



Emerging Critical Infrastructure Vulnerabilities: a perspective of systems thinking & reflective scenario planning in the United Arab of Emirates

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Goal

- By drawing upon an analysis of CI vulnerabilities within the UAE through the application of systems thinking and scenario planning, we illustrate how a network mindset can support critical infrastructure protection by revealing the hyper/hybrid risks (Masys et al., 2014), the systemic complexity and interdependency-induced vulnerability.

Outcomes (a work in progress)

- To develop networked understanding of the vulnerability induced by complex, nonlinear and dynamic interconnectivity and interdependence that exists in modern critical infrastructure.
- To develop isomorphic foresight through reflective scenario planning practice that recognizes the inherent uncertainty in the complex hybrid-risk landscape as it pertains to modern critical infrastructure.
- To develop a new disaster risk reduction paradigm required to support the networked understanding of hybrid-risks and building organizational resilience as it pertains to critical infrastructure.

Critical Infrastructure

- Critical Infrastructure (CI) has become fundamental to the functioning of our economy and the public wellbeing in all countries.
- Modern society increasingly depends on the goods and services provided by critical infrastructures.



Complexity

- The inherent complexity in modern social-technical systems challenges our understanding pertaining to their structure, processes and dynamics and thereby our understanding regarding the vulnerabilities and disaster risk reduction of critical infrastructure.



Dubai CI Interdependencies

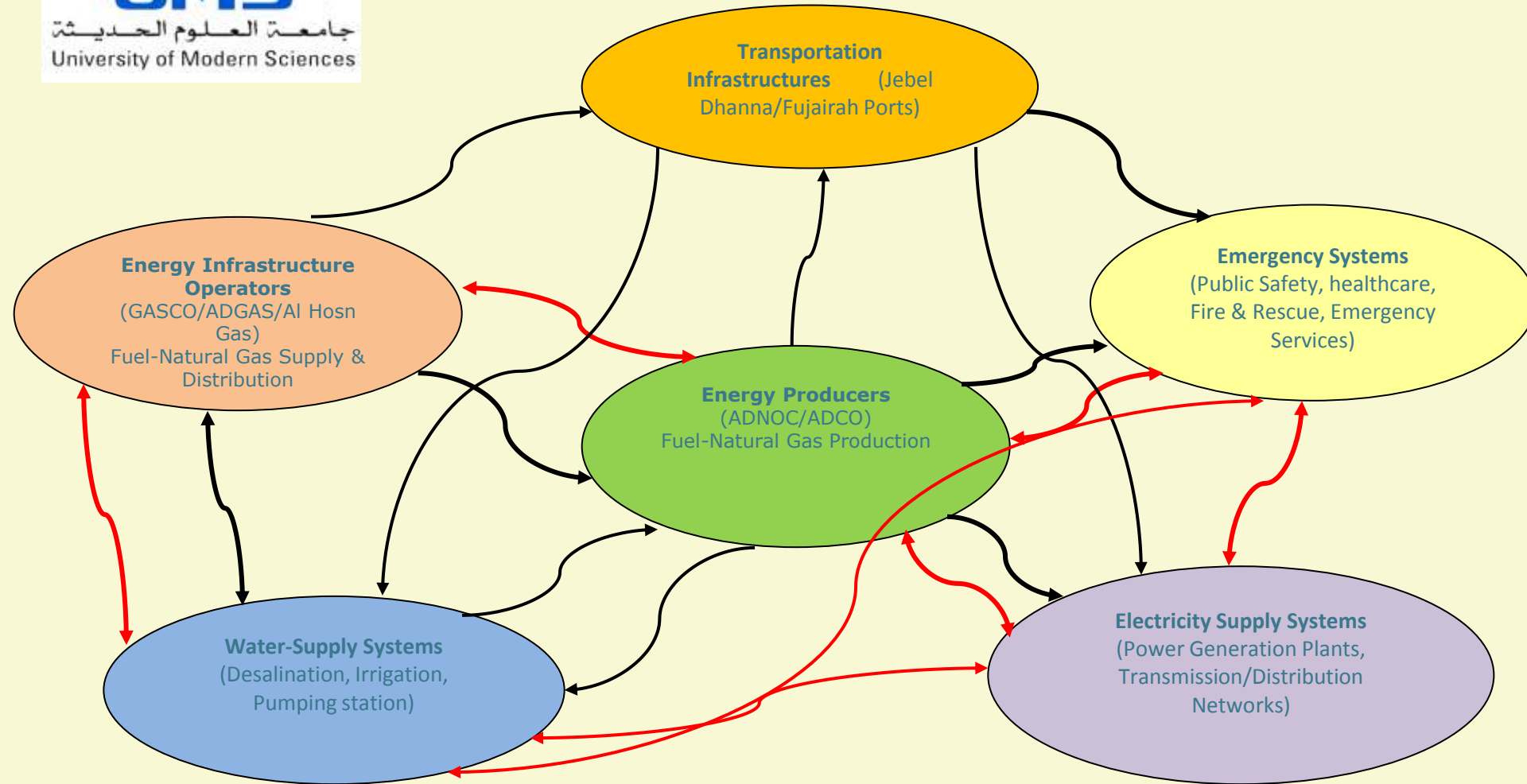


Figure 1. Networked Interdependence between Energy Systems and other Critical Infrastructures in the UAE

Vulnerabilities in CI

- Vespignani (2010:984) argues that ‘...relatively localized damage in one system may lead to failure in another, triggering a disruptive avalanche of cascading and escalating failures.
- Understanding the fragility induced by multiple interdependencies is a major challenge in the design of resilient infrastructures
- How can we better design for resilience?

UAE Critical Infrastructure

- Critical infrastructure protection investment in the GCC region as a whole is forecasted to increase from \$5.74 billion to \$13.07 billion by 2018.
- In the context of UAE, ever since 2007 with the establishment of NCEMA, disaster resilience of critical infrastructure has been a top priority on the government agenda.

UAE CI Resilience

- UAE is currently the frontrunner in the GCC region in regards to both the awareness of emerging security challenges and the government's approach in improving critical infrastructure protection strategies and practices up to par with standards in the developed countries.

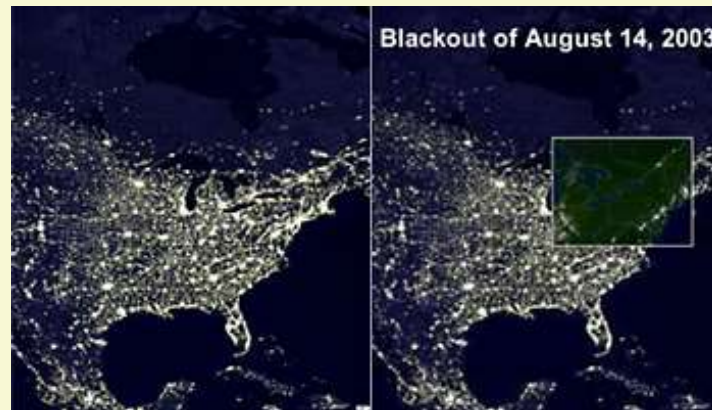
Vulnerability to CI

- Recent disasters such as Japan Earthquake/Tsunami (2011) and Typhoon Haiyan (2013) highlight the vulnerability of critical infrastructure to conjoint events of social, natural and technical disasters.



Resilient Infrastructures

- Vespignani (2010:984) argues that ‘...relatively localized damage in one system may lead to failure in another, triggering a disruptive avalanche of cascading and escalating failures. Understanding the fragility induced by multiple interdependencies is one of the major challenges in the design of resilient infrastructures’.



Understanding CI: designing for resilience

- Therefore, it is argued that events of socio-technical failure can be understood only by analyzing its paradigm of interdependency, complexity and wholeness.
- Systems thinking and scenario planning have their applications as reflective practices to enable resilience through ‘active foresight’.

- Given the increased vulnerability of critical infrastructures due to infrastructure interdependency, further efforts are being made to understand the nature of infrastructure interdependency (Canada, 2005).

- ABU DHABI // The UAE is expected to issue a law this year requiring companies that operate critical infrastructure to implement heightened security systems.
- Key areas include the energy sector, nuclear power plants, oil and gas production facilities, water treatment and electricity.

- ABU DHABI // The protection of the critical national infrastructure involving oil, gas, water and electricity in the UAE is lagging, according to an official at the National Electronic Security Authority (Nesa).

Figure 2 – Evolving Threats to Critical Infrastructure



Dubai Critical Infrastructure



Interdependencies

- While individual infrastructures have their inherent vulnerabilities, the power outage on 14 August 2003 in the north-east of the US points to additional vulnerability as a result of infrastructure interdependency:
 - the shutdown of water pumps causing potential water contamination.
 - All trains running into and out of New York were also cancelled.
 - Some regional airports were closed due to the unavailability of a passenger screening facility, and certain flights were cancelled even after the power had been restored due to the inaccessibility of electronic tickets.



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