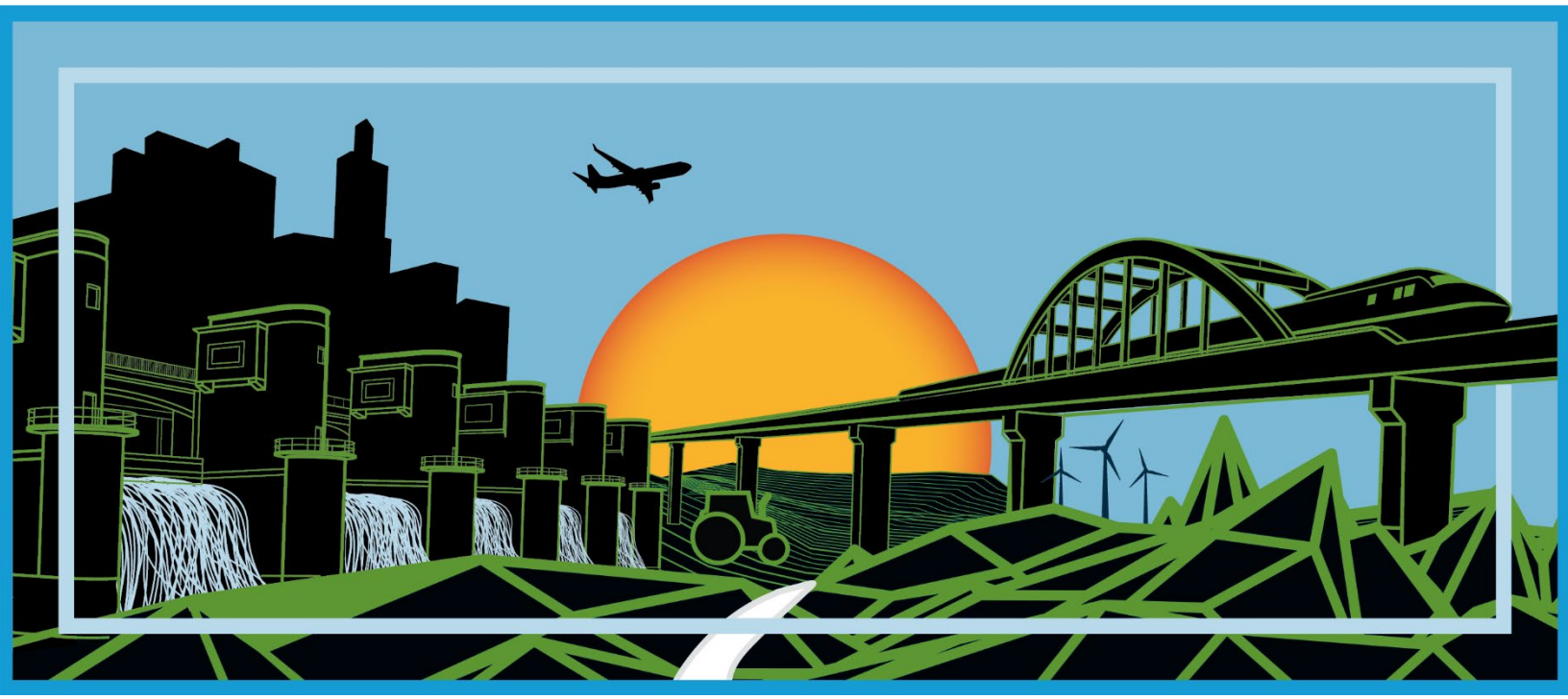

Secure Tomorrow Series

Scenarios Workshop #3: Running Free

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RUNNING FREE

January 21, 2035

The ongoing U.S. trucker strike over the use of brain-computer interface (BCI) devices in the transport industry does not, at first blush, seem to bear much connection to this week's 15th anniversary of the first U.S. COVID-19 case. But a path leads directly—if in winding fashion—from post-COVID deregulation to the domination of new technology in the 2030s. And that domination took its own winding path to the technology backlash occurring today.

When BCIs first came on the market, the trucking industry embraced them as a way to improve safety. The devices monitored alertness and greatly decreased the number of accidents that occurred due to drivers becoming distracted or falling asleep at the wheel.

Now, however, BCIs have transitioned from a piece of safety equipment to a surveillance system, monitoring employee performance, productivity, and activities. They are even used to track employee sentiment about specific issues. The monitoring is presumably for the detection of insider threats. However, the strikers and civil liberties organizations claim that these uses of BCIs are a violation of employee privacy and that they are misused to curtail employee efforts to unionize.

For all the benefits of BCI technology, limited and lax privacy legislation has enabled this invasion of individual rights. And it is no coincidence that this deregulation arose from the aftereffects of the COVID-19 pandemic.

Before the pandemic, legislators on both sides of the Atlantic were enacting increasingly restrictive laws to protect the privacy of individuals. The General Data Protection Regulation set the standard and led others to enact similar laws.

But the regulatory environment hit an inflection point as the world transitioned from a pandemic to an endemic state. For example, the momentum that seemed to be building for privacy regulation around 2020 waned, with no major movements in data privacy laws in the mid-2020s. Across sectors and countries, the focus on economic recovery and economic competitiveness led regulators to loosen the reins on existing regulations and fostered a reluctance among some legislators to introduce new regulations.

In the United States, Congress instead focused on shoring up gaps revealed by the pandemic and stimulating progress in select technologies of strategic importance. The memory of shortages of personal protective equipment in the early days of the pandemic, for example, conjured up fears of an overreliance on foreign supply chains. In response, Washington enacted legislation to help domestic companies compete—not only in medical supplies but also in other key fields, from artificial intelligence (AI) to synthetic biology, including genetically modified foods and other agricultural

products. These key fields in the domestic market were also bolstered by federal support and investment.

Tax cuts also favored big business as more fiscally conservative leaders were elected at the state and federal levels. Starved of revenue by both tax cuts and the economic costs of the pandemic, leaders in Washington and in state capitals shifted their focus to fiscal responsibility. At the federal level, funding for basic and translational research and development was spurned for initiatives that were deemed to provide more near-term benefits to the U.S. economy and shore up critical supply chains.

Over the next decade, the return to trickle-down economics achieved much of the desired effect. The U.S. economy thrived. The private sector clearly benefited from a looser regulatory environment and experienced an influx of capital due to a strong economy. Technology developed at a rapid pace, with advances focusing primarily on lucrative ventures. A few key technologies—which had been just emerging around the time of the COVID-19 pandemic—became established in everyday life by 2030.

One of those technologies was BCIs. By 2030, advances in noninvasive BCIs led to a prevalence of wearables for gaming, accessing the metaverse, and other augmented reality and virtual reality applications, such as online shopping. BCIs also began to enable rapid communications, essentially cutting out the hardware of a keyboard; as a result, they became a preferred way—if not *the* preferred way—of interacting with the digital world.

Invasive BCIs also matured, primarily for use in the medical field, finding applications for stroke rehabilitation, treatment of cognitive diseases, and mental health treatment. Some progress, albeit limited, was also made in controlling robotic limbs and restoring lost motor control and communications capabilities for those patients who were “locked in.”

Two other areas of rapid technology development were in synthetic biology and quantum computing. The private sector had made incredible strides in these fields by 2030. For example, the mRNA technology used to create the first COVID-19 vaccines was applied to create treatments for a number of diseases, including cancer and cystic fibrosis. Meanwhile, a breakthrough for the food industry came when U.S. researchers used synthetic biology to develop the first pig resistant to African swine fever. Although farming this pig has not yet taken hold in the United States, the regulatory environment to do so is favorable. The research team behind the modified pig recently sold the patent to the second-largest pig producer in the United States, which announced plans to begin mass production this year.

Quantum computing also made significant strides. During the 2020s, large technology firms reaped the benefits of providing academia with early access to their quantum computers, establishing a robust applied research community that drove advancements in quantum simulation. Early access also allowed these firms to identify promising researchers and recruit them to work in-house. The decade also saw some companies beginning to offer access to quantum processers as a cloud service.

Additionally, quantum simulation became an active area of commercial research for development of new catalysts, materials, and pharmaceuticals. Large pharmaceutical companies harnessed AI and quantum capabilities to understand how genetic mutations affect protein folding, which led to a renaissance of novel pharmaceuticals that target misfolded proteins. At present, gene editing for therapeutic purposes is in the clinical trial phase for several fatal diseases caused by misfolded proteins (e.g., the neurodegenerative diseases of Parkinson’s and Alzheimer’s).

The United States experienced some technological advances in areas beneficial to the public sector and critical infrastructure. For example, BCIs began to increase operator safety and to control semiautonomous vehicles, drones, and robots. And the Food and Agriculture Sector achieved benefits from more genetically engineered pest-resistant crops. But federal support for cooperative strategies and ventures aimed at modernizing critical infrastructure technology never materialized, and implementation of these advanced technologies by the public sector remains a patchwork, in both application and distribution. As a result, the private sector has reaped most of the rewards from these advances in technology.

Eventually, the rapid technological development in some areas, coupled with a minimally restrictive operating environment, served as the foundation for a backlash against technology. There is a growing sentiment today that many of these new technologies are being used for inappropriate purposes, are poorly regulated, and have created new and unacceptable risks. Critics—including some of the early leading researchers in these fields—have compiled a growing list of concerns, such as the following:

- The truckers and unions claim that BCI adoption and a lack of protection of neurodata together have increased "surveillance capitalism." Beyond evaluating employee performance, it is clear that neurodata are frequently bought and sold by third-party data brokers and used to market products to individuals, allowing companies to take advantage of insights into an individual's health or cognitive state.[1]
- Fears are renewed surrounding the ability of quantum technology to break legacy cryptographic protections following the realization of practical achievements in quantum computing.
- Systems can be deployed with quantum cryptographic protections, but the deployment of these quantum capabilities varies across industries and jurisdictions. Many critical infrastructure sectors and local jurisdictions are lagging in transitioning to post-quantum cryptographic algorithms, leaving them vulnerable to cyberattacks.
- Organizations and jurisdictions are concerned about the quantum threat but have a poor understanding of it. This want for expertise has led to a rapid growth of commercial services that can support these entities; however, the reliability of some of these vendors and consultants is questionable.
- Synthetic biology and gene-editing techniques are proving to be effective strategies for combating some diseases. Personalized medicine, based on one's genetic makeup, is also rapidly progressing. However, the techniques and approaches are costly and thus only available to those with significant means, increasing inequity.
- The burgeoning field of large-scale biomanufacturing, driven by advances in synthetic biology, has placed stress on the agriculture community. Biomanufacturing companies require extraction of biomass from the environment to fuel their operations, and they have purchased wide swaths of land to support those needs. This shift has dramatically changed the use of some land and displaced many small farmers.

[1] Of note: Quantum computers have further enhanced the ability to leverage neurodata for machine learning; researchers have shown that quantum machine learning is superior to classical machine learning, especially for identifying subtle correlations in neurodata.

- In the past 5 years, the United States has experienced a few high-profile instances of the release of a synthetic-biology product into the environment with unintended negative consequences. For example, in 2034, a bacterium genetically modified to degrade oil was released into the Gulf of Mexico following an oil spill; however, an intermediary byproduct of the bacterial degradation began getting into shrimp and killing them. This decimated the area's shrimp population and will have a detrimental effect over many years.
- More broadly, environmentalists are concerned that, similar to what geoengineering has done to climate change, advances in synthetic biology capabilities have shifted the narrative away from environmental protection. Many believe they can simply "fix" environmental problems later with, for example, bioremediation capabilities.

A chorus of opinions is now calling for privacy and equity protections across these areas and more. Disagreements about the appropriate level of protections for emerging technologies are far from new. And although it has always been important not to stymie technological development with too many restrictions, based on these emerging trends, it might be time to rethink the existing environment with an eye toward understanding where it came from in the first place.

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