Resilience of global food supply chains
ABOUT THE RESILIENCE SHIFT

The Resilience Shift exists to inspire and empower a global community to make the world safer through resilient infrastructure. More people than ever depend on the critical infrastructure systems that provide essential energy, water, transport and communications services, and underpin food, healthcare and education. When this infrastructure fails the consequences can be catastrophic.

Supported by Lloyd’s Register Foundation and Arup, the Resilience Shift provides knowledge and tools for those responsible for planning, financing, designing, delivering, operating and maintaining critical infrastructure systems. Our aim is to ensure infrastructure systems are able to withstand, adapt to, and recover quickly from anticipated or unexpected shocks and stresses - now and in the future.

DEFINING RESILIENCE

Resilience is the ability to withstand, adapt to changing conditions, and recover positively from shocks and stresses. Resilient infrastructure will therefore be able to continue to provide essential services, due to its ability to withstand, adapt and recover positively from whatever shocks and stresses it may face now and in the future.

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Foreword

The movement of food around the world is an important reality of today’s globalised, urbanised and heavily populated world. Even small disruptions within the supply chain can result in cascading impacts that have negative consequences from farmers to consumers.

The Resilience Shift’s focus is on the resilience of critical infrastructure systems, and we recognise that complex global supply chains (of food and other commodities) rely on transport, energy, water and communications to retain core functionality under diverse shocks and stresses. Our work to date has told us that in the food sector, there are multiple and diverse threats, and that the resilience of infrastructure has limited visibility, with a tendency for supply chains to react to unexpected events rather than to proactively plan for them. In an industry dominated by private sector actors, there is no common understanding of the wider system, and hence no joined-up approach to taking steps to improve its resilience in practice.

This brief report presents the findings from a global series of workshops, engaging stakeholders from across the food supply chain, seeking to benchmark how the resilience of critical infrastructure is understood and dealt with in practice. It presents a global view of current practice, highlighting common themes and regional and organisational differences.

Enhancing the resilience of the global supply of food requires everyone in the supply chain to understand the system and its vulnerabilities in order to be able to respond to and recover from unexpected events.
Droughts in California led to significant decrease in groundwater levels in aquifers, which led to new sustainable rules, limiting and monitoring the groundwater usage for farmers. (Photo - Red and green lettuce fields in California, courtesy of Malcolm Carlaw)
Introduction

A supply chain’s ability to deliver a customer the right product, of the right quality, in the right place, at the right time, for the right price, is the bedrock of supply chain managers around the world. This holds true for food supply chains, and their resilience is therefore a topic that concerns not only the organisations within the supply chain but also governments and policy makers. At their worst, disruptions can lead to significant impacts on society.

Escalating urbanisation and globalisation is resulting in supply chains that are more complex and diverse. Supply chains, and therefore communities, rely on critical infrastructure to function. However, global supply chains are extremely difficult to map and understand. The Business Continuity Institute (BCI)’s 2017 survey found that 69% of their industrial respondents do not have full visibility of their supply chains. The report concluded that the surprising aspect was not that 69% of respondents did not have visibility of their global supply chains, but that 31% claimed they did.

Furthermore, two-thirds (65%) of BCI’s respondents (408 respondents over 64 countries) have experienced at least one supply chain disruption. The causes of these are varied, from supply chain operational issues, such as the shortfall of chickens in UK Kentucky Fried Chicken outlets in 2017, or microchip shortages resulting from a fire at a Philips facility in New Mexico in 2000 which led to a significant loss in market share for the mobile phone company Ericsson, to natural disasters such as the 2011 Thailand floods.

1. BCI Supply Chain Resilience Report 2017, Business Continuity Institute, Berkshire, UK
Figure 1:
Overview of the food supply chain and its dependencies.

5. Adapted from Figure 1, p viii, Resilience in the Australian food supply chain, Department of Agriculture, Fisheries and Forestry, Australian Government, February 2019
Initial research

Initial research, covering over 40 companies in the UK food supply chain sector highlighted that infrastructure, as a key component within a supply chain, has received limited attention. There is little understanding within supply chains as to how the resilience of the infrastructure that a supply chain relies upon should be managed and influenced.

Findings of the research suggest that, it is more essential than ever for all parties involved in the grocery supply chain to be more adaptable going forward, in order to be resilient to potential failures.

The incoming headwinds of Britain leaving the European Union, climate change and the exponential increase in the pace of technological change mean that producers, logistics firms, distributors, retailers and asset owners in the supply chain must take action to ensure resilience.
Global workshops

Building on this research, a subsequent phase of engagement, comprising a global series of stakeholder workshops was undertaken. More than 70 representatives from organisations connected with food supply chains took part in workshops in San Francisco, New York, Manchester, Madrid, Hong Kong, Johannesburg and Brisbane. These cities provide a diverse context of coastal vs inland, varying natural and manmade hazards, and differing political contexts.
Workshop approach

The workshops considered shocks and stresses that can affect the availability and effectiveness of food supply chain infrastructure covering political drivers, environmental drivers and technological drivers. These were categorised based on

• their impact on operations, and
• the ability of organisations to respond.

For example, torrential rain could have a high potential impact on operations because of flooding of roads. The ability to respond might depend on flood prevention measures, or the availability of alternative routes.

Figure 3 shows the overall categorisation of shocks and stresses from all workshops.

Attendees were also asked to identify measures that would help to increase the overall resilience of supply chains, and to discuss gaps or priority areas for further research.

Collated results for all workshops are available on the Resilience Shift [website](http://resilience-shift.com).
Figure 3
Categorisation of shocks and stresses by both high impact/low ability to respond, and high impact/high ability to respond
Common themes

The following common themes emerged across all regions:

**POOR PLANNING**

Poor planning was rated as the most significant stress but was interpreted in different ways by each region. National planning frameworks were blamed for ills such as traffic congestion, crime, urban sprawl, slums and natural degradation. This failed planning also has a considerable impact on infrastructure operators flexibility to respond to market and demand changes, as well as the ability to mitigate shocks and stresses. A second focus was on the poor planning of supply chains, and inadequate risk management.

**FRAGMENTED GOVERNANCE**

Public sector leadership and governance allows a region/city to function effectively. However, fragmented governance can result in non-transparent decision making and poor leadership can undermine the welfare of citizens, and lead to conflict. From a supply chain perspective, poor governance includes lack of clear ownership, and therefore not putting in place the right oversight and measures (process, system or asset changes).
Transferable findings

The following themes emerged in some cities, which can and should be transferable to other regions and geographies. The fact that these themes were not common across all the workshops demonstrates that stakeholders are often very focused on their own knowledge and experience, and lessons from across the wider system are not being shared or acted upon.

**DISASTER PREPAREDNESS**

This was a key measure prioritised by attendees at the San Francisco workshop, clearly a function of its location in an area of high earthquake risk. Attendees in both San Francisco and New York (which was severely impacted by Superstorm Sandy in 2012\(^6\)) highlighted the importance of integrated decision-making across all infrastructure sectors. The views of the workshop attendees in South Africa were influenced by their vulnerability to droughts.

**SUSTAINABLE AND RESILIENT INFRASTRUCTURE**

There was a greater focus in New York on the role of ‘green technology’ in the provision of infrastructure and on sustainable development of infrastructure. One priority intervention was the need for the development of resilient infrastructure networks including hardware.

**LOCAL AND INTERNATIONAL POLITICAL CHALLENGES**

Challenges in South Africa around political instability emerged in the Johannesburg workshop, which focused on prioritising improved governance and greater control in asset management, as well as the measurement and monitoring of polices and regulations related to infrastructure.

The response in Manchester was dominated by the political uncertainty around Britain leaving the European Union. There was an urgency to better prepare for consequences of leaving the European Union in having clarity of options and additional capacity through intermodal solutions. Attendees in Brisbane also supported better alignment of different transport modes.

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Australia’s stringent biosecurity laws and regulation mean that supply chains can be significantly impacted by threats of invasive species and pests. The example of the stink bugs found in shipping containers and requiring extensive interventions, causing disruption to supply chains, was shared at the Brisbane workshop\textsuperscript{7}.

**SPATIAL PLANNING**

Hong Kong is exposed to typhoons and high winds. Underground facilities were identified as a potential response measure, which also makes sense in a region where space is in very high demand.

**COMMUNICATIONS AND CYBER-SECURITY**

Attendees in Brisbane expressed concern about governance of communication infrastructure, and its security against cyber-threats. Cyber security was also important in Spain.

**GEOGRAPHIC CONSTRAINTS**

In Brisbane, there was an emphasis on the need for more storage capacity for liquid fuels, related to the vast distances of hinterland transport corridors.

**PUBLIC-PRIVATE COLLABORATION**

Responses in both Madrid and Hong Kong included reference to public-private collaboration. In Hong Kong this was noted as an area for potential improvement, whereas in Madrid, the Zaragoza logistics cluster\textsuperscript{8} was highlighted as a successful development example between government and private sector logistics service providers.

\textsuperscript{8} https://www.zlc.edu.es/research/logistics-clusters/
Figure 4
Priority shocks and stresses by region

NEW YORK
- Availability of labour
- Communication infrastructure failure
- Severe weather events (e.g. tornado, etc)

SAN FRANCISCO
- Poor planning
- Water scarcity and contamination
- Utilities infrastructure failure

MANCHESTER
- Poor planning
- Lack of access to information/data
- Flooding

MADRID
- Poor planning
- Lack of access to information/data
- Poor governance

HONG KONG
- Poor planning
- Water scarcity and contamination
- Utilities infrastructure failure

JOHANNESBURG
- Communication infrastructure failure
- Poor governance
- Economic instability

BRISBANE
- Flooding
- Communication infrastructure failure
- Water scarcity and contamination
Opportunities for action

**NEW YORK**
- Green technology
- Cross harbour
- Public awareness
- Networks and hardware
- Data analytics
- Increased automation
- Control and governance

**SAN FRANCISCO**
- Integrated decisions on infrastructure
- Emergency food hubs
- Understanding systems
- Life cycle impact of infrastructure
- Coordinated planning
- Regenerative agriculture infrastructure

**MANCHESTER**
- Integrated modal policies
- Better education
- Business continuity
- Best practices guides
- Register of infrastructure
- Intermodal supply chains

**HONG KONG**
- Policy review of food supply chain infrastructure
- Collaborative with government
- Develop underground facilities
- Automation and digitalisation not useful (too expensive)

**MADRID**
- Policy coherence
- Integrated planning
- Control and governance
- Public-private collaboration
- Improve education
- Cyber awareness
- Technological education

**JOHANNESBURG**
- Appropriate education
- Control and governance
- Measure and monitor policies
- Integrated planning
- Traceability
- Supply chain metrics

**BRISBANE**
- Policy resources
- Capacity development SMEs
- Better cyber crime protection
- Governance and collaboration
- Intermodal alignment
- Storage capacity
- Infrastructure
Each workshop considered the question “How could the Resilience Shift best support organisations in improving their resilience?” Figure 5 shows the key opportunities for action for each region, but the following themes were common across all regions:

1. A common understanding of the importance of the resilience of critical infrastructure – why this matters.
2. Better integrated planning across all types of infrastructure, from design, construction and commissioning.
3. Intermodal integration of transport infrastructure to improve interconnectivity across road, rail, sea, inland waterways and air.
4. Better integration between public and private sector in the management of infrastructure systems, with consideration of resilience.
5. Technology as an enabler of resilience by creating the ability to rapidly react, respond to, and recover from unexpected events.