

Thesis Project Portfolio

**Smart Contracts for Government Use: Utilizing Ethereum and Hyperledger Fabric for
Ledger Management**
(Technical Report)

**The Paradox of Decentralized Technologies: Government Adoption and the Reaction of
Cryptocurrency Users**
(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Capstone Research:

My capstone project explored how blockchain technologies, specifically Ethereum and Hyperledger Fabric, can be applied to improve government-level document management systems. In collaboration with Innova8 LLC, I worked to develop a hybrid architecture combining a secure non-blockchain system with blockchain-based verification layers. The technical goal was to enable secure, immutable, and accessible verification of documents for state-level governments, with use cases such as identity verification in emergency situations.

By designing and deploying a minimum viable product using Ethereum smart contracts, and attempting a parallel implementation using Hyperledger Fabric, I explored both public and permissioned blockchain architectures. These efforts in both technologies revealed key technical trade-offs: Ethereum offered easier development and public transparency, while Hyperledger Fabric promised stricter access control and institutional suitability, albeit with a steeper learning curve and integration challenges. My work demonstrated that blockchain can complement traditional databases by adding immutability and distributed verification without replacing existing infrastructure.

The project aimed to address a pressing social need: the modernization of inefficient and insecure paper-based systems. Additionally, it also aimed to raise questions about how decentralized technologies are reshaped when adopted by centralized institutions like governments. These questions laid the foundation for my STS research into how the cryptocurrency community reacts to such institutional adoption of blockchain technologies.

STS Research:

My paper, spurred by my capstone, presents a sociotechnical analysis of public discourse surrounding governmental adoption of blockchain technology within the cryptocurrency community. My research aims to answer the question: If one of the main principles of cryptocurrency is decentralization, meaning there is no central authority to enforce policies or assign value, why do governments choose to adopt this technology and how do cryptocurrency users and developers reconcile the expectation of decentralized financial systems with increasing government involvement and regulation?

To attain information, I researched two different social media platforms: X (formerly Twitter) and Reddit. I then analyzed user commentary found within relevant social groups (such as r/cryptocurrency or X threads discussing cryptocurrency topics) to identify recurring sentiments, ideas, and ideological divisions. Drawing from the qualitative data found on both of these platforms, I was able to sort the blockchain community into three relevant social groups: The Critical Group, The Supportive Group, and the Self-Interest Group. Each of these groups interpreted the same events and technologies in different ways, which revealed interpretive flexibility, central to the Social Construction of Technology (SCOT) framework.

Utilizing Actor-Network Theory (ANT) and the SCOT, I aimed to highlight the complex interplay between technology, institutions, differences in platform, and community interpretation. ANT's emphasis on both human and nonhuman actors frame Reddit and X not simply as platforms, but as active participants shaping discourse through algorithms, engagement patterns, and generated bot activity. Reddit's design fosters long-form critical engagement, which often leads to more productive conversations to be found on the platform. Additionally, this longer

form discussion leads to more critical and skeptical opinions to be found and emphasized on the platform, as other users are then able to refute and discuss an opinion. X in contrast, amplifies reactive, emotionally charged responses that are more varied, including enthusiastic support and political activity. ANT helps explain the difference found in the two social media platforms, and how the same topic, such as Elon Musk's proposal to place the U.S. Treasury on a blockchain, evokes different responses across users of these platforms.

SCOT then helps explain how the aforementioned groups in the crypto community assign various meanings to blockchain. The Critical Group, mainly found on Reddit, views government adoption as a betrayal of decentralization. They argue that centralized use of blockchain defeats its purpose, reducing it to something akin to an inefficient database. The Supportive Group, seen more actively on X, is mainly cautiously optimistic. They hope that if implemented correctly, blockchain could improve transparency and efficiency in the government. Additionally, they hope that adoption of blockchain could offer an easy entry point to cryptocurrency. While they recognize risks, they view institutional adoption as a path towards mainstream legitimacy. The Self-Interest Group was mainly motivated by politics or personal profit. They supported whatever narrative best fit their goals, regardless of how the narrative would actually affect the technology and how the technology was utilized.

In conclusion, the path forward requires a delicate balance. As blockchain technologies continue to mature, the community and governmental institutions must find a common ground that respects the technology's original vision while addressing the legitimate needs for regulation and stability. The ongoing dialogue between the community will be essential in determining the transformative potential of blockchain technology in governance.