Thesis Project Portfolio

Accessible Customer Analytics: Building a Webapp for No-Code Customer Analytics at a Major Retailer

(Technical Report)

Coastal Climate Change Response: An Analysis of the Use of Technology by Governments, Nonprofits, and Private Businesses in Coastal Climate Adaptation

(STS Research Paper)

An Undergraduate Thesis

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Luke Flynn

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Department of Computer Science

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Sociotechnical Synthesis

In both engineering practice and societal analysis, complex problems demand more than isolated solutions. Technical design alone cannot solve deeply embedded structural issues, and policy reform cannot succeed without the tools to implement it. My STS research paper and technical capstone project address this intersection from different domains: climate adaptation and customer analytics. However, they converge around a central insight. Technology becomes effective only when it is accessible, integrated across institutions, and shaped by the needs of its users.

My STS research paper examined the fragmented use of technology in coastal climate adaptation across three key sectors: governments, nonprofit organizations, and private businesses. Through a comparative case study of King County, Washington and Coastal Virginia, I analyzed how each sector contributed distinct technological capabilities to climate resilience. Governments implemented predictive models and environmental sensors. Nonprofits led participatory mapping initiatives and nature-based infrastructure efforts. Businesses provided innovations ranging from sustainable materials to flood-resilient systems. Although each initiative showed promise, their isolated nature limited their overall impact. Even the most sophisticated technologies underperformed when they were not accompanied by collaboration, trust, or shared governance. One of the central takeaways was that successful adaptation depended not on how advanced the tools were, but on how they were used, who had access to them, and how they fit within institutional systems.

At the core of this analysis was a critique of technological determinism, the belief that technical innovation alone can drive progress. In both King County and Coastal Virginia, technical solutions faltered without institutional alignment or community engagement. GIS maps

improved planning only when they incorporated local knowledge. Sensors provided valuable flood data, but only some municipalities had the resources to act on that data in time. The private sector offered promising prototypes, but these remained small in scale when public incentives and coordination were lacking. These cases illustrated that climate adaptation is not just a technical problem. It is a systems problem that must be addressed through governance, equity, and collaboration.

My technical project reflected a similar dynamic in a very different setting. As part of a team at a global retailer, I developed a no-code analytics tool called Data Explore to solve a persistent internal challenge. The company's reliance on LookML, the proprietary coding language within Looker, created a significant barrier for employees without technical backgrounds. Business teams needed access to customer insights to make informed decisions, but the tools they were given required coding expertise. This led to delays, bottlenecks, and lost opportunities.

Data Explore was designed to eliminate that barrier. Built with ReactJS on the frontend and Java Spring Boot on the backend, the tool enabled non-technical users to create and customize dashboards without writing LookML. It translated user selections into Looker-compatible queries and offered a streamlined experience that maintained analytical depth. Just as my STS research emphasized the importance of aligning technology with the social context in which it operates, this project demonstrated how thoughtful system design can empower users and enhance decision-making across an organization. The key technical challenge was not just building the tool, but ensuring that it was usable, flexible, and deeply integrated into existing workflows.

In both projects, the success of the technology depended on the structures that surrounded it. In the climate adaptation case, that meant overcoming fragmented governance and siloed data systems. In the retail analytics project, it meant abstracting technical complexity without compromising flexibility and designing around the needs of users who had previously been excluded from data workflows. In both cases, the broader message was clear: even well-designed tools will fail if they are not embedded in systems that support their use and promote inclusion.

Both projects challenged the idea that improving access to technology is simply a matter of better design. Access is not just a question of usability; it is shaped by funding structures, organizational priorities, and assumptions about who should have influence. In the climate adaptation space, nonprofits struggled to get their community-generated data into formal government planning. In the corporate setting, non-technical employees were excluded from analytics processes, not because they lacked insight, but because they could not code. The most effective uses of technology arise when technology is made accessible; in both scenarios, there is not a lack of technology available, but a lack of access and coordination between major stakeholders.