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AGENDA SETTING SCOPING STUDIES

RESILIENT FOUNDATION THROUGH SYSTEMS THINKING

SUMMARY DOCUMENT

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INTRODUCTION

This document is a summary of the full report into the findings of MMI Engineering's investigation into resilience practice within the UK's critical infrastructure industry, applying a systems engineering approach. This research was performed as part of the Resilience Shift, a Lloyd's Register Foundation[1] initiative delivered by Arup. The programme will contribute to influencing the education of engineers; creating change in practice through tools, technologies and piloting, as well as influencing standards and regulations; and catalysing a global network of resilience change leaders.

Purpose of Study

This study provides a review of current practise across critical infrastructure sectors, based on a series of interviews undertaken with stakeholders from various infrastructure organisations. Gaps and opportunities were identified and an outline for a value-based approach to diagnosing, measuring and building resilience is suggested.

The performance of critical infrastructure sectors were also comparatively assessed using the suggested approach value metrics.

Context

The World is entering what has been termed a VUCA (Volatile, Uncertain, Complex and Ambiguous) future. There is a "perfect storm" of stress factors such as climate change, resource scarcity, wealth inequality, an ageing population, increasing non-communicable disease, housing shortages, congestion, poor air quality, the automation of more and more of the economy, but to name a few. Many of these stress factors increase the impact and frequency of shock incidents such as flooding or heatwaves or make the systems that support our way of life more susceptible to them.

This is happening at a time of continuing public-sector cuts, potentially reducing the capacity of the state to respond to shocks or adapt to meet the challenges posed by stresses. The UK has a finite budget to spend on National Infrastructure and the effectiveness of that spending directly impacts our nations productivity and therefore competitiveness. In light of Brexit, making sure we maximise our resource spend ensuring every pound delivers the maximum productivity gains in the long term is even more important and must be the government's number one priority. It is not acceptable to invest our finite resources in large infrastructure projects that we know will not deliver the long-term benefits needed or will be obsolete before they can show a return on

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[1] Lloyd's Register Foundation is a charitable foundation, helping to protect life and property by supporting engineering-related education, public engagement and the application of research.

investment. The money could be much more effectively invested where there is a more likely future need.

For many, resilience holds the key to meeting these challenges in the long term. Moving our society away from a reactive, response focused strategy for shock and stress factors and moving instead to a proactive, preventative strategy and through to a foresight model where resilience is seen as a means of exploiting opportunities in the future. Within risk management circles this is referred to as "the shift left"; from response to prevention and then opportunity.

UK Infrastructure

Within the UK, infrastructure strategy is steered by the National Infrastructure Commission (NIC) and implementation is overseen by the Infrastructure and Projects Authority (IPA). The NIC has produced a National Infrastructure Delivery Plan (NIDP) which defines the priorities for investment over the next 5 years (2016-2021). Infrastructure here is split into two groups:

- Economic infrastructure
    - Transport – Road, rail, airports and ports
    - Energy
    - Communications – Mainly focussed on digital communications
    - Flood & Coastal Erosion
    - Science & Research
    - Waste
    - Water
- Social Infrastructure
    - Education – Schools
    - Health – Hospitals and laboratories
    - Justice - Prisons
    - Housing & Regeneration

The NIDP explicitly cites resilience in its Improving Delivery and Performance section. Therefore, in theory, resilience is being built in to any new infrastructure projects. Resilience is defined as "*the ability of infrastructure to withstand, prevent, adapt to or rapidly recover from disruptive challenges. This includes 4 characteristics to improving systemic resilience:*

- *Resistance: preventing damage or disruption by strengthening or protecting assets, for example building flood defences to protect transport networks*
- *Reliability: designing assets to operate under a range of conditions, for example designing electrical cables to operate in extreme temperatures*

- *Redundancy: making backup installations or spare capacity available in networks and systems to enable operations to be switched or diverted, for example installing back-up data centres*

- *Response and recovery: understanding the weaknesses in networks and systems and have arrangements in place to respond quickly to restore services, for example ensuring an organisation is prepared to rapidly respond to disruptions"*

The NIDP also highlights the fact that infrastructure projects may be interdependent, i.e. there could be "*mutual dependence between 2 or more assets or networks, which impacts their efficient and effective functioning.*"

The same 4 approaches to improving systemic resilience are cited within the government's Sector Security and Resilience Plans. These set out the resilience of the UK's most important infrastructure to the relevant risks identified in the National Risk Assessment. The plans are produced annually and are placed before ministers to alert them to any perceived vulnerabilities, with a programme of measures to improve resilience where necessary, in keeping with legal and regulatory frameworks, industry standards, licence agreements and business models.

Summary of key findings from interviews and review of current practice

A number of interviews were conducted across infrastructure sectors with those responsible for resilience. Key findings included:

- A lack of incentives or mandates for providers to work proactively with other providers and sectors;

- No incentives or mandate to deliver cross-sectoral resilience;

- A focus on response and recovery rather than proactive mitigation measures;

- Industry structure and fragmentation (particularly in the power sector) means that resilience is not joined up (no golden thread);

- The impact of disruption on the UK was not being measured (e.g. loss of productivity) – better understanding of losses assists with building a business case for investment;

- No comprehensive approach to resilience: i.e. future trends being considered separately from day-to-day resilience;

- A review of the National Risk Register identified a number of areas for improvement.

A NEW APPROACH

THE IMPORTANCE OF DEFINING AND MEASURING VALUE

A resilient organisation has a clear vision that understands value, its dynamic nature and brings each part of the business together to sustainably and coherently create and protect that value within a disruptive and changing environment. Coupled to this, a resilient organisation is far sighted, coherent and has high adaptive capacity, allowing opportunities to be exploited and threats to be avoided.

Figure 1 below has the core value creation process running through the centre of the model with strategic direction functions above and verification functions below.
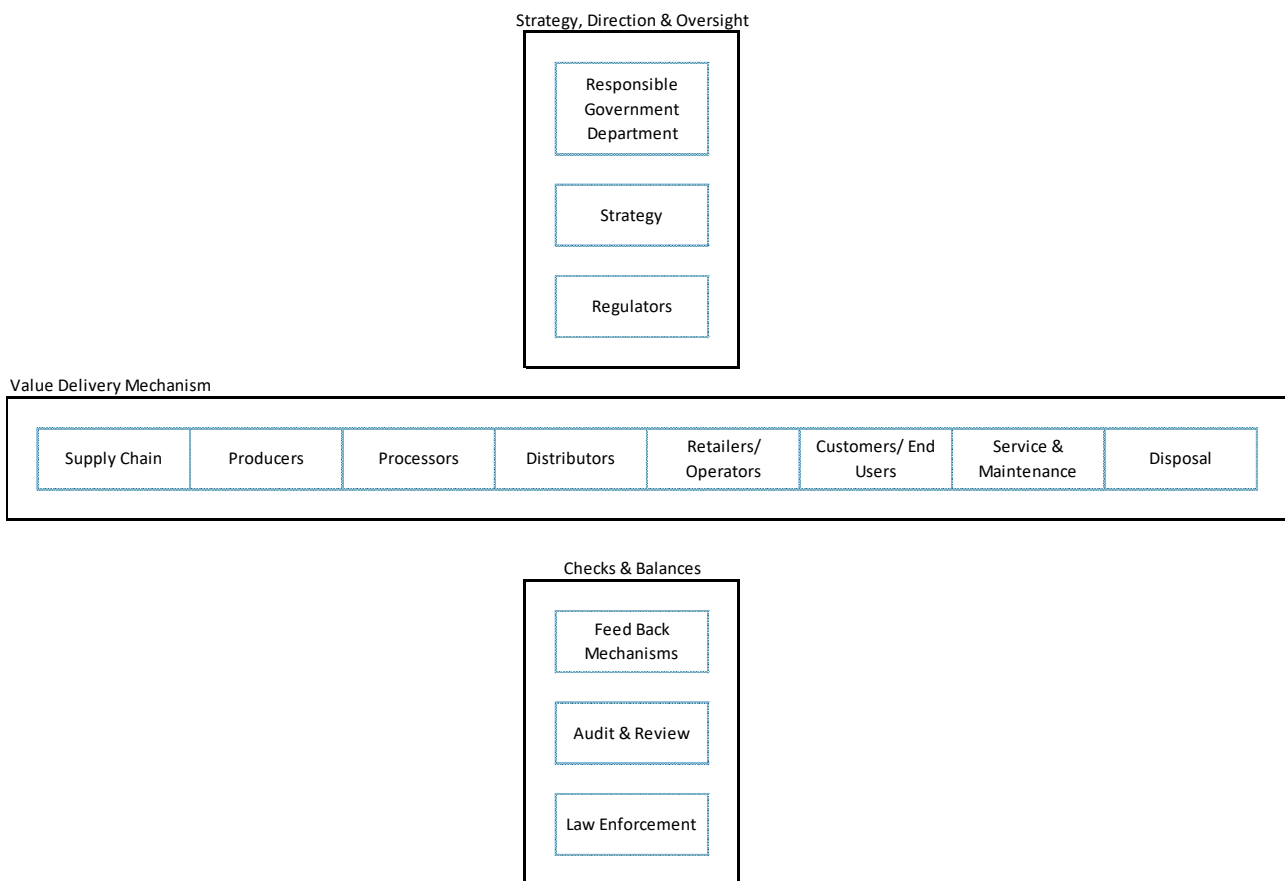
Strategy, Direction & Oversight

Responsible Government Department
Strategy
Regulators

Value Delivery Mechanism

Supply Chain	Producers	Processors	Distributors	Retailers/ Operators	Customers/ End Users	Service & Maintenance	Disposal

Checks & Balances

Feed Back Mechanisms
Audit & Review
Law Enforcement

Figure 1 Generic Infrastructure Industry Structure

As *Figure 1* shows, each type of infrastructure has a responsible government department which is specific to the type of infrastructure and main stakeholder groups concerned. There is usually a body responsible for the long-term strategy and governance of each

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infrastructure type. In most cases this is the National Infrastructure Commission and the Infrastructure & Projects Authority, with notable exceptions. Most infrastructure also has a regulator exercising autonomous authority to ensure competitiveness and fairness. All infrastructure has a core value chain through which services and supplies are delivered. In many areas, there has been significant integration of the value chain which can help or hinder overall resilience depending on how it is managed. All infrastructure types also have checks and balances such as law enforcement, complaints procedures and audit requirements. It is the function of strategic leadership to view infrastructure as a whole, understanding the inter-dependencies, this is why the work of the National Infrastructure Commission and Infrastructure & Projects Authority is so critical and must be consistent across all infrastructure and take into account a wide array of shock and stress factors.

Value could be seen as the golden thread running through a whole industry. Using this as a starting point, developing an understanding of complex systems is possible, as well as designing a targeted set of assessment metrics. Value is also the key to unlocking one of the most difficult resilience problems; what is a vulnerability and how do you prioritise vulnerabilities?

In Figure 2, value has been defined in the following ways, (although should be tailored to each organisation); **financial** value (profit, meeting shareholder requirements, affordability for customers etc); the central **utility** (e.g. usefulness, purpose, benefit, scope, criticality to a system); **quality** (specified requirements, reliability, consistency, effectiveness at meeting needs and wants); **time** (improvements in productivity, control and efficiency; the ability to manage and respond to change; the ability to create and save time); reputation and **social** value (culture, integrity, trust, aspiration, meaning, belonging, desire, security, public perception, social good); and finally **environment** (enhancing natural environment, reducing emissions, environmental stewardship, etc.) It is important to note that reputational valuations are the most complex and colour all others. They are a mixture of perception and emotion.

In order to protect value, we need to understand where and how it is vulnerable. To do that we need to understand the complete chain that creates value; from supply chain to sales and servicing and market communications. We then need to know the relative importance of each link in the chain in terms of delivering that value and then where the chain is susceptible to disruption/harm/failure or change; as well as where opportunities exist.
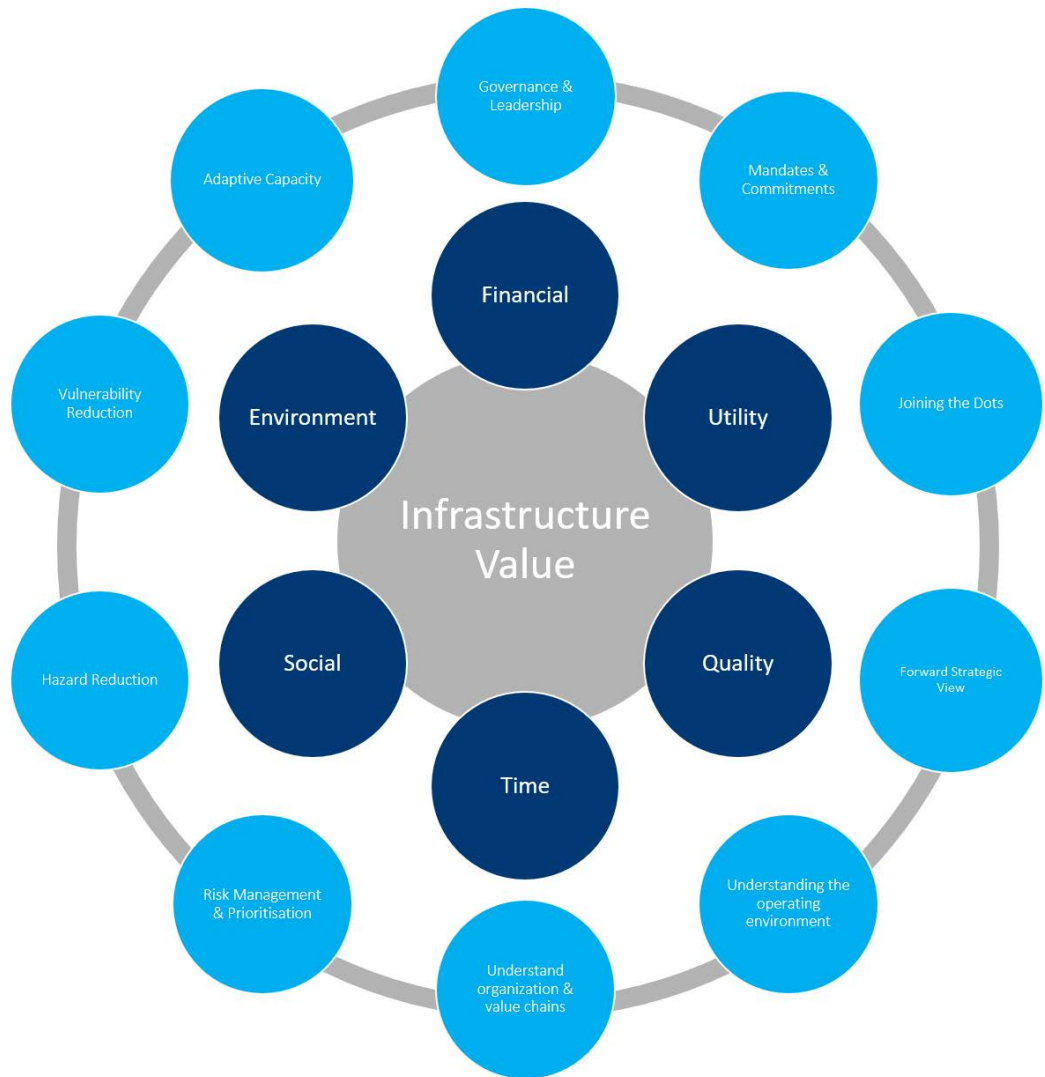
Figure 2 Value Framework

Based on the findings of this study there are a number of key areas that are essential for delivering resilience (protecting and realising value). Suggested grouping terms are provided below and shown in the outer circle of Figure 2 :

- Good governance & leadership

- Mandates & commitments

- Joining the dots

- Forward strategic View

- Understanding the operating environment

- - Shocks, stresses and future trends
- Understanding the organisation and value chains
  - Good information management & data sharing
- Risk management & prioritisation
- Resilience Capacity Building
  - Hazard reduction or avoidance
  - Vulnerability Reduction
  - Developing Adaptive Capacity (agility)

PROPOSED PROCESS

Infrastructure comprises complex systems of systems with diverse ownerships and subject to a range of shock and stress factors. Building the resilience capacity of infrastructure must be seen as an ongoing process of defining the core value and how it will change; assessing and analysing the constituent parts within the disruptive and changing environment. Based on a good understanding of the operating environment, clear direction and strategies to build the resilience of infrastructure are required, supported by appropriate leadership and governance. Initiatives to build resilience must be implemented whilst maintaining constant review; allowing for learning and adaptation of plans ensuring resilience capacity building meets the needs of the organisation now and in the future. The following process builds on the principles outlined earlier and provides a mechanism to build resilience over time. Taking the basis of value protection and realisation along with the important components for delivering resilience, a process has been developed which is shown in *Figure 18* and described below.
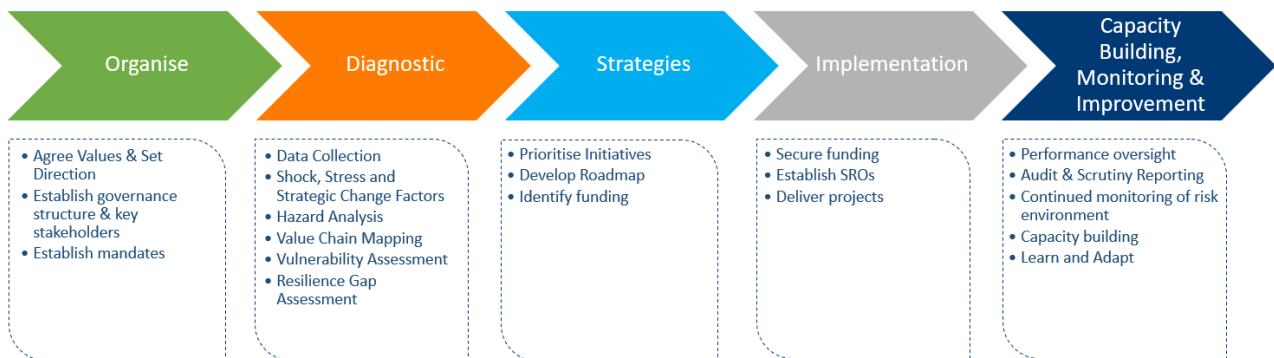

Organise	Diagnostic	Strategies	Implementation	Capacity Building, Monitoring & Improvement
• Agree Values & Set Direction • Establish governance structure & key stakeholders • Establish mandates	• Data Collection • Shock, Stress and Strategic Change Factors • Hazard Analysis • Value Chain Mapping • Vulnerability Assessment • Resilience Gap Assessment	• Prioritise Initiatives • Develop Roadmap • Identify funding	• Secure funding • Establish SROs • Deliver projects	• Performance oversight • Audit & Scrutiny Reporting • Continued monitoring of risk environment • Capacity building • Learn and Adapt

Figure 3 Proposed Infrastructure Resilience Building Process

1   Organise

GOVERNANCE & LEADERSHIP

Good governance and leadership are perhaps the two greatest determinants of success for a holistic resilience capacity building programme.

Themes around governance controls, accountability for decisions, the ability to prioritise competing agendas in an open and transparent way as well as good communications and collaboration came through strongly from stakeholders. What also came through clearly was the pivotal role of government and regulators in setting the conditions for effective infrastructure, resilience capacity building and collaboration to deliver more value through value chains. Regulators and the structure of incentives they put in place have a significant influence on market behaviour and some of that influence has unintended consequences.

Resilience is top down and bottom up; it needs to be driven by leadership but needs to empower employees and stakeholder to develop a resilient culture & behaviours.

MANDATES

At an infrastructure level, leadership needs to be supported by cross-organisational mandate and subject to the checks and balances of an inclusive, accountable, open and transparent governance system to prevent abuse of power or ineffective delivery and waste. This should include:

a)   Accountability for decisions

b)   The ability to prioritise competing agendas in an open and transparent way

c)   Good communications and collaboration

d)   Regulations & incentives to build resilience.

Mandates can take the form of statements of commitment, policy, business cases, legislation or regulation and are strengthened with incentives (the carrot and the stick).

COMMITMENT

The governance structures must maintain overall control of the resilience capacity building programmes. They must make a commitment to delivering the vision and improved resilience; agree the roadmap and supporting policies and strategies; assign resources; consult and engage with stakeholders; establish mandates for action; remove barriers and agree business cases for significant projects. The commitment can often be summarised within a short Resilience Policy.

JOINING THE DOTS

Statements such as "joining the dots" and "clear direction and structure" expressed the need for an overarching strategy for each infrastructure value chain that developed the infrastructure to meet future needs. For many types of infrastructure this role is delivered by the National Infrastructure Commission supported by the Infrastructure and Projects Authority; however, this is not true for all infrastructure leaving a significant infrastructure resilience gap. With infrastructure the principle of centralised planning, decentralised execution is essential if the UK's infrastructure is to be coherent.

Resilience requires breaking down the traditional silos to work together around a common goal. Relevant stakeholder groups need to be engaged, setting clear mandates for action, removing barriers, clarifying priorities, supporting information flows across boundaries and encouraging the right behaviours through example and enforcement. This is often best achieved through a cross sector forum with the right strategic representation. From this frame of reference and through further stakeholder engagement

the long-term vision for infrastructure can be constructed. The vision provides the golden thread that will link all the resilience capacity building initiatives together. It needs to include a well communicated desired end state.

FORWARD STRATEGIC VIEW

A common theme proving to be a strength or weakness for the organisations interviewed was the ability to take the long view of the operating environment. For example, the electricity sector is playing catch-up with technology and will struggle to fulfil the demand from rail electrification and the transition to electric vehicles. Also, there was limited reference made to the critical role infrastructure has regarding the productivity and therefore competitiveness of the nation; this is a fundamental of infrastructure. Those organisations that were better able to take that long view were in a position to anticipate market needs in advance and put effective strategies in place for their organisations to meet that need. Taking the long view must be based on effective data sources that allow projection and scenario hypothesis to be created from which relevant strategies can be developed. This should be seen as a reiterative function for the top level of governance in the organisation based on an ever-greater bank of data/information.

Linked to the ability to anticipate and to take forward action is the governance discipline of risk management. The ability to view risk management from a range of perspectives i.e. operational, tactical and strategic and looking outwards rather than just inwards is key to identifying potential threats and opportunities early.

2 Diagnostics

UNDERSTANDING THE OPERATING ENVIRONMENT

The starting point for developing more resilient infrastructure is to understand the operating environment. The key elements to understand are the value the infrastructure delivers, the value chain used to realise that value, threats to that value chain and opportunities represented in the environment. The value chain is in effect the structure of the industry including government and regulators. A key source for such information should be customers, investors and other stakeholders; their needs and expectations. The core value of the value chain acts as the golden thread that should link together strategies, governance controls, performance management metrics, risk management impacts assessment criteria etc. Additionally, data needs to be captured on the cost of disruptions, for example the loss in productivity, so that the business case for investing in resilience can be strongly made.

Additionally, a comprehensive risk assessment should be undertaken that considers shocks and stresses and incorporates horizon scanning for future trends and stress factors.

UNDERSTANDING THE ORGANISATION

The next part is understanding the organisation and the value chains that deliver the organisation's value and their susceptibility to the identified shocks and stresses.

The value chains will include people, processes, suppliers, physical infrastructure, virtual information as well as customers and the environment. These systems first need to be mapped and then the importance and vulnerability understood.

Taking stock of existing resilience capacity and how this will change over time in light of global and structural stress factors is an essential component of developing a resilience diagnostic. The current capability of the infrastructure/organisation to resist or respond to these factors would ideally be through proactive risk reduction measures, but also through the agility of the firm to respond, recover, learn and manoeuvre quickly. The resilience capacity of these value chains can be measured considering the following:

a) Measures taken to reduce vulnerability:

Terms such as strengthening, redundancy, protection and fail-safes are all forms of vulnerability reduction; however, vulnerability reduction cannot be systematically approached or designed until value is properly understood and all the elements needed to create that value. This can be described as vulnerability mapping and when performed in combination with a robust understanding of risk, can provide a prioritised programme of measures needed to reduce vulnerability starting with the areas of greatest need.

b) Measures taken to develop adaptive capacity (agility):

Adaptive capacity is the capacity of people, organisations, cities, regions, nations and trans-national organisations to anticipate, respond, learn and adapt to the changing environment. Measurable strategies for adaptive capacity include an effective response system that provides good preparation, response capability, recovery and the ability to learn, adapt and improve. Adaptive capacity can be seen as the capacity to effect change, adapt to a changing operating environment in line with or ahead of the speed of change. Adaptive capacity is a combination of many of the elements above and is characterised by a proactive and agile stance to identifying and responding to change.

The key enabler of adaptive capacity is data, leading to exploitable information. The more this information can be collected and shared throughout the value chain, the more adaptive that value chain will be, and by means of that, the more resilient each organisation within that value chain can be. Again, this level of integration must be built on a relationship of mutual trust, which is itself underpinned by resilient leadership, culture and behaviours. Technology and cyberspace represent significant threats and opportunities in this area for the future. It is clear that those organisations that are slow

to realise the potential of information sharing, integration and the use of information technologies to facilitate this, will be the ones that drop by the wayside. Although they may also be joined by organisations that fail to provide sufficient security in this area.

PRIORITIZATION

It is important that resilience building is prioritised to those areas with the greatest risk posed by those shocks and stresses that have the potential to cause the most disruption or realise the most potential opportunity. The gap between the risk and current measures can be determined as a means for prioritising action. This needs to lead to a gap analysis of current and future resilience demands against current and future capacity.

3   Strategies

The complexity of resilience capacity building at a whole infrastructure scale needs to be coordinated through a strategic planning process such as a roadmap or blueprint depending on methodology. There are hundreds of potential initiatives needed to cohesively and comprehensively build resilience. Lots of these strategies already exist, but coherence is needed to realise the co-benefits from joining these up around a common resilience goal focused on delivering value. Metrics need to be devised based on these core values in order to prioritise the various initiatives and form an overall roadmap.

Resilience Capacity Building will include the following types of strategy to achieve the following:

- o   Hazard reduction or avoidance
- o   Vulnerability Reduction
- o   Developing Adaptive Capacity (agility)

Some of the strategies may be legislative, some may be physical and some will be process or people orientated. These strategies needs to be prioritised based on need, benefit and interdependencies.

A robust business case should be developed that incorporates measurements of resilience benefit – e.g. reduction in disruption, increases in productivity.

4   Implementation

The implementation of the roadmap should be left to managers to deliver with control being maintained by leadership and governance structures through periodic or staged reporting. Portfolio, Program and Project Management methodologies promoted by the UK Cabinet Office (AXELOS) are recommended.

Governance arrangements support implementation by establishing Senior Responsible Owners (SROs); maintain executive control; removing barriers; stopping projects where necessary; ensure benefits are realized; publicly showing support and leading by example.

5 Monitor, Validate, Review, Learn and Adapt

Resilience building progress needs to be monitored to ensure outputs are being delivered on schedule and benefits are being realised. Audit, public scrutiny or regulatory oversight should provide assurance of fit and appropriate action. All capabilities delivered as part of the of resilience capacity building should be tested individually and exercised as part of wider systems with learning and recommendations feeding back to leadership and governance systems. This also applies to any real incidents or significant near misses that occur from which organisations can learn, adapt and be better prepared.

Leaders and organisations should expect learning to come from all disruptions so that infrastructure advances from disruptive experience, using it to increase adaptive capacity and ultimately increase competitive advantage. The focus needs to be on the realisation of broad resilience benefits rather than the short-term outputs of individual projects.

VALUE ASSESSMENT METRICS

To illustrate the importance of value as a diagnostic aid to understanding resilience the various infrastructure types were reviewed in terms of their effectiveness at delivering their potential value for stakeholders. In order to produce this assessment each infrastructure type was reviewed in terms of value expectations from its various stakeholder groups; initially focusing on the end user/customer and then including investors, suppliers and constituent organisations. Using the value model discussed above the following value criteria were created against which each infrastructure type was assessed:

FINANCIAL	VALUE FOR MONEY
	RETURN ON INVESTMENT
	STABLE AND LOW RISK OR HIGH RISK HIGH REWARD
	PROFITABLE
	EFFICIENCY
	APPRECIATION
	REVENUE
	CREDIT RATING
	WIN-WIN RELATIONSHIPS
UTILITY	DELIVERY OF BASIC SERVICE/SUPPLY
	FACILITATE PRODUCTION
	PREDICTABLE
	ON DEMAND
QUALITY	WITHIN RECOGNISED STANDARDS
	MEETING SERVICE EXPECTATIONS
	EASY COMMUNICATION & ISSUE RESOLUTION WHEN NECESSARY
	OPEN & TRANSPARENT
	UNOBTRUSIVE
	SAFE & SECURE
	MINIMAL DISRUPTION
	LEARNING & IMPROVING
	CONSISTENCY

TIME	IMPROVE PRODUCTIVITY
	MINIMAL WAITING
	24/7
SOCIAL	CUSTOMER SATISFACTION
	DEPENDABLE
	TRUSTWORTHY
	ENVIRONMENTALLY FRIENDLY
	NOT PROFITEERING
	FAIR
	RESPONSIBLE
	FUTURE READY
	REPUTATION ENHANCING
ENVIRONMENTAL	ENVIRONMENALLY FRIENDLY
	REDUCED IMPACT
	REDUCED EMISSIONS
	SUSTAINABLE
	OPTIMISING ECO-SYSTEM SERVICES
	ENVIRONMENTAL STEWARDSHIP
	SUSTAINABLE LAND USE
	ADAPTING TO CLIMATE CHANGE

THE COMPARATIVE VALUE ASSESSMENT

The above value assessment criteria were weighted in terms of relative importance and then each type of infrastructure (this report is focused on English infrastructure owing to the stakeholders interviewed) was assessed in terms of maximum relative value and actual relative value. These scores were then complied and an overall assessment score produced. These scores were as shown in Table 1.

Table 1 Results of Comparative Value Delivery Assessment

Transport	
Road	56%
Rail	62%
Air	71%
Sea	74%
Public	62%
Power	77%
Communications	69%
Flood & Coastal Erosion	82%
Science & Research	81%
Waste	
Solid	81%
Water/Sewage	83%
Water	88%
Education	69%
Health	67%
Justice - Prisons	72%
Housing & Regeneration	73%
Cyberspace	88%
Emergency Services	76%
Finance	66%
Defence	84%
Civil Nuclear	80%
Chemicals	82%

There does appear to be a link between state ownership, strength of regulation and value rating. Referring to the systems diagrams for each infrastructure points to some potential reasons for these disparities especially when viewed through the lens of the resilience themes that came through from the interviews.

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Highways infrastructure in particular is a very fragmented value chain. No single entity has a **strategic view** of the whole or a **strategy** or **governance controls** to support it; there is no golden thread joining the values of these organisations together. Highways England is only responsible for 2% in terms of miles of the network. Although at project and operational levels **risk management** is said to be very effective, the strategic risk picture is less well considered resulting in less effective planning for long term strategic issues and a focus on technical solutions to what are more often behavioural problems. There is also not sharing of risk understanding between organisations within the value chain – there is no risk golden thread and therefore there is no **enterprise risk** approach for the whole value chain. Many of the organisations appear to have a poor understanding of their **value capacity** and their **vulnerabilities** and how they could be impacted by shocks and stresses within the **operating environment**. Many of the organisations have a very effective response capability for short term disruptive incidents, but appear to have poor **adaptive capacity** when it comes to longer term issues. The sharing of **information and integration** of information management systems would significantly improve overall situational awareness for all organisations in the value chain and users/customers/suppliers.

Conversely, the water industry scored more highly. This better performance can be attributed to a very well-integrated value chain with a good strategic view that understands the changing environment with broad strategies prepared for the future. The industry seems the be well regulated and close relationships seem to exist between many of those involved.

For systems to be engineered to incorporate higher levels of resilience the systems resilience performance standards need to be defined and then turned into performance based requirements. Without performance based requirements, the system cannot be designed, assured and investment decisions are less likely to be made. Requirements are a series of measurable and defined needs taken from all stakeholders; and form the basis of capabilities/ functions or features to be engineered into the overall system solution. Requirements need to be defined in terms of outcomes not process e.g. not define roles and responsibilities but enable accountability. In this way, having value as the starting point for systems engineering helps focus all requirements on the outcome, the golden thread, which should always be to deliver value.

Once values are agreed and understood, these themselves can be turned into broad user requirements around which a suite of more specific system requirements can be built e.g. "on demand" can be turned into a "SMART" (Specific, Measurable, Attainable, Realisable, Traceable) requirement when directly applied to the relevant context as "on demand" has clear implications on time scales and availability. Setting requirements to meet social values will always prove more difficult as they are hard to measure and any measurement will usually be retrospective. Requirements are often focused on delivering utility, quality and time values and to a lesser extent financial values. This shows a gap in current practice as financial and social factors are more likely to be the final determinants of investment decisions.

CONCLUSION

There is significant opportunity to improve the resilience of UK Infrastructure. A more joined-up cross-sectoral approach is needed based on protecting the value delivered to the UK and its citizens. A clear method for prioritising investment in resilience building is required based on a comprehensive review of the whole system and its dependencies, a clear understanding of the value chains that deliver this and those areas most vulnerable to future shocks and stresses. The methodologies outlined in this document are a starting point for further development.

Next Steps

- A further study testing the proposed framework would be useful, to build a robust model and provide greater confidence in the results.

- Applying the outcomes from this report to different infrastructure and a different scale would test the transferability and scalability of the studies outcomes.

- The subjective nature of the assessments in this study would be strengthened through a broader survey based study on public and industry value perceptions.

- Working closely with one industry to prove the value of the outcomes would help prove the business case for taking such a resilience approach and encourage further investment in this area.

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