focused on the development of remote working solutions and virus prevention and control solutions.

3. Which of the UK's international relationships and programmes do you think are most important to the UK's resilience?

N/A

4. What international risks have the greatest impact on UK resilience?

1. Dependence on global supply chains
   - The UK imports almost all its copper, ferrous metals, lead, zinc, rubber, and raw cotton; most of its tin, raw wool, hides and skins, and many other raw materials; and about one-third of its food.
   - The manufacturing industry in the UK is facing growing resilience and productivity challenges due to the supply and price volatility of raw materials.
Cellular meat and plant-based proteins from Singapore as an example to reduce reliance on imports.

The UK also has a reliance on shipping away waste that is subject to risk. This can be migrated by embracing the circular economy to keep material cycling within the economy by extending product lifetimes and recycling waste materials into new products.

Taking it to the extreme, nothing that is made in a circular economy becomes waste, moving away from our current linear ‘take-make-dispose’ economy. The circular economy’s potential for innovation, job creation and economic development is huge to the UK.

Example technologies within the UK:

- Micro H2AD: generates bioenergy, treats wastewater and produces bio-fertilizer from industrial bio-based waste. [https://h2ad.org.uk/](https://h2ad.org.uk/)
- Gomi: Bluetooth speaker from recyclable plastic waste. [https://www.gomi.design/](https://www.gomi.design/)
- Recycling Technologies: modular technology to recycle plastic waste into feedstock for new plastic production. [https://recyclingtechnologies.co.uk/](https://recyclingtechnologies.co.uk/)

2. Climate change

Multiple risks to the UK from climate change impacts overseas are outlined in The Third UK Climate Change Risk Assessment Technical Report, Prepared for the Climate Change Committee. These include:

- Risks to UK food availability, safety, and quality from climate change impacts overseas
- Risks to the UK from international violent conflict resulting from climate change impacts overseas.
- Risks to international law and governance from climate change that will impact the UK
- Risks associated with international trade routes
- Risk to UK public health from climate change impact overseas

3. Reliance on international labours

A number of sectors are currently complaining about labour shortages brought on by the pandemic and BREXIT (i.e., agriculture, food processing, transportation, and hospitality).

- In the UK alone there are 64,000 seasonal migrants in the fresh produce sector picking fruits and vegetables.

5. How can the UK encourage international partners to build resilience to global risks?

N/A