Thesis Project Portfolio

The Impact of Electric Vehicles and Infrastructure on Economic Development and Energy Consumption

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
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In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

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Introduction

Both my technical capstone and STS research explore how emerging technologies drive large-scale institutional and societal change—whether in government operations or public infrastructure. My capstone focuses on modernizing outdated supply chain systems used by federal agencies, while my STS project investigates the economic and infrastructural impacts of electric vehicle (EV) adoption. Together, these projects highlight a central theme: technologies do not operate in isolation; their development, implementation, and effects are shaped by—and in turn shape—social contexts.

Capstone Discussion

The capstone project addresses inefficiencies within the Department of Defense (DoD) and Department of Homeland Security (DHS), which currently rely on the platform that was developed a long time ago for managing logistics and supply requests. In response, my team at Ernst & Young is developing "Disconnected Operations" (DiscOps), a modern, web-based application designed to streamline operations through improved performance, usability, and data security. The application features a React front-end, a scalable Spring Boot backend, and a secure SQL database architecture that adheres to ACID principles. Authentication and role-based access are implemented through JSON Web Tokens (JWT), ensuring secure and efficient user management. Initial results demonstrate a substantial reduction in latency and an improved user experience. However, the technical improvements alone are not enough; for DiscOps to be truly successful, it must be adopted, trusted, and integrated across complex governmental structures—highlighting the importance of considering the human and technological dimensions of system deployment at large.

STS Discussion

This concern drives the core of my STS research, which applies the Social Shaping of Technology (SST) framework to understand the impact of EV adoption on economic and infrastructure development. SST challenges the idea of technological determinism by arguing that technology is not an independent force that shapes society on its own. Instead, social, political, and institutional factors influence how technologies are developed, adopted, and used. I use this framework to examine how the rise of EVs affects job creation, infrastructure planning, and regional economic development. My analysis shows that EVs are not simply replacing the current lineup of vehicles—they are prompting positive shifts in public policy, economic markets, and long-term investment decisions. The benefits of EVs, such as environmental sustainability and economic growth in green industries, are driven by how governments and communities invest in charging infrastructure, electricity grids, and public awareness. These choices are not technologically inevitable; they are socially shaped and politically contested by a wide group of people of varying interests.

Conclusion

Viewed together, my capstone and STS research emphasize that the success of technological systems depends not only on engineering excellence but also on how well they align with the

institutions and communities they intend to serve. DiscOps has the potential to modernize critical federal operations, just as EVs have the potential to drive sustainable economic development. But both cases underscore that these outcomes are shaped by human decisions, institutional dynamics, and policy frameworks. The Social Shaping of Technology framework provides a powerful tool for understanding and designing innovations that succeed not just technically, but socially.

The Impact of Electric Vehicles and Infrastructure on Economic Development and Energy Consumption

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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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I. Introduction

The rapid shift from internal combustion engines to electric vehicles (EVs) is not just a technological advancement but a profound societal transformation. As consumers, governments, and industries move away from outdated systems, the rise of EVs reflects broader shifts in social values, economic structures, and environmental priorities. In 2023, EVs accounted for 16% of total vehicle sales, a dramatic rise from under 2% in 2013, illustrating how rapidly this transition is unfolding (McCarthy, 2024). This shift can be analyzed through the Social Shaping of Technology (SST) framework, which argues that technology is not a neutral force but is influenced by cultural, economic, and political factors. As environmental concerns grow and consumers seek sustainable alternatives, EVs have emerged as a solution that aligns with evolving societal expectations. The increasing adoption of EVs signifies more than a preference for cleaner transportation; it reflects a deeper change in consumer behavior, government policies, and urban planning strategies.

Beyond consumer choices, the widespread integration of EVs is reshaping urban infrastructure, energy consumption patterns, and even global economic landscapes. Urban centers are adjusting to accommodate charging networks, and energy grids are evolving to manage the demands of electrified transportation. The shift to EVs also brings economic and geopolitical implications, such as job creation in battery manufacturing and infrastructure development while raising concerns over resource dependencies on critical minerals like lithium and cobalt (Lin, 2024). This research will explore how EV adoption influences driving behaviors, city planning, and energy systems using a combination of quantitative data—such as traffic flow studies and grid demand—and qualitative insights from policymakers, urban

planners, and EV users. By examining the electrification of transportation through the lens of SST, this study will provide a deeper understanding of how social forces shape technological transitions and how these changes, in turn, impact society. Overall, the central claim will show how electric vehicles, and their supporting infrastructure and societal influence are a net positive.

II. Problem Definition

To explore the impact of electric vehicles (EVs) on today's society through the lens of the Social Shaping of Technology, a historical overview is essential to fully understand the implications and evolution of this invention. In the United States, the first electric vehicle was introduced in 1890 by William Morrison in Des Moines, Iowa (*The History of the Electric Car*, 2014). In fact, during the early 1900s, electric vehicles were quite popular. However, with the introduction of Ford's now-legendary Model T, gasoline-powered cars became significantly cheaper to produce at scale, surpassing the more expensive EVs. Additionally, the discovery of vast oil reserves in Texas and Louisiana made gasoline more readily available and affordable, allowing it to be quickly distributed to rural areas that lacked reliable access to electricity. As a result, by 1935, EV development had come to a complete halt, remaining dormant until the 1990s (*The History of the Electric Car*, 2014). With growing concerns about the emissions produced by gasoline-powered vehicles, the development of electric cars has gained momentum once again.

In recent years, the climate crisis has become a pressing issue, with many scientists expressing concerns about the future of humanity. Studies show that the transportation sector contributes a significant share of rising emissions, with cars producing a larger proportion of global greenhouse gases than any other single source. In fact, the U.S. transportation sector alone

is responsible for nearly 30% of the country's total global warming emissions, making it the highest-emitting sector (*Car Emissions and Global Warming*, 2014). However, environmental concerns are not the only driving force behind the resurgence of EV development. Another major factor is the projected depletion of fossil fuels, which are expected to run out by 2052 (Kuo, 2023). With both issues at the forefront of automakers and consumers' minds, it is no surprise that numerous entrepreneurs and companies have accelerated their efforts in EV innovation in recent years. Recent examples of how EVs been expanding to these conditions would be the growth of companies such as Tesla and the similar companies drive EV sales growth. As show in Figure 1, Open EV Charts (n.d.) illustrates the U.S. electric vehicle ratio by quarter, split by companies below.

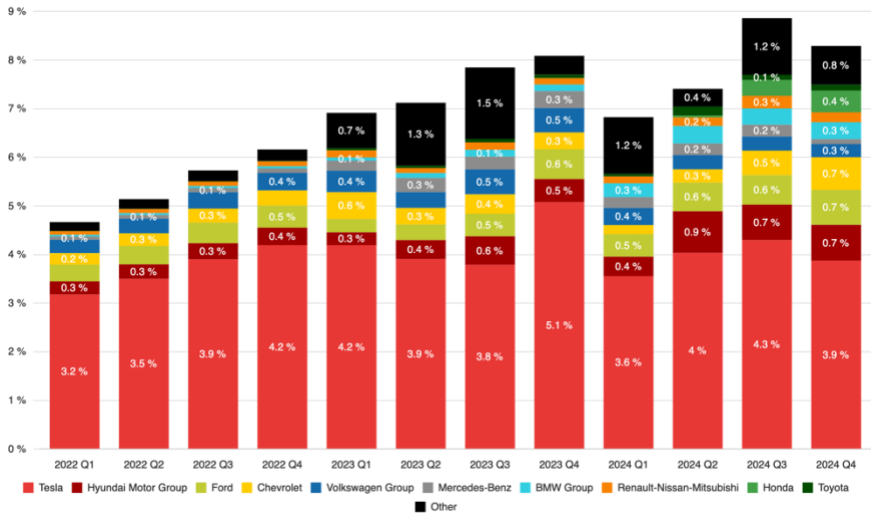

Figure 1: *EV Sales Chart.* Chart shows breakdown of total car sales by EV manufacturer

Now that the reasons behind the resurgence of EV development and sales have been established, a more pressing issue must be addressed: the infrastructure and energy required for

greater adoption. One of the most apparent infrastructure and urban planning challenges is the need for more charging stations. Fortunately, many private EV companies are taking it upon themselves to build these stations, ensuring that consumers are not burdened by charging difficulties.

Tesla, as the leading EV brand, has built around 60,000 Superchargers and introduced a charging standard called the North American Charging Standard (NACS) (Sriram, 2023). In fact, most automakers have pledged to follow Tesla's lead and design their charging systems to adhere to this standard (Sriram, 2023). Sriram (2023) also highlights that many states have been providing grants to automakers to encourage the development and implementation of EV infrastructure, such as Superchargers. However, some states have mandated that, to qualify for these grants, automakers must adopt the North American Charging Standard for consistency.

This is only one aspect of the government's involvement in expanding EV infrastructure. The United States, under the Biden administration, recently introduced a $7,500 tax credit for qualifying electric vehicles as part of the Inflation Reduction Act. This initiative underscores the government's commitment to growing the EV sector. Further assessments of different government policies (US and foreign nations) will be brought up in later sections of this paper.

One might wonder about the actual effects of EV adoption and infrastructure development, particularly regarding energy consumption. Since EVs have not yet been fully mass-adopted, it is difficult to determine the long-term effects. However, the short-term impacts are undeniable. Because EVs typically charge overnight, they place less stress on the electric grid when demand is significantly lower than capacity. This has resulted in over $3 billion in savings for electricity grids across the nation between 2011 and 2023 (Brinn, 2024).

Beyond these monetary savings, EVs are also engineered to use energy more efficiently. Traditional gasoline-powered vehicles lose a staggering 80% of the energy provided to them, whereas EVs experience only an 11% energy loss. This difference is astronomical. While the long-term effects of EV adoption on energy usage remain to be seen, EVs significantly outperform their gasoline-powered counterparts in energy efficiency (Kirk, 2024). This advantage will become increasingly evident as energy is supplied to superchargers through the grid, whether sourced from clean energy or traditional methods such as fossil fuels.

Given this information, EVs offer substantial environmental and economic benefits in the short term. However, a major concern in the ongoing transition revolves around charging accessibility and the range limitations of EVs before requiring a recharge. Additionally, while the long-term effects on energy consumption remain uncertain, if short-term trends can be extrapolated over a longer time frame, the expected outcomes become more apparent.

Moving forward, this paper will continue to examine the economic and environmental effects of this mass transition. Thus far, only a surface-level analysis has been provided to establish background information on the topic. To further explore the short-term effects, this paper will analyze specific studies on EV infrastructure development and urban planning conducted by private institutions commissioned by the oil and gas industry, the clean energy industry, and the automotive industry. Additionally, public sector research from educational institutions and governmental agencies will be examined to strengthen the paper's main argument. Where relevant, surveys of private citizens will also be incorporated to assess public sentiment.

Ultimately, this paper will affirm that electric vehicles and their supporting infrastructure positively influence economic development and energy consumption. However, drawing

conclusions about long-term effects is not yet feasible, as they have yet to materialize. A more detailed examination of the paper's approach as well as more complex delve into the results is necessary which will come in later sections.

III. Research Methods

During the research for this paper, multiple analytical methods were used to construct a better understanding of the development and adoption of electric vehicles (EVs). As evidenced in the previous section, the first approach involved researching historical events to piece together the story of EV development from its inception. This process aimed to determine when EVs first emerged, when they gained popularity, the factors contributing to their rise, and the barriers that prevented their widespread adoption earlier. Establishing this historical context provided a foundation for later analysis of EV sales and economic data and infrastructure development.

The next phase of analysis focused on understanding why EVs became popular, with an emphasis on environmental factors such as global warming and climate change. By examining the growing awareness of climate issues, the research built an argument for the increasing traction of EVs in the market due to growing human awareness. This highlights the Social Shaping of Technology (SST) that was introduced in the introduction. Following this, data related to EV sales and charging infrastructure was introduced to complement the discussion on demand, highlighting how companies and governments have responded to infrastructure needs to support the growing number of EVs on the road furthering the SST argument.

To gather relevant data, the research relied on searching for the latest EV-related information across various sources, including infrastructure developments, sales figures, and public

sentiment. Given the dynamic and rapidly evolving nature of the EV industry, the internet provided a vast repository of information, making it the best resource for understanding trends and patterns. The results of this research will be further analyzed in the results section to draw meaningful conclusions that support the central argument of this paper.

To reiterate, the overall analysis process started with a logical and comprehensive examination of the factors influencing EV adoption, with the goal of establishing and reinforcing that EVs are a net positive for society. The first step involved conducting historical research to establish a timeline of EV development, identifying key milestones such as early prototypes, the decline of EVs with the rise of internal combustion engines, and their resurgence due to environmental concerns and technological advancements. The second step focused on understanding the key drivers of EV adoption, particularly the impact of climate change awareness, government incentives, and advancements in battery technology. This was followed by an in-depth data collection phase, where sales trends, charging infrastructure developments, and policy changes were analyzed to quantify the growth of EV adoption.

The chosen framework and evidence are highly relevant because they provide both historical context and empirical support for the argument that EVs contribute positively to society. By combining qualitative historical analysis with quantitative data trends, the research establishes a well-rounded perspective on EV adoption. The historical approach explains why EVs have experienced fluctuations in popularity, while the data-driven analysis validates the argument with evidence from sales figures and infrastructure development. This methodology ensures that the research is not only grounded in theoretical discussion but also supported by real-world trends. The results section will further focus on data regarding the positive effects of EV adoption and

development, including reductions in carbon emissions, economic benefits, and advancements in infrastructure that support a more sustainable future.

IV. Results

With the discussion and breakdown of the research approach concluded, a thorough examination of the results can now begin. The first portion of the results will focus on the environmental benefits of electric vehicles (EVs) in conjunction with the Social Shaping of Technology (SST) framework introduced earlier. One of the most compelling statistics highlighting the environmental advantage of EVs is the disparity in emissions between electric and gasoline-powered vehicles. According to 2022 data from the Department of Energy, gasoline vehicles emit approximately 12,594 pounds of carbon dioxide per year, whereas electric vehicles produce only 2,727 pounds (Emissions from Electric Vehicles, 2022). This fivefold reduction underscores the significant role EVs play in reducing greenhouse gas emissions and mitigating climate change. The shift toward EV adoption aligns with broader societal concerns about sustainability, reflecting how technological transitions are shaped by social values and environmental conditions.

As discussed in the introduction, increasing public awareness of climate change has influenced consumer behavior, making individuals more cautious about contributing to global warming. This is supported by a study conducted by the Pew Research Center, which assessed consumer sentiment regarding EVs. According to the study, the primary motivation for potential EV buyers was environmental preservation, with 72% of respondents citing “saving the environment” as their top reason for considering an EV. The second most cited reason, at 70%, was saving money on fuel costs (Spencer, 2023). These findings indicate that consumer interest

in EVs is strongly linked to both ecological and economic factors, reinforcing the idea that technological adoption is influenced by multiple societal pressures.

However, despite these positive inclinations, the study also revealed persistent hesitancy toward EV adoption. Only 38% of respondents were somewhat or very likely to purchase an EV, while 50% expressed no intention of doing so (Spencer, 2023). This resistance can be attributed to several factors, including concerns over battery range, charging infrastructure, upfront costs, and uncertainties about long-term technological advancements. These barriers highlight the relationship between technology and social acceptance, emphasizing that innovations do not exist by themselves but are shaped by economic, political, and infrastructural conditions.

The evolving political landscape must also be considered, as it directly influences consumer attitudes and policy decisions related to EV adoption. Since the study was conducted in 2023, political tensions have continued to escalate, potentially affecting public perception of EVs. Factors such as government incentives, regulatory changes, and partisan divisions over climate policies may influence willingness to transition away from gasoline-powered vehicles. A follow-up study would be necessary to reassess the current sentiment toward EV adoption, particularly in light of recent economic developments and policy shifts.

The study from the Pew Research Center also surveyed public opinion on the development and availability of electric vehicle (EV) infrastructure. Approximately 53% of Americans believe that the U.S. government is not doing enough to support the widespread adoption of EVs through infrastructure development (Spencer, 2023). This concern is reinforced by the fact that most EV owners primarily charge their vehicles at home and often struggle to find public charging stations. However, this situation is likely to improve in the future. One key factor is the growing

adoption of the North American Charging Standard (NACS) by automakers and EV infrastructure companies, which simplifies charging by standardizing connector types. Additionally, the Infrastructure Investment and Jobs Act of 2022 allocated significant funding to expand the charging network, including $5 billion dedicated to building EV chargers. A primary goal of this initiative is to establish charging stations approximately every 50 miles along major highways, significantly enhancing accessibility and convenience for EV users (Domonoske & Cronin, 2022).

In summary, while the environmental benefits of EVs are evident and public awareness of climate concerns is growing, barriers to widespread adoption remain. The Social Shaping of Technology framework helps contextualize these findings by illustrating how EV adoption is not solely a matter of technological capability but also of social, economic, and political dynamics. Future research should continue to examine how these factors evolve, shaping the trajectory of EV integration into mainstream transportation.

The next section of the results will focus on the economic impact of electric vehicles (EVs). One of the most significant aspects of this impact is the total investment in the sector, which has surged to nearly $200 billion (*What are the economic benefits of EVS?* 2024). This growth is primarily driven by increased private sector investment—including venture capital and corporate funding—as well as substantial government spending through the infrastructure bills in the previous section (*What are the economic benefits of EVS?* 2024). This financial commitment reflects a broader shift in both corporate and governmental priorities toward EV adoption. The expectation is that these investments will lead to the production of more affordable EVs, ultimately influencing consumer preferences and accelerating the transition away from gasoline-

powered vehicles. However, while these aspirations are promising, their full realization remains to be seen.

One change that can be seen through the investment is the job growth, however. 188,000 jobs have been announced by corporations relating to EV development. This is directly attributable to the investment (*What are the economic benefits of EVS?* 2024). Going further, studies have come out that the full economic impact will create up to 931,000 indirect and secondary jobs because of development in this industry (*What are the economic benefits of EVS?* 2024). Added job creation is always a plus. While the outlook for EV adoption is largely optimistic, it is important to approach the transition with caution. As demand for EVs increases, it is likely to reduce the demand for oil, which could lead to declining revenue and investment in the oil exploration and refining industries. The long-term effects of this shift remain uncertain. Additionally, it is unclear whether job growth in the EV sector will be sufficient to absorb displaced workers from the fossil fuel industry, raising concerns about economic disruptions in traditional energy sectors.

One of the most significant economic takeaways is that lower- and middle-income nations also have the potential to benefit from the growth of the EV industry. While EVs generally have higher upfront costs, they are considerably cheaper to operate and maintain—potentially saving up to $5,000 compared to traditional gasoline-powered vehicles (Briceno-Garamendi, 2022). Additionally, many of these nations impose higher taxes on gasoline while subsidizing electricity, which could further encourage EV adoption. However, due to the limited number of studies examining EV adoption in these regions, these projections remain speculative.

Another significant economic benefit of EV adoption is the reduction in healthcare costs, an area that is not often considered. In California, studies project that by 2050, Los Angeles

residents will save approximately $12.6 billion in healthcare-related expenses, while residents of the San Joaquin Valley are expected to save up to $2.8 billion. Notably, these estimates are based on current EV sales trends and account for California's plan to ban the sale of gasoline-powered vehicles by 2035. The study assumes that by 2050, EVs will be fully adopted across the state. However, if adoption rates accelerate beyond projections, these savings could be even greater. This highlights a crucial connection between cleaner transportation and public health, reinforcing the broader societal benefits of transitioning to EVs. Nonetheless, these figures remain speculative, and only time will reveal the true extent of cost savings in the healthcare sector.

In conclusion, the environmental and economic impacts of electric vehicles are closely linked, offering both immediate and long-term benefits. The shift to EVs not only helps reduce emissions and improve public health but also presents exciting economic opportunities, particularly for lower- and middle-income nations, and offers potential savings in healthcare costs. By looking through the lens of the Social Shaping of Technology (SST) framework, we can better understand how these advancements are influenced by a mix of social, economic, and political factors. As we move forward, it is important to keep exploring how these dynamics evolve, shaping the future of transportation and the role of EVs in our daily lives.

V. Conclusion

The shift to electric vehicles (EVs) brings clear environmental and economic benefits, making it an important step in tackling climate change, improving public health, and boosting economic growth. By reducing emissions and improving air quality, especially in cities, EVs help combat global warming and cut down on harmful pollutants. On the economic side, they offer lower operating costs for consumers, create jobs in the EV industry, and could lead to

significant savings in healthcare expenses. Looking through the lens of the Social Shaping of Technology (SST) framework, it is clear that EV adoption is influenced by a mix of social, political, and economic factors. While the long-term effects are still unfolding, the positive results already seen in the short term suggest that the development and adoption of EVs are headed in the right direction.

That said, there are still challenges that could limit the full potential of EVs. Issues like infrastructure development, job shifts in the fossil fuel industry, and the affordability of EVs in lower-income areas remain barriers. Even with projections pointing to significant savings in healthcare and energy, these benefits will depend on how quickly EV adoption grows and the policies put in place to support it. Moving forward, continued research and cooperation between governments, industries, and communities will be crucial to addressing these obstacles. Despite these challenges, the early positive effects show strong promise, making it likely that the future of EVs is bright and an overall net-positive for society.

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Optimizing Supply Chain Efficiency: Development and Adoption of The EY DiscOps Solution

How Do Electric Vehicles and their Supporting Infrastructure Influence Driving Behaviors, Urban Planning, and Energy Consumption

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
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Bachelor of Science in Computer Science

By
Agrim Sharma

December 5, 2024

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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INTRODUCTION

The federal government requires a sophisticated software supply chain solution that enables tiered access for various levels of supplies and service for their soldiers and miliary officers. This is especially urgent in crucial agencies such as the Department of Defense (DoD) and the Department of Homeland Security (DHS), which collectively account for over 50% of discretionary spending—amounting to over $750 billion annually (Ogendi & Wessel, 2023). Timely access to resources within these agencies is critical, as it can mean the difference between mission success and failure, or even life and death (Alperovitch, 2023). With the United States Military maintaining a presence on every continent, a soldier stationed in East Africa might need to request critical supplies, such as ammunition, from a supply base in Europe, requiring approval from a regional general. For example, a foot soldier might need to request ammunition from the nearest supply base through a streamlined, reliable software system, while a senior officer might need to requisition multiple new uniforms for the soldiers under their command or coordinate larger logistical efforts (Lacroix, 2023).

Historically, these technological solutions have been developed to support specific user bases in mind, catering to the hierarchical structure and diverse operational needs of different subagencies and during various military campaigns. However, the inherently prolonged and complex process of technology adoption often results in these software systems becoming obsolete well beyond the expiration of the underlying technology (Hinchman, 2023). This software results in being slow, lacking modern functionality, and incurring significant maintenance costs that far exceed the cost of producing new solutions. As these challenges accumulate, it becomes evident that modernization is urgently needed to address inefficiencies

and improve the responsiveness of essential services. In the context of software, modernization refers to the process of upgrading outdated systems with advanced, scalable, and efficient technologies to better meet current demands. Recognizing this need, the federal government recently issued a contract for a comprehensive overhaul of the supply chain management system specifically tailored for DoD sub-agencies (Eversden, 2021).

Ernst & Young (EY), a global leader in professional services with an established government and public sector department, saw this as an opportunity to expand its influence in public sector modernization projects. After a highly competitive bidding process, EY's proposal emerged as the most promising, beating out other top government consulting firms. EY was awarded the contract, setting the stage for a transformative project that promises to revitalize the supply chain system. To achieve this, EY is designing a modern, robust system dubbed "Disconnected Operations," or "DiscOps" for short. This solution allows users to securely sign in, authenticate their identities, and request a range of supplies regardless of their physical location. The software system is designed to leverage role-based access control, ensuring that the capabilities available to users align with their assigned roles and permissions within the agency.

Due to this ambitious scope of the project, EY anticipates significant challenges that extend beyond the technical requirements. One of the most daunting hurdles is the adoption of the new system by personnel who are accustomed to legacy processes. Transitioning from established practices to new technologies often encounters resistance, particularly as consistency and familiarity are highly valued. This is especially true for seasoned or older personnel, who may find it difficult to adapt to new processes and tools. Furthermore, building the system itself presents a set of unique technological challenges. EY's technical and strategic approach to

DiscOps aims to not only meet current operational demands but also lay the foundation for future technological adoption across other sectors. The lessons learned from developing and implementing DiscOps could provide a valuable framework for modernizing systems in both private and public organizations, ensuring they remain responsive to the evolving needs of the people they serve.

The technical project for DiscOps is centered on designing and constructing a robust supply chain software system that seamlessly integrates with its users' needs.

TECHNICAL TOPIC

The current technology that the DoD sub agencies use is a SAP Concur System from the year 2001. The outdated SAP Concur system, once a pioneering solution for supply chain and logistics management, has become notorious for its clunky interface and sluggish performance, impeding operational efficiency and user satisfaction. One major challenge with SAP Concur is its cumbersome approach to role-based access control, making it difficult to incorporate new roles and accommodate new supply types as operational needs evolve. This rigidity results in delays and inefficiencies when adapting the system to new structures or demands. Additionally, the system’s outdated design presents a steep learning curve for new users, making training a time-consuming and often frustrating process that hampers rapid onboarding and effective use.

Due to the current challenges faced by service members, as noted in the introduction, EY plans to develop a new web-based application (“DiscOps”) featuring a user interface built with React, supported by a scalable RESTful API and a Spring Boot backend. This solution is designed to address user experience issues and ensure system scalability to accommodate future

user growth and minimize latency and potential bottlenecks. The choice of React for the frontend offers significant benefits. React was initially developed by Facebook with usability and user experience as its core focus (Hunt, 2013). It provides a clean, responsive user interface and faster component rendering, ensuring that elements such as buttons function smoothly and efficiently. However, most of my work consisted of the authentication and database layer. In these cases, the design choices were made collaboratively with input from both the engineers and me. Specifically, in the backend, we chose Spring Boot as an ideal solution for resolving current role-based access issues. It facilitates a straightforward three-tier architecture comprising the client (React), the database (managing users and roles), and the backend (handling RESTful API supply requests) (Gillis, 2019). This structure enables greater scalability and simplified system setup, unlike the original SAP configuration, which lacked robust design. With the addition of a database that we selected, data integrity can be maintained effectively while managing user attributes and components seamlessly using SQL, which adheres to ACID principles (Mullins, 2017). ACID (Atomicity, Consistency, Isolation, Durability) is crucial as it ensures reliable transactions that maintain data accuracy and consistency, even in cases of system failures or concurrent access (Sheldon, 2023). The old solution employed a storage technique that failed to uphold these principles, leading to potential data corruption or inconsistency. The current solution addresses these issues and ensures robust data management. Additionally, the Spring Boot framework supports JSON Web Token (JWT) authentication, which I implemented as my first solo task to enhance the efficiency of the authentication process enhances the efficiency of the authentication process. Once a user is authenticated, they do not need to repeatedly undergo the full authentication process as long as the session remains valid (Kumar, 2022).

This approach streamlines authentication, making subsequent resource requests faster and more user-friendly. EY's success in ensuring the adoption of new tech solutions like DiscOps offers key lessons for the EV industry. By prioritizing user-centric design, strategic rollout plans, and comprehensive user education, EY has managed to integrate complex systems seamlessly into their user base.

STS TOPIC

The EV industry can adopt strategies like those used by EY to shape driving behaviors, influence urban planning, and energy consumption, while fostering a co-evolution between humans and technology within this rapidly evolving system. Much like the federal government, society is moving away from outdated legacy systems. In this context, the transition from combustion engines to electrification marks a significant societal shift. The electric vehicle (EV) revolution is rapidly gaining momentum, marking a significant shift in consumer sentiment and behavior. In 2023, EVs accounted for 16% of total vehicle sales, a dramatic increase from less than 2% in 2013 (McCarthy, 2024). To fully understand this shift, one must examine the Social Shaping of Technology and what it entails. Social Shaping of Technology refers to the theory that technology is not a neutral force, but is significantly influenced by social, cultural, economic, and political factors (Williams, 2019). Several factors contribute to this shift, with the most pressing being the environmental impact of traditional gasoline-powered vehicles. The carbon emissions from these vehicles are prompting individuals to seek more sustainable alternatives (Moseman & Paltsev, 2022). As awareness of personal carbon footprints grows, many people are choosing to abandon internal combustion engines in favor of electric options, reflecting a societal shift towards technology that is more sustainable. This transition highlights

the human aspect of technology adoption: people are more likely to embrace technologies that align with their values and social contracts. If a technology, such as the internal combustion engine, violates these values (e.g., contributing to pollution), consumers are motivated to seek alternatives.

The widespread adoption of EVs is not just a passing trend; it signifies a long-term transformation in the transportation industry and individual lifestyle choices (Castaros, 2024). From a Social, Technical, and Scientific (STS) perspective, this shift benefits a wide range of stakeholders. Historically marginalized communities often live in urban areas with poorer air quality (Rura, 2022), and the widespread use of electric vehicles could significantly reduce smog and pollution, thus improving the quality of life for these populations. This demonstrates the STS aspect of how EV technology can positively impact societal well-being. The growth of the EV industry is creating new job opportunities (Cosier, 2024). Research and development investments in EV technology are driving job creation in sectors such as battery manufacturing, infrastructure development, and software engineering (Singh, 2016). This growth offsets the potential job losses in industries such as gasoline extraction, fracking, and traditional car assembly (Stein, 2024). Unlike other technological shifts that face resistance due to job displacement concerns, the EV revolution promises to benefit the workforce by creating new, sustainable employment opportunities. However, this transformation also introduces geopolitical challenges. The demand for critical minerals like lithium and cobalt, essential for EV batteries, is reshaping global power dynamics, giving resource-rich countries increased leverage while destabilizing oil-dependent economies (Lin, 2024). This dual narrative highlights the complexities of the EV transition, where societal and economic benefits may come with new global dependencies and challenges.

RESEARCH TOPIC

Relating back to the STS topic, a research question I am interested in is how electric vehicles (EVs) and their resulting infrastructure have changed driving patterns, urban planning, and energy consumption. This will be studied using both quantifiable metrics, such as traffic flow data, EV adoption rates, and energy grid demand, as well as non-quantifiable aspects like the social atmosphere of society. The importance of this question is clear, as EVs represent the future of the vehicle market and transportation industry (Andreoni, 2024). Researching this question identifies how this transition impacts our lives, guiding whether the change is for the better or worse.

The topic will be analyzed using a combination of data collection methods. Quantitative data will come from governmental studies, urban development records, and energy studies, revealing shifts in commuting behaviors and grid use. Qualitative data will be gathered through interviews with urban planners, EV users, and community leaders to understand societal attitudes and changes. These findings will be interpreted by comparing data pre- and post-EV adoption. This analysis will help governments create laws that support seamless integration or safeguard against potential negative impacts. This research will be grounded in the Social Shaping of Technology (SST) framework, which highlights how technology is shaped by societal values, norms, and behaviors. By examining the adoption of EVs and related infrastructure changes, the study will explore how social factors like sustainability concerns influence the development of new technologies. The SST framework will guide the analysis, showing that the shift to electrification is driven not just by technical advances but also by collective social choices, policy, and cultural shifts, offering a deeper understanding of the EV transition's societal impact.

CONCLUSION

The successful implementation of the EY “DiscOps” supply chain solution represents a significant step forward in overcoming the limitations of legacy systems like SAP Concur. This new system’s technical deliverable will include an adaptive software platform designed to streamline supply requests and enhance role-based access control, making it easier for service members to request supplies without being hampered by technical difficulties. Additionally, maintenance costs will decrease as outdated components are replaced, leading to a more efficient and user-friendly system.

Similarly, the adoption of electric vehicles (EVs) will present comparable benefits, such as reduced carbon emissions and minimized individual carbon footprints. The deliverables of this research will provide insights into how urban planning and infrastructure may evolve positively with widespread EV adoption. These findings will equip policymakers and stakeholders with data-driven strategies to foster a smooth transition, ensuring that both technological and societal shifts contribute to sustainable development.

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