Thesis Project Portfolio

Swift Securities Analyzer: A Deeper Look into Settlement Failures using Java Spring Boot and Python

(Technical Report)

Regulating the Revolution: Lessons from Vaccine Regulation to Guide CRISPR Oversight

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Every three days, over $100 trillion (the equivalent of the world's GDP) flows through the Swift banking network as it powers the backbone of the entire global economy. Meanwhile, CRISPR gene editing technologies represent a different sort of power as it holds the promise of curing genetic diseases but also raises profound ethical dilemmas. For my technical project during my summer internship at Swift, I developed a Swift Securities Analyzer to improve financial message compliance and address settlement failures. My STS research, on the other hand, uses vaccine regulation as a historical lens to propose regulatory frameworks for emerging CRISPR technologies. Both projects are relevant to STS in engineering practice as they explore how robust technical design and ethical frameworks are needed to ensure societal trust, sustainability, and equity in innovation.

The technical portion of my thesis produced the Swift Securities Analyzer, a tool designed to analyze compliance of securities settlement messages with Swift's guidelines. Using a combination of Java Spring Boot for backend processing and Python for advanced analytics, this tool automates the parsing of complex MT537 financial messages. It generates insights into settlement failures, enabling the Swift Securities View team to identify bottlenecks and improve operational efficiency. Beyond the technical functionality of the project, it emphasizes transparency in financial systems as errors can result in numerous economic repercussions down the line. By providing a deeper understanding of compliance patterns, the analyzer not only reduces operational risks but also reinforces trust in the Swift network.

In my STS research, I examined vaccine regulation as a historical case study to propose frameworks for CRISPR gene editing governance. Vaccines have had a long history of navigating tensions between necessities in public health and controversies surrounding individual

autonomy, which offers valuable lessons for managing CRISPR's potential in both medicinal and non-therapeutic (ie. cosmetic) applications. By analyzing how regulatory bodies built trust through rigorous and transparent safety oversight, exemptions for specific use-cases, and public-private collaboration, I identified three key principles that can inform CRISPR governance. My research highlights the need for institutions that not only address CRISPR's technical challenges but also prioritize ethical considerations like equity in access and the protection of individual rights to prevent exacerbating societal inequalities.

At first glance, analyzing securities settlement failures in global financial transactions and regulating genetic engineering might seem worlds apart. However, both projects reveal the critical need for oversight and systemic integrity when developing technologies with immense societal impact, regardless of whether the impact pertains to moving trillions of dollars across countries or providing therapies for previously incurable diseases. When using the lens of Actor Network Theory (ANT), the connection becomes clearer. It is important to understand that technology does not exist in a vacuum; it is continuously shaped by complex interactions between human and non-human actors within a network. As Carolyne Stanforth writes, "our technologies mirror our societies as they are continuously shaped and reshaped by the interplay of a range of heterogeneous forces within the networks" (174). For instance, while the Swift Securities Analyzer enhances financial efficiency, it must also uphold principles of fairness and transparency, given its influence on global markets. Similarly, CRISPR regulation must be rooted in ethical responsibility to balance innovation with equity. Adopting a sociotechnical perspective through ANT fosters ethical responsibility in engineering by requiring us to consider the interconnected roles of technology, society, and regulatory oversight. Both projects have deepened my understanding that technical solutions are not neutral as they carry both ethical

weight and societal consequences, and that true innovation must align technical progress with social good.