Summary of *Through a Glass, Darkly: Mapping Emerging Technologies and their Supply Chains*

Emerging technologies are of keen interest to policymakers, private firms, and researchers due to their perceived economic and national security promise. This interest stems from the shared perception that advances in key areas like biotechnology, artificial intelligence/machine learning (AI/ML), quantum computing, and advanced classical computing will confer asymmetric economic and national security advantages in the coming decades. However, **ongoing supply chain interruptions have exposed the worldwide reliance and fragility of some technologies' global value chains**.

Governments are pursuing policies and regulations to cultivate emerging technology innovation **at a pace that exceeds competitors' ("promote") and to deny competitors access to new technologies ("protect"). However, from a supply chain perspective, efforts to protect and promote emerging technologies are only as good as efforts to protect and promote the underlying supply of products that enable these emerging technologies.**

This paper asserts that policymakers' efforts to protect and promote emerging technologies and supply chains should be inextricably linked. Emerging technologies are much more speculative and necessarily predictive, while supply chains are much more concrete and urgent. However, the underlying analytic effort to characterize both draws on the same sources of information and methodological approach. These efforts will be made stronger by borrowing sources and methods from the supply chain security world, and vice versa.

Policymakers face several challenges in their efforts to map emerging technologies and their supply chains. These include **definitional uncertainty, pace of progress,** and **incomplete or proprietary data**. Policymakers need access to information that can identify a particular technology's potential emergence and its underlying supply chain. This information is frequently overwhelming and disorganized.

Academia, industry, and the government monitor emerging technology and supply chains using specific sources of information and distinct methods. Each methodological approach offers partial solutions, but comes with unique tradeoffs. Ultimately, there is no one resource that provides worldwide coverage of high-fidelity data on emerging

technology development or supply chains. However, by combining and interpreting information from different sources (i.e., comparing patent filings, academic publications, and public R&D funding for a specific technology), it is possible to characterize an emerging technology's development and map its supply chain.

Mapping an emerging technology's supply chain is a three-step process: (1) establish a basic understanding of the ecosystem (what currently exists, how it is used, what knowledge gaps remain); (2) analyze the particular subsegment(s) of interest; and (3) build a map to represent the findings. Each of these steps requires successively more detailed information. Because nearly all emerging technology development is occurring in universities and private firms, it is a matter of collecting names, mapping relationships, quantifying progress, and assessing trends.

The Emerging Technology Observatory's Map of Science and Supply Chain Explorer offer a model policymakers can use for mapping emerging technology supply chains. The ETO's Map of Science can help policymakers identify technologies that exhibit signs of emergence. The supply chain explorer, though currently focused on advanced semiconductors, employs a methodology that is technology agnostic. **Combined, these tools and methodologies can assist policymakers interested in identifying and mapping emerging technology supply chains.**

For more information:

- Download the report: https://cset.georgetown.edu/publication/through-a-glass-darkly-mapping-emerging-technologies-and-their-supply-chains/
- Contact: CSET@georgetown.edu