Resilience of global food supply chains

Brisbane, Hong-Kong, Johannesburg, Madrid, Manchester, New York, San Francisco
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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Introduction

During February, March and April 2019, the Resilience Shift, working with Arup’s supply chain logistics experts, hosted seven workshops on the topic of Resilience of Food Supply Chains. These were designed to improve our understanding of how diverse stakeholders view the dependency of global supply chains on infrastructure resilience and how the Resilience Shift could support organisations to better plan for certain events.

Objective

The main objective of the workshops was to engage with senior industry stakeholders across the food supply chain. The key questions discussed were:

- How does the supply chain depend on critical infrastructure to be resilient?
- How might attendees’ businesses be impacted by a range of possible shocks and stresses?
- How would various decision makers respond to shocks and stresses?
- What would the consequential cascading effects of those decisions be?

The intention was that the workshops would provide the basis for multi-stakeholder learning and collaboration.

Seven workshops were held in the following global cities:
Workshop approach

The seven workshops all followed the same basic format, to see common and differing priorities between the different regions.

**RANKING OF SHOCKS AND STRESSES**

At each workshop delegates were asked to take part in an exercise to consider the impact of possible shocks and stresses on their businesses and consider the perceived control that they had over responding to these impacts, as shown below. Those with a high impact should be considered further in terms of how to enhance resilience.

The aim of this exercise was to understand critical assumptions that different stakeholders make, depending on the nature of their organisation, and on regional differences. This exercise revealed where actions could be put into place by individuals (with high ability to respond) in order to mitigate impacts, and where the supply chain felt it had a low ability to respond, hence requiring wider resilience measures.

**PRIORITY ACTIONS**

Delegates were asked to suggest opportunities for mitigating the impact of key shocks and stresses, and to vote on their favourites.

The summary report of these workshops is available on the Resilience Shift website.
Food supply chain infrastructure is well-developed in Australia. Brisbane was chosen for the workshop as it represents the current realities in Australia adequately.

**ATTENDANCE**

The following companies were represented by senior delegates:

- Deloitte (Management consultants)
- Ethos Urban (Urban planners)
- Queensland Farmers Federation
- Biarri (Business optimisation consultants)
- Department of Transport and Main Roads - TMR (Government)
- DB Schenker (Global multi-modal logistics service providers)
- Green Cross Australia (Environmental and disaster resilience company)
- Roadside Assistances Club of Queensland - RACQ
- Queensland Investment Corporation
- Global Greentag (Green product certification)
SHOCKS AND STRESSES

Shocks and stresses are shown in the graphs B1 and B2, in terms of which organisations are well positioned to respond and therefore should develop actions, and which organisations are poorly positioned to respond and therefore need to consider how they would respond and recover.

The top 12 drivers where there is a high ability to respond are shown in graph B1:

1. Communication infrastructure failure
2. Water scarcity and contamination
3. Poor governance
4. Transport infrastructure accidents
5. Availability of labour
6. Infrastructure capacity (power)
7. Disease
8. Cyber crime
9. Poor planning
10. Infrastructure capacity (roads)
11. Crime/terrorism
12. Reliance on specific customers

The top 12 drivers where there is a low ability to respond are shown in Graph B2:

1. Cyber crime
2. Poor planning
3. Severe weather events (e.g. tornado, etc)
4. Changing shipping routes
5. Infrastructure capacity (roads)
6. Fragmentation within transport operations
7. Water scarcity and contamination
8. Infrastructure capacity (rail)
9. Economic instability
10. Introduction of new border tariffs
11. Communication infrastructure failure
12. Disease

PRIORITY ACTIONS

The following were voted as the top priorities to be considered with regards to infrastructure:

1. Pooling resources for reconstruction of large sections of the state-controlled road network through the Transport Network Reconstruction Program (TNRP).
2. Capacity development for small business to develop continuity plans along with scenario and disaster planning when communication infrastructure fails.
3. Strengthening reporting protocols and protection for people reporting cyber crime that can negatively impact infrastructure.
4. Governance of dependence on ICT and communications infrastructure with better collaboration between all levels of government.
5. Road, rail and air should be better aligned when changes in shipping routes are made to ensure optimal utilisation of transport infrastructure.
6. Storage capacity for liquid fuel infrastructure needs to be increased to allow the 90-day agreement with the IEA (International Energy Agency) is honoured.
7. Organisations and government should spend the money on design, construction and commissioning of infrastructure.

These priorities reflect the particular need for pooling resources for reconstruction of the road network, capacity development for business continuity plans, protection against cyber crime, better ICT collaboration, improved intermodal alignment (road, rail and air), increased fuel storage capacity and more investment in infrastructure.
BRISBANE WORKSHOP - PLACEMENT OF DRIVERS

Graph B1 - High Potential Impact and High Ability to Respond

COMMUNICATION INFRASTRUCTURE FAILURE
WATER SCARCITY AND CONTAMINATION
POOR GOVERNANCE
TRANSPORT INFRASTRUCTURE ACCIDENTS
AVAILABILITY OF LABOUR
INFRASTRUCTURE CAPACITY (POWER)
DISEASE
CYBER CRIME
POOR PLANNING
INFRASTRUCTURE CAPACITY (ROADS)
CRIME/TERRORISM
FRAGMENTATION WITHIN TRANSPORT...
RELIANCE ON SPECIFIC CUSTOMERS
INFRASTRUCTURE CAPACITY (RAIL)
SEVERE WEATHER EVENTS (E.G. TORNADO...
ECOSYSTEM DEGRADATION
EXTREME HOT WEATHER
FAILURE OF INTERNATIONAL GOVERNANCE
ECONOMIC INSTABILITY
LACK OF ACCESS TO INFORMATION/DATA
POVERTY AND INEQUALITY
UTILITIES INFRASTRUCTURE FAILURE
INDUSTRIAL ACCIDENTS
INTRODUCTION OF NEW BORDER TARIFFS
LAND CONTAMINATION
AIR POLLUTION
BUILDINGS COLLAPSE
CHANGING SHIPPING ROUTES
EXTREME COLD WEATHER
FAILURE OF NATIONAL GOVERNANCE

High Potential Impact and Low Ability to Respond
High Potential Impact and High Ability to Respond
Other responses
BRISBANE WORKSHOP - PLACEMENT OF DRIVERS

Graph B2 - High Potential Impact and Low Ability to Respond
Food supply chain infrastructure is well-developed in Hong Kong. The city was chosen for the workshop as it represents the current realities adequately.

ATTENDANCE

The following industry sectors and organisations were represented by senior delegates:

- Air-freight terminal operations
- University education
- Chartered Institute of Logistics and Transport (CILT)
- Planning consultancy
SHOCKS AND STRESSES

Shocks and stresses are shown in the graphs HK1 and HK2, in terms of which organisations are well positioned to respond and therefore should develop actions, and which organisations are poorly positioned to respond and therefore need to consider how they would respond and recover.

The top 12 drivers where there is a high ability to respond are shown in graph HK1:
1. Communication infrastructure failure
2. Cyber crime
3. Industrial accidents
4. Lack of access to information/data
5. Availability of labour
6. Infrastructure capacity (roads)
7. Poor planning
8. Disease
9. Flooding
10. Poor governance
11. Transport infrastructure accidents
12. Extreme cold weather

The top 12 drivers where there is a low ability to respond are shown in Graph HK2:
10. Poor planning
11. Flooding
12. Poor governance

PRIORITY ACTIONS

The following were voted as the top priorities to be considered with regards to infrastructure:

1. Policy review of food supply chain infrastructure (together with the national policy).
2. Collaboration with the China government, including the possibility of importing labour from other countries.
3. Underground development of facilities.
4. Automation and digitalisation not regarded as useful to resolve the problems of shortage of manpower, due to high investment costs and long payback period.

These priorities reflect the particular need for policy review and better aligned education collaboration with government.

The comment on automation and digitalisation is interesting as it reflects the particular concern of industry in Hong Kong with regards to affordability and payback times.
HONG KONG WORKSHOP - PLACEMENT OF DRIVERS

Graph HK1 - High Potential Impact and High Ability to Respond

- Communication Infrastructure Failure
- Cyber Crime
- Industrial Accidents
- Lack of Access to Information/Data
- Availability of Labour
- Infrastructure Capacity (Roads)
- Poor Planning
- Disease
- Flooding
- Poor Governance
- Transport Infrastructure Accidents
- Extreme Cold Weather
- Extreme Hot Weather
- Reliance on Specific Customers
- Utilities Infrastructure Failure
- Air Pollution
- Economic Instability
- Introduction of New Border Tariffs
- Infrastructure Capacity (Power)
- Water Scarcity and Contamination
- Land Contamination
- Crime/Terrorism
- Poverty and Inequality
- Buildings Collapse
- Severe Weather Events (e.g. Tornado, Hurricane, etc.)
- Failure of National Governance
- Fragmentation Within Transport
- Infrastructure Capacity (Rail)
- Failure of International Governance
- Changing Shipping Routes
- Ecosystem Degradation

High Potential Impact and Low Ability to Respond
High Potential Impact and High Ability to Respond
Other responses
HONG KONG WORKSHOP - PLACEMENT OF DRIVERS

Graph HK2 - High Potential Impact and Low Ability to Respond
Food supply chain infrastructure is well-developed in South Africa. Johannesburg was chosen for the workshop as it represents the current realities in South Africa adequately.

**ATTENDANCE**

The following companies were represented by senior delegates:

- Council of Supply Chain Management Professionals (Vocational society)
- SA Association of Freight Forwarding (Industry association)
- Imperial Logistics (Global logistics service provider)
- KPMG (Management consulting)
- National Department of Transport - Freight Logistics (Government)
- SAPICS (Vocational society)
- Transnet Freight Rail (Railway service provider)
- University of Pretoria (Centre of Excellence in Food Security)
- University of Pretoria (Institute of Food, Nutrition and Well-being)
- Savino Del Bene (Global freight forwarder)
SHOCKS AND STRESSES

Shocks and stresses are shown in the graphs J1 and J2, in terms of which organisations are well positioned to respond and therefore should develop actions, and which organisations are poorly positioned to respond and therefore need to consider how they would respond and recover.

The top 12 drivers where there is a high ability to respond are shown in graph J1:

1. Communication infrastructure failure
2. Poor governance
3. Economic instability
4. Poor planning
5. Availability of labour (in particular, skilled labour)
6. Lack of access to information/data
7. Cyber crime
8. Infrastructure capacity (roads)
9. Changing shipping routes (east coast ports versus west coast ports)
10. Infrastructure capacity (rail)
11. Infrastructure capacity (power)
12. Poverty and inequality

The top 12 drivers where there is a low ability to respond are shown in Graph J2:

1. Failure of national governance
2. Infrastructure capacity (power)
3. Poor governance
4. Crime/terrorism
5. Extreme hot weather
6. Flooding
7. Infrastructure capacity (rail)
8. Poverty and inequality
9. Water scarcity and contamination
10. Failure of international governance
11. Utilities infrastructure failure
12. Economic instability

PRIORITY ACTIONS

The following were voted as the top priorities to be considered with regards to infrastructure:

1. Improve appropriate education and training in design and maintenance of infrastructure.
2. Improve governance and controls in asset management.
3. Measure and monitor current policies and regulations related to infrastructure.
4. Better integrated planning for the design, construction and commissioning of infrastructure.
5. Increase traceability, with specific relevant to asset management.
6. Establish hierarchy of supply chain metrics that depends on fully functional infrastructure.

These priorities reflect the particular need for improved education, governance and controls in asset management and better integrated planning, reflecting the current reality of food supply chain infrastructure in South Africa. Infrastructure has been ageing over time and desperately needs better maintenance and increased capacity to be able to accommodate the anticipated growth in demand.
JOHANNESBURG WORKSHOP - PLACEMENT OF DRIVERS

Graph J1 - High Potential Impact and High Ability to Respond

COMMUNICATION INFRASTRUCTURE FAILURE
POOR GOVERNANCE
ECONOMIC INSTABILITY
POOR PLANNING
AVAILABILITY OF LABOUR
LACK OF ACCESS TO INFORMATION/DATA
CYBER CRIME
INFRASTRUCTURE CAPACITY (ROADS)
CHANGING SHIPPING ROUTES
INFRASTRUCTURE CAPACITY (RAIL)
INFRASTRUCTURE CAPACITY (POWER)
POVERTY AND INEQUALITY
SEVERE WEATHER EVENTS (E.G. TORNADO, AIR POLLUTION, FLOODING)
FRAGMENTATION WITHIN TRANSPORT (.... INDUSTRIAL ACCIDENTS)
WATER SCARCITY AND CONTAMINATION
ECOSYSTEM DEGRADATION
LAND CONTAMINATION
INTRODUCTION OF NEW BORDER TARIFFS
DISEASE
CRIME/ TERRORISM
BUILDINGS COLLAPSE
RELIANCE ON SPECIFIC CUSTOMERS
TRANSPORT INFRASTRUCTURE ACCIDENTS
EXTREME COLD WEATHER
FAILURE OF NATIONAL GOVERNANCE
EXTREME HOT WEATHER
FLOODING
FAILURE OF INTERNATIONAL GOVERNANCE
UTILITIES INFRASTRUCTURE FAILURE
JOHANNESBURG WORKSHOP - PLACEMENT OF DRIVERS

Graph J2 - High Potential Impact and Low Ability to Respond

[Diagram showing the placement of drivers based on high potential impact and low ability to respond across various factors such as failure of national governance, infrastructure capacity (power), poor governance, crime/terrorism, extreme hot weather, flooding, infrastructure capacity (rail), poverty and inequality, water scarcity and contamination, failure of international governance, utilities infrastructure failure, economic instability, cyber crime, ecosystem degradation, land contamination, transport infrastructure accidents, poor planning, severe weather events (e.g., tornado), air pollution, disease, buildings collapse, communication infrastructure failure, infrastructure capacity (roads), extreme cold weather, availability of labour, lack of access to information/data, changing shipping routes, fragmentation within transport, industrial accidents, introduction of new border tariffs, and reliance on specific customers.]
Food supply chain infrastructure is well-developed in Europe and Spain. Madrid was chosen for the workshop as it represents the current realities in Spain adequately.

**ATTENDANCE**

The following companies were represented by senior delegates:

- Madrid City Council (Municipal government)
- Ministry of Development - General Directorate of Land Transport (Government)
- Ministry of Development - General Directorate of Civil Aviation (Government)
- Freight Hub - Benavente (Logistics service provider)
- TCS Quimtran (Logistics service providers)
- Transfesa - SEMAT (Rail logistics service providers)
- CEL (Spanish Logistical Centre)
- CIMALSA (Government of Catalonia)
- Zaragoza University (Infrastructure)
- Zaragoza University (Business)
SHOCKS AND STRESSES

Shocks and stresses are shown in the graphs MD1 and MD2, in terms of which organisations are well positioned to respond and therefore should develop actions, and which organisations are poorly positioned to respond and therefore need to consider how they would respond and recover.

The top 12 drivers where there is a high ability to respond are shown in graph MD1:
1. Poor planning
2. Lack of access to information/data
3. Poor governance
4. Air pollution
5. Availability of labour
6. Reliance of specific customers
7. Failure of international governance
8. Infrastructure capacity (power)
9. Fragmentation within transport operations
10. Economic instability
11. Cyber crime
12. Severe weather events

The top 12 drivers where there is a low ability to respond are shown in Graph MD2:
10. Communication infrastructure failure
11. Poor planning
12. Poor governance

PRIORITY ACTIONS

The following were voted as the top priorities to be considered with regards to infrastructure:
1. Improve policy coherence and better integrated planning for infrastructure.
2. Improve governance and controls in the design, construction and commissioning of infrastructure.
3. Engage all stakeholders to use public-private collaboration models for development of infrastructure.
4. Improve appropriate education and training in accommodating environmental aspects in the design and maintenance of infrastructure.
5. Improve cyber awareness and connectivity related to infrastructure.
6. Focus on technological education for the planning, design, and construction of infrastructure.

These priorities reflect the particular need for improved policy coherence and better integrated planning for infrastructure, improved governance and control, better engagement with the private sector, improved appropriate education, in particular technological education as well as better cyber awareness.
MADRID WORKSHOP - PLACEMENT OF DRIVERS

Graph MD1 - High Potential Impact and High Ability to Respond
MADRID WORKSHOP - PLACEMENT OF DRIVERS

Graph MD2 - High Potential Impact and Low Ability to Respond

HIGH POTENTIAL IMPACT AND LOW ABILITY TO RESPOND

- CYBER CRIME
- INFRASTRUCTURE CAPACITY (ROADS)
- LACK OF ACCESS TO INFORMATION/DATA
- AIR POLLUTION
- AVAILABILITY OF LABOUR
- RELIANCE ON SPECIFIC CUSTOMERS
- SEVERE WEATHER EVENTS (E.G. TORNADO, ETC)
- INFRASTRUCTURE CAPACITY (RAIL)
- UTILITIES INFRASTRUCTURE FAILURE
- COMMUNICATION INFRASTRUCTURE FAILURE
- POOR PLANNING
- POOR GOVERNANCE
- FAILURE OF INTERNATIONAL GOVERNANCE
- INFRASTRUCTURE CAPACITY (POWER)
- ECONOMIC INSTABILITY
- CRIME/TERRORISM
- FLOODING
- EXTREME COLD WEATHER
- FAILURE OF NATIONAL GOVERNANCE
- INTRODUCTION OF NEW BORDER TARIFFS
- FRAGMENTATION WITHIN TRANSPORT OPERATIONS
- LAND CONTAMINATION
- EXTREME HOT WEATHER
- ECOSYSTEM DEGRADATION
- DISEASE
- WATER SCARCITY AND CONTAMINATION
- POVERTY AND INEQUALITY
- CHANGING SHIPPING ROUTES
- INDUSTRIAL ACCIDENTS
- BUILDINGS COLLAPSE
- TRANSPORT INFRASTRUCTURE ACCIDENTS

High Potential Impact and Low Ability to Respond
High Potential Impact and High Ability to Respond
Other responses
Manchester
06.02.2019

Food supply chain infrastructure is well-developed in the United Kingdom. Manchester was chosen for the workshop as it represents the current realities in the UK adequately.

ATTENDANCE

The following companies were represented by senior delegates:

- Liverpool John Moores University (Department of Maritime and Mechanical Engineering)
- Manchester City Council (Government)
- Campden BRI (Food and beverage industry)
- Associated British Ports - ABP (Port operator)
- Lloyds Register Foundation (Sponsor)
SHOCKS AND STRESSES

Shocks and stresses are shown in the graphs MC1 and MC2, in terms of which organisations are well positioned to respond and therefore should develop actions, and which organisations are poorly positioned to respond and therefore need to consider how they would respond and recover.

The top 12 drivers where there is a high ability to respond are shown in graph MC1:

1. Poor planning
2. Lack of access to information / data
3. Flooding
4. Industrial accidents
5. Availability of labour
6. Disease
7. Poor governance
8. Transport infrastructure accidents
9. Buildings collapse
10. Water scarcity and contamination
11. Crime / terrorism
12. Communication infrastructure failure

The top 12 drivers where there is a low ability to respond are shown in Graph MC2:

1. Infrastructure capacity (roads)
2. Infrastructure capacity (power)
3. Communication infrastructure failure
4. Cyber crime
5. Economic instability
6. Extreme cold weather
7. Failure of international governance
8. Severe weather events (e.g. tornado, etc)
9. Failure of national governance
10. Utilities infrastructure failure
11. Water scarcity and contamination
12. Introduction of new border tariffs

PRIORITY ACTIONS

The following were voted as the top priorities to be considered with regards to infrastructure:

1. Influence joined up government policy regarding infrastructure for all modes, namely rail, road, ports and access to these modes.
2. Education on why resilience of infrastructure is so important
3. Business continuity plans when infrastructure fails (e.g. alternative suppliers, collaboration, etc.)
4. Best practice guides for the design, construction and commissioning of infrastructure.
5. Register of the resilience rating of key infrastructure.
6. Open data platform on environmental events that may impact infrastructure.
7. Intermodal supply chains to integrate infrastructure for all modes.
8. Web-based Transport Analysis Guidance (Webtag) of the Department for Transport, to have an infrastructure resilience factor.
9. UK governance of food supply infrastructure and not only quality of food.

These priorities reflect the particular need for improved integration of government policy for all modes, namely rail, road, ports and access to these modes, education on why resilience of infrastructure is so important, business continuity plans, best practice guides, register of resilience rating of key infrastructure and integrated intermodal infrastructure. It is important to note that the discussions were dominated by the uncertainties around Brexit and related policy implications.
MANCHESTER WORKSHOP - PLACEMENT OF DRIVERS

Graph MC1 - High Potential Impact and High Ability to Respond
MANCHESTER WORKSHOP - PLACEMENT OF DRIVERS

Graph MC2 - High Potential Impact and Low Ability to Respond

- Infrastructure Capacity (Roads)
- Infrastructure Capacity (Power)
- Communication Infrastructure Failure
- Cyber Crime
- Economic Instability
- Extreme Cold Weather
- Failure of International Governance
- Severe Weather Events (e.g., Tornado, etc.)
- Failure of National Governance
- Utilities Infrastructure Failure
- Water Scarcity and Contamination
- Introduction of New Border Tariffs
- Extreme Hot Weather
- Poverty and Inequality
- Infrastructure Capacity (Rail)
- Flooding
- Disease
- Crime/Terrorism
- Reliance on Specific Customers
- Land Contamination
- Air Pollution
- Changing Shipping Routes
- Ecosystem Degradation
- Poor Planning
- Availability of Labour
- Poor Governance
- Buildings Collapse
- Fragmentation Within Transport Operations
- Lack of Access to Information/Data
- Industrial Accidents
- Transport Infrastructure Accidents

- High Potential Impact and Low Ability to Respond
- Other responses
New York
27.02.2019

Food supply chain infrastructure is well-developed in the United States of America. New York was regarded as a good location to represent current realities in the food supply chain on the east coast.

ATTENDANCE

The following companies were represented by senior delegates:

- City College (Tertiary education)
- Gateway JFK (Industrial Business District)
- HDR (Architects)
- KK and P (Food systems consultants)
- NJTPA (Transportation planning authority)
- NYC Department of Transportation
- NYC Economic Development Corporation
- Port Authority of New York and New Jersey
- Philadelphia Office of Emergency Management (OEM)
- UPS (Logistics service provider)
SHOCKS AND STRESSES

Shocks and stresses are shown in the graphs NY1 and NY2, in terms of which organisations are well positioned to respond and therefore should develop actions, and which organisations are poorly positioned to respond and therefore need to consider how they would respond and recover.

The top 12 drivers where there is a high ability to respond are shown in graph NY1:

1. Availability of labour
2. Communication infrastructure failure
3. Severe weather events
4. Poor planning
5. Transport infrastructure accidents
6. Infrastructure capacity (roads)
7. Crime/terrorism
8. Changing shipping routes
9. Reliance on specific customers
10. Flooding
11. Cyber crime
12. Buildings collapse

The top 12 drivers where there is a low ability to respond are shown in Graph NY2:

1. Severe weather events (e.g. tornado, etc)
2. Infrastructure capacity (rail)
3. Infrastructure capacity (power)
4. Flooding
5. Availability of labour
6. Communication infrastructure failure
7. Crime/terrorism
8. Economic instability
9. Disease
10. Water scarcity and contamination
11. Utilities infrastructure failure
12. Infrastructure capacity (roads)

PRIORITY ACTIONS

The following were voted as the top priorities to be considered with regards to infrastructure:

1. Application of green technology in the design, construction and commissioning of infrastructure.
2. Development of the cross harbour intermodal tunnel between New Jersey and Long Island.
3. Public awareness and education on why resilience of infrastructure is so important.
4. Sustainable development of infrastructure.
5. Vocational training with regards to the design, construction and commissioning of infrastructure.
6. Development of resilient infrastructure networks and hardware
7. Data analytics; such as preventative warning systems on vulnerable infrastructure.
8. Increased automation (robotics, autonomous vehicles) in the design, construction and commissioning of infrastructure.

These priorities reflect the particular need for sustainability, regional intermodal connectivity, public awareness and education on importance of resilience of infrastructure, vocational training, data analytics, increased automation and improved governance and control of infrastructure.
NEW YORK WORKSHOP - PLACEMENT OF DRIVERS

Graph NY1 - High Potential Impact and High Ability to Respond

- Availability of Labour
- Communication Infrastructure Failure
- Severe Weather Events (e.g., tornado, hurricane)
- Poor Planning
- Transport Infrastructure Accidents
- Infrastructure Capacity (Roads)
- Crime/Terrorism
- Changing Shipping Routes
- Reliance on Specific Customers
- Flooding
- Cyber Crime
- Buildings Collapse
- Introduction of New Border Tariffs
- Ecosystem Degradation
- Lack of Access to Information/Data
- Industrial Accidents
- Infrastructure Capacity (Rail)
- Economic Instability
- Fragmentation within Transport
- Failure of National Governance
- Extreme Cold Weather
- Extreme Hot Weather
- Air Pollution
- Land Contamination
- Disease
- Infrastructure Capacity (Power)
- Water Scarcity and Contamination
- Utilities Infrastructure Failure
- Failure of International Governance
- Poverty and Inequality

Legend:
- High Potential Impact and Low Ability to Respond
- High Potential Impact and High Ability to Respond
- Other responses
NEW YORK WORKSHOP - PLACEMENT OF DRIVERS

Graph NY2 - High Potential Impact and Low Ability to Respond

- SEVERE WEATHER EVENTS (E.G. TORNADO, TYPHON)
- INFRASTRUCTURE CAPACITY (RAIL)
- INFRASTRUCTURE CAPACITY (POWER)
- FLOODING
- AVAILABILITY OF LABOUR
- COMMUNICATION INFRASTRUCTURE FAILURE
- CRIME/ TERRORISM
- ECONOMIC INSTABILITY
- DISEASE
- WATER SCARCITY AND CONTAMINATION
- UTILITIES INFRASTRUCTURE FAILURE
- INFRASTRUCTURE CAPACITY (ROADS)
- CYBER CRIME
- INTRODUCTION OF NEW BORDER TARIFFS
- FRAGMENTATION WITHIN TRANSPORT
- FAILURE OF NATIONAL GOVERNANCE
- FAILURE OF INTERNATIONAL GOVERNANCE
- EXTREME COLD WEATHER
- EXTREME HOT WEATHER
- POOR GOVERNANCE
- POOR PLANNING
- BUILDINGS COLLAPSE
- ECOSYSTEM DEGRADATION
- LACK OF ACCESS TO INFORMATION/DATA
- TRANSPORT INFRASTRUCTURE ACCIDENTS
- CHANGING SHIPPING ROUTES
- RELIANCE ON SPECIFIC CUSTOMERS
- INDUSTRIAL ACCIDENTS
- AIR POLLUTION
- LAND CONTAMINATION
- POVERTY AND INEQUALITY

Colors:
- Green: High Potential Impact and Low Ability to Respond
- Grey: High Ability to Respond
- Black: Other responses
San Francisco
21.03.2019

Food supply chain infrastructure is well-developed in the United States of America. San Francisco was regarded as a good location to represent current realities in the food supply chain on the west coast.

ATTENDANCE
The following companies were represented by senior delegates:
- Urban / Regional Planning Consultants
- Sustainable Agriculture Education - SAGE (Tertiary education)
- Foodservice Partners (Food production and delivery)
- Off the Grid (Food and catering services)
- City of Oakland (Government)
- Bay Area UASI (Urban Areas Security Initiative)
- California Resiliency Alliance (Cross-sector information sharing partnerships)
- Climate Resilience (Industry)
- Contra Costa County Office of the Sheriff (Government)
- U.C. Berkeley (Tertiary education)
- California Department of Food and Agriculture (Government)
- Atelier Ten (Consultants)
- San Francisco Produce Market
SHOCKS AND STRESSES

Shocks and stresses are shown in the graphs SF1 and SF2, in terms of which organisations are well positioned to respond and therefore should develop actions, and which organisations are poorly positioned to respond and therefore need to consider how they would respond and recover.

The top 12 drivers where there is a high ability to respond are shown in graph SF1:

1. Poor planning
2. Water scarcity and contamination
3. Utilities infrastructure failure
4. Poor governance
5. Severe weather events
6. Disease
7. Lack of access to information / data
8. Extreme hot weather
9. Crime / terrorism
10. Flooding
11. Land contamination
12. Availability of labour

The top 12 drivers where there is a low ability to respond are shown in Graph SF2:

10. Lack of access to information/data
11. Utilities infrastructure failure
12. Fragmentation within transport operations

PRIORITY ACTIONS

The following were voted as the top priorities to be considered with regards to infrastructure:

1. Viewing and making decisions about infrastructure as an integrated system versus an independent system.
2. Development of emergency food system resiliency hubs.
3. Improving understanding of systems, their interdependencies, and cascading impacts on infrastructure (several tiers down).
4. Understanding life cycle impact in the design, construction and commissioning of rail infrastructure.
5. Federal, state, or regional mandates to create a coordinated planning and response effort (public and private) in the rehabilitation of damaged infrastructure.

These priorities reflect the particular need for an integrated perspective on infrastructure, development of food hubs, improve understanding of systems and their interdependencies as well as life cycle impact and supportive mandates for coordinated planning on all levels in government.
SAN FRANCISCO WORKSHOP - PLACEMENT OF DRIVERS

Graph SF1 - High Potential Impact and High Ability to Respond

- **Availability of Labour**
- **Communication Infrastructure Failure**
- **Severe Weather Events (e.g. tornado...)**
- **Poor Planning**
- **Transport Infrastructure Accidents**
- **Infrastructure Capacity (Roads)**
- **Crime/Terrorism**
- **Changing Shipping Routes**
- **Reliance on Specific Customers**
- **Flooding**
- **Cyber Crime**
- **Buildings Collapse**
- **Introduction of New Border Tariffs**
- **Ecosystem Degradation**
- **Lack of Access to Information/Data**
- **Industrial Accidents**
- **Infrastructure Capacity (Rail)**
- **Economic Instability**
- **Fragmentation within Transport...**
- **Failure of National Governance**
- **Extreme Cold Weather**
- **Extreme Hot Weather**
- **Air Pollution**
- **Land Contamination**
- **Disease**
- **Infrastructure Capacity (Power)**
- **Water Scarcity and Contamination**
- **Utilities Infrastructure Failure**
- **Failure of International Governance**
- **Poor Governance**
- **Poverty and Inequality**

**Legend:**
- Green: High Potential Impact and Low Ability to Respond
- Grey: High Potential Impact and High Ability to Respond
- Light Grey: Other responses

**Notes:**
- Graph SF1 illustrates the high potential impact and ability to respond for various drivers affecting global food supply chains.
- The graph is color-coded to indicate the level of impact and response ability.
SAN FRANCISCO WORKSHOP - PLACEMENT OF DRIVERS

Graph SF2 - High Potential Impact and Low Ability to Respond