

## **Thesis Project Portfolio**

### **Enhancing Observability with Generative AI and Large Language Models: Centralizing APIs and Documentation for Improved Support Team Responsiveness**

(Technical Report)

### **Design and Impact: Evaluating SBA Programs Efficacy in Small Business Success**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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# **Sociotechnical Synthesis**

## **Introduction**

The capstone project and the STS research paper, although focusing on different aspects of technology's interaction with society, share a common thread in their exploration of how technological systems and societal factors shape each other. The capstone project delves into the practical application of AI and machine learning techniques to enhance the observability and management of complex IT infrastructures, while the STS research paper investigates the perceived ineffectiveness of Small Business Administration (SBA) assistance programs and the assumptions held by small businesses in their decision-making processes. Both projects demonstrate the importance of aligning technological solutions with the needs and expectations of their intended users, whether it be supporting teams in large corporations or small business owners navigating the federal contracting landscape.

## **Technical Report**

The capstone project addresses the challenges faced by Fidelity Investments in managing and enhancing the observability of their complex IT infrastructure, which is characterized by thousands of APIs, an extensive volume of documentation, and a vast amount of system logs. The proposed solution leverages Large Language Models and Generative AI technologies to design and implement an intelligent system that centralizes and processes the myriad of APIs, documentation, and logs, subsequently presenting them in a coherent and accessible manner to the support team. The system utilizes advanced AI and machine learning techniques, such as LangChain for unified integration of LLMs, PineconeDB for efficient storage and retrieval of high-dimensional vector representations of text data, OpenAI embeddings for converting text

into semantic vectors, and AWS for hosting and model management. The process of embedding documents using an LLM and retrieving them with semantic search is central to the system's capability to efficiently manage and access the extensive documentation within Fidelity Investments' technical ecosystem. The preliminary results of the implementation demonstrate significant improvements in the efficiency and effectiveness of the support team's operations, empowering them to deliver swift and accurate resolutions to queries. Further work is needed to refine the system's accuracy, expand its API coverage, improve its user interface, and explore broader applications of this solution across different departments within Fidelity Investments to maximize its organizational value.

### **STS Research Project**

The STS research paper investigates the perceived ineffectiveness of SBA assistance programs and the assumptions held by small businesses in their decision-making processes. Employing Sheila Jasanoff's co-production framework, the paper examines how societal values, technological infrastructure, and government policies collectively influence the experiences and outcomes of small businesses in the federal contracting landscape. Despite the government's efforts to support small businesses through policies and financial commitments, operational challenges such as intricate certification processes, unclear contracting cycles, and technological and bureaucratic hurdles hinder the effectiveness of SBA initiatives. The paper advocates for a comprehensive reassessment of SBA and government agency initiatives, proposing a dynamic framework that incorporates feedback from small businesses to ensure alignment between policy objectives, technological capabilities, and the operational realities of small businesses.

### **Conclusion**

Working on both the capstone project and the STS research paper simultaneously has provided valuable insights into the complex interplay between technology, society, and policy. The capstone project highlights the potential of advanced AI technologies to address the challenges faced by large corporations in managing complex IT infrastructures, while the STS research paper exhibits the importance of aligning technological systems and policy designs with the socio-economic realities of small businesses. By examining these two distinct yet related domains, I have gained a deeper understanding of how technological solutions must be tailored to the specific needs and expectations of their intended users. This realization has encouraged me to adopt a more holistic approach in the design and implementation of the capstone project, ensuring that the technological solution is not only technically sound but also socially and organizationally viable. In conclusion, this academic experience has enriched my understanding of the complex relationships between technology, society, and policy, highlighting the need for a multi-disciplinary approach in addressing the challenges faced by organizations of all sizes. This experience has equipped me with a more comprehensive perspective on the role of technology in shaping and being shaped by societal factors, which will undoubtedly inform my future work as a technologist and engineer.