Understanding the Effects of Port Operational Emissions: A Sociotechnical Examination of the Port of Los Angeles Using Actor Network Theory

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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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Introduction

The Port of Los Angeles is one of the busiest ports in the world, handling over 9 million twenty-foot equivalent units (TEUs) of cargo each year. (Port of Los Angeles, 2022) The port plays a crucial role in the global shipping industry, connecting North America with Asia and other parts of the world. Despite its importance, however, the Port of Los Angeles has faced a range of challenges and issues over the years, including environmental concerns, labor disputes, and health issues among nearby communities. One of the most pressing concerns facing the Port of Los Angeles is the impact of its operational emissions on the health of nearby residents (Mazza, 2018). A study conducted at the Port of Los Angeles found that communities in close proximity to the port experience higher rates of asthma, coronary heart disease, and depression compared to other communities (OECD, 2014). These health issues are believed to be linked to the air pollution and other environmental hazards associated with the port's operations (Ostrov, 2009).

Research on the port thus far has primarily focused on technical aspects such as specificities of the emissions, trade flows, competition, and port efficiency. However, there has been limited research on the social and environmental impacts of the port, especially from the perspective of actor-network theory. Clearly, operations of a port can affect the health and well-being of local residents, highlighting the need for a more comprehensive understanding of the complex network of actors and factors that shape port operation. I am studying the Port of Los Angeles and its network of actors, including government officials, port authorities, shipping companies, labor unions, and local communities, because I want to find out why the port has been a subject of environmental concerns and health issues among its community.

Through an Actor-Network Theory analysis of historical documents, news articles, and current policies, I argue that port officials and community-representing boards are the combined key actors that have contributed to failures such as environmental degradation, poor health of local residents, and overall insufficiency to improve the port community. Actor-Network Theory (ANT) is a socio-technical framework that focuses on the relationships and connections between different actors, including both human and non-human entities as they try to accomplish a goal. My research aims to inform future port planning and policy decisions, and to contribute to a better understanding of the role that social, political, and economic factors play in the success or failure of large-scale infrastructure projects.

Literature Review

Despite the growing importance of ports in global trade and commerce, there is a dearth of academic literature that utilizes Actor-Network Theory (ANT) or other socio-technical frameworks to analyze the failures and destabilization of port networks. While some research has explored the application of ANT in other fields, such as healthcare and urban planning, there remains a gap in the literature regarding the use of ANT in understanding the complexities of port networks and the actors that shape their operations. However, some literature exists that sheds light on the actors that influence the “socio-technical regime” that exists at ports (Damman, 2021).

Damman and Steel utilize a sociotechnical approach *similar* to actor-network theory in order to understand the actors responsible for change at ports in Norway. Specifically, they use a multi-level perspective in order to understand various feedback loops of actors that drive environmental upgrading at ports. They even recognize that ports are “multi-faceted”, as they acknowledge that ports are “heterogeneous networks of actors" (Damman, 2021). One notable

conclusion they draw regarding the "regime" is that the lack of emissions in their community "implicates a complex network of local stakeholders" even though "the port has a more central position and may exert a stronger influence." In Figure 1, we can see how the port functions given actors such as regulators and landlords and the networks between them. The authors recognize that understanding this actor-network allows for "an empirically rich discussion of the main barriers, opportunities, and conceptions of ports as zero-emission energy hubs" (Damman and Steel).

However, Damman and Steel fail to consider the actors involved as a *result* of the port and its actions; for example, actors such as the nearby communities and their affected health. While the article provides insights into the factors that can influence the implementation of sustainable energy practices in ports, it may not fully address the complexities and nuances of the specific health risks that the Port of Los Angeles faces.

In similar fashion, Carl J. Hatteland offers a view of ports as an actor within the industrial network. When discussing the environmental impact of ports, Hatteland ties a network relationship between ports and the local community: "ports also impact on local environment through pollution, congestion and tying up the use of property and resources for alternative use" (Hatteland, 2010).

Additionally, Hatteland draws a conclusion that "port authorities appear to be distanced from substantive interaction with others." (Hatteland, 2010). This idea coupled with another of his notions that "the interaction amongst industrial actors shapes a bundle that is imposed on ports, and this comes with pollution, land use, road congestion, etc" suggests that there is a need for greater collaboration and coordination among the actors in the industrial network (Hatteland, 2010). His dissertation thus emphasizes the importance of understanding the roles and

interdependent relationships between these actors, as well as the power dynamics and institutional contexts that influence their decisions and actions. By analyzing these factors, the dissertation provides insights into how ports can effectively collaborate and coordinate with other actors to achieve sustainable development and competitive advantage in the industrial network.

While both of these pieces explore the network of actors involved at ports around the world, neither explore how a port and involved actors affect the surrounding port community. Thus, we cannot *fully* understand the actor-network relationships of a port, specifically the Port of Los Angeles. As such, there is a need for further investigation and analysis to shed light on the factors that contribute to port failures and the role of various actors in this process.

Conceptual Framework

To understand the actors and networks of the Port of Los Angeles, I will utilize Actor-network theory (ANT), a sociotechnical approach in which both human and non-human elements (heterogeneous actors) are considered within a network (Cressman, 2009). Actor-network theory serves to quantify relationships between actors not just by power, but rather by the strength of the association between them. Furthermore, ANT utilizes the idea that "there are no causes, only effects" when viewing networks of "people, organizations, technologies, nature, politics, and social order(s)" (Cressman, 2009). ANT emphasizes the importance of both human and non-human actors in shaping social phenomena, and it allows for a nuanced understanding of the ways in which actors are connected and how they influence one another as they collectively solve a problem. I will use Callon's interpretation of ANT for the analysis of the Port of Los Angeles. Callon breaks down the steps of network building into a four step process of translation: *problematization*, *interessement*, *enrolment* and *mobilization* (Callon, 1984). In

problematization, actors are defined along with the problem they are facing. The main actor of the network is defined as well. During the stage of *interessement,* the primary actor defines the roles of the other actors as they attempt to solve the problem. At *enrolment,* actors accept the role they have been assigned and process to enroll in the network. According to Callon, *mobilization* is “ensuring that supposed spokespersons for relevant collective entities are properly representative of all members of the network that are acting as a single agent." (Callon, 1984)

Callon also emphasizes the agency of non-human actors, such as technologies or natural elements, in shaping the network. Additionally, he emphasizes the role of translations in creating new connections and associations between actors in the network.

By drawing on this framework and subsequently mapping out the network of actors involved in the operation and governance of the Port of Los Angeles, I begin by identifying key actors, challenges, and failures that the port has faced over time, particularly in relation to adverse health effects. Then, using Callon’s phases of translation, I will focus on the beginning phases of *problematization, interessement,* and *enrolment* to draw out the rogue actors of the actor-network.

Analysis

In order to understand the complex interplay of actors and factors that contribute to the various failures and challenges experienced by the Port of Los Angeles, I will draw upon Actor-Network Theory (ANT). Specifically, I will create a comprehensive actor network of the port by first identifying the heterogeneous actors involved, including human and non-human actors, and then exploring the central non-human or technological actors. From there, I will examine how these actors are or could be associated, in order to reveal the network of relationships and

dependencies that shape the functioning and performance of the port. This will reveal the true rogue actors that caused the port to harm its residents.

A crucial actor in the port network is particulate matter (PM) emissions, which are a significant environmental concern associated with port activities. PM emissions are generated by several sources in the port area, including diesel-powered equipment utilized for cargo handling, port vessels, and trucks that transport goods to and from the port. These emissions consist of small particles that are discharged into the atmosphere during port activities and have been associated with various health problems. Additionally, 1760 tons of PM emissions are largely generated by the container ships that idle near the port; as these container ships idle, they burn significant amounts of diesel fuel (Sharma, 2006). These non-technical actors are created as a result of other actors in the network, which we will delve further into.

The socio-technical network of the Port of Los Angeles is not solely composed of non-human or technological actors. Rather, a range of human actors also contribute to the port's network, and an analysis of these actors can provide valuable insights into the challenges and failures experienced by the port in recent years. In order to initiate an examination of the human agents involved, it is imperative to establish a clear definition of the pertinent human actors present within the network. A report from the 2010-2011 Los Angeles Grand Civil Jury highlights several key actors: The Port of Los Angeles and the Port Community Advisory Committee, also known as PCAC (Los Angeles Grand Civil Jury (2011).

For the purposes of this analysis and based on the Grand Civil Jury’s findings, Port of Los Angeles refers to the members and employees of the Port. PCAC refers to the community-based organization that was created in 2001 to allow for an efficient method to collect

community input for Port related operations and projects. They also have the power to identify environmental mitigation projects for the benefit of the community.

To examine power dynamics and mechanisms of influence in this actor-network, an understanding of how the previously defined actors interact with each other and within the network is needed.

The Port of Los Angeles can be considered as the principal actor due to its pivotal role in the actor-network. Not only is it responsible for listening to the community members of PCAC, but it also serves as the 'creator' of the PM emissions that negatively impact the community's health. Additionally, as seen in Figure 2 below, almost all actors can be linked to the Port in some manner, whether directly or indirectly. This further suggests the Port's central role in the actor-network.

During the initial stage of Callon's definitional framework for translation, the process of *problematization* can be said to be of critical significance. In this phase, the Port of Los Angeles had determined that the growth of trade in the last 30 years resulted in erosion of the patience of the surrounding communities (Los Angeles County Grand Civil Jury, 2011). The increase in demand on the Port had resulted in the creation of "larger container terminals, taller container cranes, bigger and brighter lights for 24-hour operations, and significantly more truck traffic" (Los Angeles County Grand Civil Jury, 2011). Thus, the Port Community Advisory Committee (PCAC) was created to respond to the complaints of the community as air, water, and visual pollution had steadily increased.

In the following phase, *interessement*, the role of PCAC was formalized as PCAC's role involved "reviewed Port capital projects, environmental reviews, and mitigation projects" (Los Angeles County Grand Civil Jury, 2011). Moreover, the Port's function within the actor-network

is situated at this stage as well as it entails assuming the responsibility of attending PCAC meetings to effectively listen to the concerns and viewpoints of PCAC members. Moreover, the Port also assigns themselves roles such as adhering to mandates in their own effort to reduce emissions. Nonetheless, during the subsequent phase of translation, enrolment, it will become apparent that PCAC and the Port did not succeed in fulfilling and enlisting the roles that had been established in these preceding stages.

In an ideal world, the enrolment phase of this actor-network would entail the Port financially backing any support needed for PCAC related endeavors, reducing total particulate matter emissions, and the PCAC performing their duties as defined in the *interessement* stage. However, this did not hold true. The failure of the Port of Los Angeles' network can be traced to a breakdown in the *enrolment* phase of translation between the Port and PCAC, leading to a mutual failure caused by factors on both sides. Additionally, the Port's self-imposed mandate, the Central Air Action Plan (CAAP), also serves to explain the Port's failure to meet specified guidelines.

The Port of Los Angeles

The Port bears initial responsibility for generating particulate matter emissions, but the Port also neglected to fulfill its obligations within the actor-network by not establishing specific, measurable objectives for mitigating pollutants. According to the findings from the Los Angeles Grand Civil Jury, "The Clean Air Action Plan does not include goals for reducing total particulate matter." This self-imposed mandate that the Port created expresses a goal of reducing DPM, a type of particulate matter emission from diesel engines. The Port assumes that reducing DPM will "reduce the risk of cancer and improve the health status of nearby residents" (Los Angeles County Grand Civil Jury, 2011). However, DPM is not the only type of particulate

matter emission. The omission of total particulate matter from the Port's objective renders the mandate analytically unsound, indicating a failure of the Port in adequately addressing all relevant factors.

Secondly, it should be noted that the Port also was discovered to have removed financial backing for several PCAC related relationships. The Grand Civil Jury's investigation found that "the Port eliminated staff support for five out of nine original PCAC subcommittees…by reducing the overtime budget" (Los Angeles County Grand Civil Jury, 2011). By taking away financial support for the endeavors related to listening to community voices, the Port failed in its role of effectively listening to PCAC. This defeated the purpose of the creation of this relationship in the actor-network as it was created solely for the purpose of PCAC keeping the Port in check. Additionally, "the Port also eliminated the funding of private consultants that formerly had performed work on behalf of PCAC."This further shows that the Port failed in its role to listen to its community by removing necessary funding. Without proper support from the Port, the PCAC can not function appropriately and provide valuable community feedback.

Based on this analysis and breakdown of the actor-network above, it may seem as though the Port is the only rogue actor responsible for the detrimental health effects on the surrounding community. Not only did the Port bear exclusive responsibility for generating PM emissions but they also implemented a deficient regulatory framework (CAAP) that lacked sufficient quantitative goals for self-monitoring and accountability and did not properly support the PCAC. However, investigations showed deficiencies on PCAC's side as well. According to the jury's findings, PCAC "has accumulated issues such as weak attendance, light agendas, entrenched interests, lack of participation from the business community, and inactive member organizations" (Los Angeles County Grand Civil Jury, 2011). This shows that the PCAC's role had degraded

from its original purpose to a role that was no longer effective in its duties. The PCAC's inadequate oversight of the Port reflects a failure to fulfill their responsibility of representing the community effectively.

Additionally, the jury found that “attendance had been an issue for years” (Los Angeles County Grand Civil Jury, 2011). Meetings rarely held quorum and sub-committees met only sporadically. This lack of involvement and interest could have contributed to failures that resulted in adverse health effects as the PCAC was not fulfilling its duties properly.

Conclusion

In conclusion, this paper has utilized Actor Network Theory (ANT) to examine the Port of Los Angeles and its network of actors in order to understand why the health of nearby communities was adversely affected. Through the identification of heterogeneous actors, central non-human or technological actors, and their associations, this paper has shown the complex interplay between various actors within the port's network and deduced rogue actors that resulted in the network’s failure. The analysis of human and non-human actors has revealed the detrimental effects of particulate matter (PM) emissions on the surrounding community and the mandates placed on the port to reduce its emissions. Moreover, the clash between the Port and the PCAC has highlighted the importance of collaboration and communication between actors within the network in order to combat particulate matter (PM) emissions.

Overall, this paper emphasizes the significance of considering the socio-technical perspective when analyzing the port and its network of actors. By doing so, a more holistic understanding of the port's network and the various challenges it faces can be achieved. This paper has also shed light on the need for sustainable and equitable practices within the port

industry to mitigate the negative impact on the environment and surrounding communities. As such, this study contributes to the ongoing conversation about the future of ports and their role in energy transition and sustainability.

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