NEGOTIATING THE CONDITIONS OF HOUSING INFRASTRUCTURE: ECOLOGY OF MAINTENANCE IN AKTAU, KAZAKHSTAN

Where is the line between broken and not broken, and how do actors negotiate it? This dissertation explores these questions using the example of the city of Aktau and its housing infrastructure. The city of Aktau is located in western Kazakhstan on the shores of the Caspian Sea. Aktau was planned and built during the Soviet era. It was one of the key cities for industry, as the region is rich in oil, gas, and uranium ore. However, the area was not suitable for building a city of the size needed for Soviet industry. To meet the need for freshwater, Soviet engineers built the world's first nuclear power plant using fast neutron reactors, which were also combined with a plant to desalinate water from the Caspian Sea. Thus the infrastructure brought the city's project to life and became the core of its historical narrative about the conquest of nature, the building of a city where it should not be (Guth, 2022). The architecture and planning principles of modernism were fully materialized in Aktau's housing, with all its micro-districts thoroughly planned and calculated (Krivov & Levin, 1982).

Aktau's critical infrastructure has not been significantly upgraded since Soviet times: the water pipes, the sewage system, and the electricity grid. As a result, the city's residents face many problems. Firstly, the city is still growing, but the capacity of the nuclear power plant, which has been converted into a thermal power plant, is limited and has not been updated to meet growing consumption needs. As a result, all the microdistricts face various kinds of infrastructure problems: water shortages, water pressure problems, power cuts, and heating problems. Secondly, the houses themselves have not undergone any major repairs since they were built, and the materials have deteriorated considerably, as have the materials of the infrastructure within and between the houses. The overall estimate of the level of deterioration for each part of the city's infrastructure, such as sewers, pipes, and the electricity grid, is around 80% (Buro Q88, 2020). The city continues to function and grow despite the gradual emergence and aggravation of infrastructure problems. However, these problems need to be solved somehow, as they require the attention of all those involved in the maintenance of these infrastructures and the citizens of Aktau who live with and through them.

THEORY

Using Aktau as an example, I mobilized the scholarship on infrastructure, maintenance, and repair (Anand, 2017; Denis, 2019; Henke & Sims, 2020) to explore how different actors negotiate the conditions of infrastructure. The functionality of things can rarely be attributed to just two states: fully functional or fully broken (de Laet & Mol, 2000). Rather, the state of things is usually described as something in between these two poles, with functionality being a shade or a spectrum. All objects, especially those as complex as housing infrastructure, are in a state of constant change: aging of their components, malfunctions, changes in materiality, and interactions with humans and non-humans. Therefore, the conditions of housing infrastructure are much more complex than just functioning or not functioning and something to be achieved and negotiated.

Maintenance practice is the practice of negotiating these conditions. Maintenance has long been perceived as a rather mundane and technical task of putting things back in order. Maintenance is much more nuanced and situated within the social, political, economic, material, and other conditions of the infrastructure. Thus, maintenance workers do not simply follow the protocol of how to clean, tinker, or replace something: repair work is innovative and full of sensual labor and knowledge that emerges in close proximity to the infrastructure (Dant,

2010; Dant & Bowles, 2003). However, it is not only the actors who directly maintain the infrastructure who participate in the negotiations about what is to be considered repaired or broken. For example, residents in mass housing, such as those in Aktau, participate by engaging with workers, authorities, and other actors to decide what should be repaired, when, by whom, and how (e.g., similar processes in Anand, 2017; Bovet & Strebel, 2019; Jacobs & Cairns, 2012).

In this thesis, I unpack the complexity of housing infrastructure and the maintenance practices behind it. The example of Soviet-built housing helps to understand modernist infrastructures from the new perspective of modernity situated within contemporary challenges. Mostly, post-socialist housing is studied in relation to its contemporary perception (e.g. in Hess & Tammaru, 2019; Zhelnina, 2019) and the different trajectories of material and social change that happened to it after the collapse of the socialist bloc (Grossmann et al., 2017; Grunze, 2017). Housing estates built in socialist or, in the case of Aktau, Soviet times should also be studied as material 'things' that need to be brought together (Domínguez Rubio, 2016) in times of energy crisis and infrastructure crisis in Kazakhstan (Högselius, 2022). This book explores the ways of negotiation within and out of the state of brokenness (Martínez & Laviolette, 2019).

METHODOLOGY

The study focuses specifically on the Soviet-built microdistricts in Aktau but does not deal with any one microdistrict in particular but with all of them. The microdistricts were built in different periods of the 1960s and 1980s, have different planning and architectural choices, and slightly different problems with housing infrastructure. However, negotiations about infrastructure in Aktau rarely occur within just one microdistrict. Rather, maintenance practices in different microdistricts form an ecology of maintenance in Aktau: different semiotic, political, economic, social, and material conditions through which matter exists and becomes (Domínguez Rubio, 2020). Following the traditions of actor-network theory scholarship and drawing the holistic picture of maintenance, I explore different aspects of maintenance practices from the perspective of different actors.

The research is based on 7 months of ethnographic fieldwork conducted between October 2023 and June 2024. I've conducted more than 50 in-depth interviews with maintenance workers, technicians, infrastructure experts, authorities, and residents involved in various ways in the maintenance issue. I've also shadowed maintenance workers during their working days, documenting maintenance practices. I also conducted go-along interviews with many residents of both Soviet-built and new housing estates. Over the course of my fieldwork, I stayed in 4 different apartments in Soviet-built microdistricts and had many interactions with maintenance workers and neighbors about the housing infrastructure. The data is supplemented by analyzing local media reports, public speeches, public meetings and hearings, and expert conferences in Almaty, Aktau, and online. In addition, I analyzed open archival documents published by Soviet-era local authorities relating to maintenance tasks in the period between 1964 and 1991.

MAIN FINDINGS

The findings are structured into four main parts. The first empirical part, Chapter 3, briefly recalls the history of the city's development and the principles behind the construction of the city's infrastructure, as well as the main political and economic events that influenced its condition. Many of the processes now observed in Aktau - decay, deterioration, breakage of the housing infrastructure - have their roots in the way housing infrastructure was

planned and designed in the first place. Chapter 3 dismantles the myth that during the Soviet period, the maintenance system did not malfunction and that deterioration occurred exclusively during the independence period. However, the urban policy of the last 20 years in Aktau, on average, has only increased the pace at which breakdowns and malfunctions occur and has faced other challenges, such as the climate crisis.

The second part, Chapter 4, describes the actors involved in maintenance, their responsibilities and capabilities, and the relationships between them. This part mainly covered actors whose daily task is to perform maintenance. It is, however, essential to acknowledge that many more actors influence the ecology of maintenance. Infrastructure, especially housing infrastructure, is a complex entity that interconnects or collides many actors in maintenance practices. Chapter 4 also reflected on path-dependencies in the maintenance sector. In Aktau, many of the primary actors inherited features of the Soviet housing maintenance system: in particular, many of the KSK and PKSK were staffed by the same workers who previously worked in the ZhEK. Despite that, many changes are still occurring in the housing maintenance sector, especially regarding the distribution of responsibility zones. This chapter shows how, regardless of the responsibilities of each actor being defined (sometimes only loosely) by law, the actors of the maintenance system are intertwined in many ways.

The third part, Chapters 5 and 6, examines two different types of maintenance practices and explores in detail the notion of *ecology* (Domínguez Rubio, 2020). Maintenance practices are situated within particular social, political, material, discursive, bureaucratic, etc., conditions. The first are *practices of ignoring* the breakages by disregarding different aspects of infrastructure: its conditions, qualities, the long-term period, the connectivity. The second is *practices of making-things-work* by addressing breakages in different ways: through collective action, normalization, and taking responsibility. These parts show how these practices are located in different parts of the infrastructure – greenery, water supply, heating – but still form the holistic ecology of maintenance. The question of functionality became crucial to identify those two types of practices. Contributing to the scholarship on brokenness and failure (Carroll et al., 2017; Martínez & Laviolette, 2019), these two chapters put the question of identifying and reacting to a breakage to its core. Thus, practices of ignoring encompassed cases when breakage is recognized as such but not directly or fully addressed. Practices of making-thing-work are a set of practices aimed at addressing a breakage by different means, including repair, sharing the knowledge, and circumventing it. The division and opposition of practices of ignoring and making-things-work is somewhat artificial. The chapters also showed that, for example, by making water pressure work for themselves, some residents can destabilize it for others. Focusing on these two sets of practices underscores that actors do not engage exclusively in repair or neglect. In most cases, they all do both from time to time, and it is not only the water providers and the akimat whose actions are causing breakages. However, decisions that could affect the infrastructure on a large and central scale can only be made within those actors who are endowed with power. This finding opens the floor to questions of how to modernize and repair Soviet-designed infrastructure in an ecology where the main actors with power waste (or sometimes have to waste) many resources to stabilize the brokenness but not eliminate the conditions that made the brokenness appear.

The last part presented in Chapter 7 analyzes the points and events where and when actors act differently from what has been described in the ecology of maintenance, and how the negotiation of conditions might take a different turn. These points vary from events unfolding rapidly, centrally shaking the whole maintenance system, to those that build up gradually over time. The part covers four points. The first (7.1) is the introduction of the new reform in the housing sector which changed the way local maintainers could operate. The reform became a

process of negotiating not only questions of maintenance, but also issues of decision-making on the republican level and the questions of political representation. Another example of the point of negotiation is emergencies and major breakdowns (7.2). Using the example of an emergency when the water on the shores of the Caspian Sea froze, the part showed the performance and enactment of control mechanisms by different branches of power. The framing of the event as a state of emergency opened up new possibilities for influencing the long-standing infrastructure problems and for officially questioning its condition. Both parts describe changes in maintenance practices, but their longevity is questionable. In the case of the reform, the change in the condition of the infrastructure is expected to be long-term. The state of emergency at the MAEK power plant also has long-term implications, but habitual maintenance practices return quickly after the state of emergency is lifted. Other practices bring less immediate and extensive but more visible change. Part 7.3 showed how seasonal changes open a window of opportunity for residents to demand changes in maintenance practices. While this window slowly narrows after the change of season, more mundane changes, explored in Part 7.4, prevail in the ecology of maintenance. These changes take different forms and shapes but provide a direct opportunity to challenge existing practices.

What the last chapter shows is that infrastructure conditions are a matter of negotiation, and maintenance is central to it (Denis, 2019). Breakdowns and emergencies change the ordinary ways. Emergencies offer the possibility of change and a window of hope when brokenness is no longer intrinsic, and conditions are questioned when parts of the infrastructure need to be repaired. Emergencies inevitably bring about change because it becomes impossible for actors to function as they did before. However, the focus on the everyday presented in this chapter allows us to amplify the mundane changes that slowly but surely transform the ecology of maintenance. Every time maintenance companies decide to go to court against non-payers, they pave the way for others to do the same. Every time a protest blocks the roads in Aktau, it may not change the entire political system as the 2022 Qantar protest did, but it is indeed perceived as an out-of-control practice to which it is hard not to respond. Emergencies may entail impressive rapid changes, but they also have temporalities with which practices can bounce back, as shown in 7.1. Everyday changes are sustainable; the question is whether they are always sufficient and timely.

The study would be useful not only in the context of infrastructure and housing in Kazakhstan. In terms of urban studies theory, it also develops a new perspective on where the change could be situated within the rigid ecology. In times of climate catastrophe, this perspective could be useful to unpack why crisis is persistent and what could be the ways to eliminate it in all contexts, be it cities of the Global South, East, or North.

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