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The People Behind the Machine: Street-Level Bureaucrats in the Bắc Hưng Hải Irrigation System, Vietnam

Léo Biré

UMR G-EAU, PhD candidate, IRD, University of Montpellier, Montpellier, France; ACROSS IJL, IRD, Thuy Loi University, Vietnam; leo.bire@ird.fr

Jean-Philippe Venot

UMR G-EAU, Senior Researcher, IRD, University of Montpellier, Montpellier, France; jean-philippe.venot@ird.fr

Lý Ngọc Thùy Dương

Faculty of Anthropology, University of Social Sciences of Hanoi, Hanoi, Vietnam; lyduowng@gmail.com

ABSTRACT: This paper explores the everyday practices of street-level bureaucrats (SLBs) in Vietnam's Bắc Hưng Hải (BHH) irrigation system, a vast hydrosocial machine in the Red River Delta. Drawing on interviews and detailed ethnographic fieldwork, we document how SLBs (hydraulic cluster managers, station workers and water guides) navigate multiple sociomaterial interfaces, in the course of which they deal with a diversity of day-to-day sociomaterial constraints to make irrigation and drainage work. Far from being faceless agents of a rigid hydrocracy, SLBs care for the infrastructure they manage and engage in continuous sociotechnical tinkering and ethical improvisation to balance competing demands that include farmers' needs, infrastructure decay, electricity costs, and bureaucratic oversight. We stress how SLBs engage in processes of intermediation, negotiation and bricolage, thereby shaping a particular form of everyday politics that combines formal rules with practical fixes and is epitomised in specific locales, the pumping stations where professional and social lives intertwine. As the Red River Delta faces mounting socio-environmental changes, understanding the hard work, gendered dynamics and situated ethics that characterise SLBs' daily realities is crucial to anticipating the future of water governance in Vietnam.

KEYWORDS: Street-level bureaucrats, daily practices, irrigation, sociohydrological systems, Red River Delta, Vietnam

INTRODUCTION

As one enters the pumping station of Duyên Linh, it is hard not to notice clean clothes hanging to dry, children's toys scattered about, and flower beds planted with vegetables or fruit trees in the inner courtyard that separates the rest house where station workers live and work from the building where electric pumps hum steadily. Old rusted pipes are stored in corners and several motorbikes are parked in front of the buildings. People come and go – evidence that the pumping station is not just a site of water management, but also functions as a social interface. This scene is representative of the thousands of pumping stations that dot the landscape of the Vietnamese Red River Delta.

Like the Mekong Delta, the Red River Delta can be understood as a 'hydrosocial machine'. This terminology is inspired by the work of Biggs et al. (2009), who used the word 'machine' to describe the Mekong Delta landscape and to stress the fact that it was constantly made and unmade through the combined effect of anthropogenic and natural forces. By qualifying the machine as hydrosocial, we echo the hydrosocial literature (see, for example, Linton and Budds, 2014) that stresses the intertwined and mutually constitutive nature of the human and the natural, the social and the technical. As in the case of

the Mekong, the most visible thing in this machine is the dense network of canals, engines and sluice gates;[1] in the background, less visible but no less important, are the people that maintain, operate and use them. The Red River Delta is an extremely complex system dating back to the 8th century. In the 1950s and 1960s, an extensive irrigation and drainage system was designed and constructed to drain excess water from, and irrigate, thousands if not millions of agricultural fields. In more recent years, growing strain is being placed on this system, which is taking the form of riverbed incision, increasingly erratic monsoons, sea level rise, salinisation, and the steady conversion of land to support urbanisation and industrialisation. While the Mekong has attracted significant scholarly and policy attention in recent years in relation to agriculture and water management (see, for example, Biggs et al., 2009; Tessier and Huynh, 2018), the Red River Delta has been the subject of much less attention. Most irrigation-related research conducted in the area has focused on technical issues such as infrastructure improvement and modeling for monitoring water quality (see, for instance, Nguyễn Dức Phong, 2023; Trần Tuấn Thạch, 2023). In the 1990s, the "DELTAS" project[2] brought much-needed attention to the institutional and economic dimensions of irrigation in the context of decentralisation and the (semi-)privatisation of water management (Fontenelle, 2001a); however, this work is now over two decades old and the hydrosocial machine has changed significantly since then.

What remains underexplored, and what this article aims to document, is how the Red River Delta's machine functions on an everyday basis. More specifically, we are interested in the people who 'make' the machine in the sense of being both part of it and running it. Critical irrigation studies have long analysed the role of bureaucracies in shaping irrigation realities (see Molle et al., 2009; more generally, see the October 2009 *Water Alternatives* Special Issue). Scholars emphasise top-down practices and organisational rigidity, often portraying bureaucracies as indifferent – or even resistant – to the needs and voices of irrigators, even in the context of policy reforms aimed at promoting Participatory Irrigation Management and Irrigation Management Transfer (Rap, 2006; Zwarteveen, 2017). Scholars argue that these reforms have fallen short of their stated objectives due to the primary concern of irrigation bureaucracies with maintaining their legitimacy and control. This line of critique has led to the use of terms like 'hydrocracies' (Molle et al., 2009; Zwarteveen, 2017), which underscore the fact that bureaucracies are first and foremost aimed at exerting and consolidating their control and power. While such perspectives are valuable, they tend to give an image of bureaucracies as monolithic entities and do not really allow for an understanding of their inner workings. Inspired by actor-oriented approaches such as that of Long and Long (1992) and Long (2003), which have notably highlighted the importance of the 'mundane' in shaping development processes (see also Lewis and Mosse, 2006), we seek to open the black box of the Red River Delta water bureaucracy by focusing on how it works in practice on a daily basis.

More specifically, we turn our attention to the thousands of street-level bureaucrats (SLBs) who operate pumps, walk along canals, manipulate sluice gates, repair infrastructure, and guide water to farmers' fields. First introduced by Michael Lipsky (1980), the concept of street-level bureaucrats has been used with reference to public agents who are on the frontline of implementing governmental policies and who, because of this work, encounter and interact with the recipients of such policies. Though their role has long remained invisible, they are central to shaping the policies and practices in sectors as diverse as development (Covey, 2023), climate change (Funder and Mweemba, 2019), health (Harrison, 2015), education (Honig, 2006), forest management (Maier and Winkel, 2017), protected areas (Putkowska-Smoter and Niedziałkowski, 2021), and water management (Wade, 1992; Pia, 2016). When applied to the irrigation sector, the attention to practices that characterises the literature on SLBs echoes the work of Kemerink-Seyoum et al. (2019) on sociotechnical tinkering and that of Cleaver's work on

[1] A sluice gate is a sliding gate that controls the flow of water along a waterway.

[2] "DELTAS" INCO-DC research project. This project was implemented by GRET (Paris) and VASI (Hanoi), and was funded by the European Union (DG XII).

(institutional) bricolage (Cleaver, 2002). Using the concept of SLBs in the context of Vietnam, our attention is also drawn to the work of Kerkvliet and his concept of "everyday politics" that allows for a nuanced reading of the Vietnamese state as multifaceted and dynamic, a place where, "people come to terms with and/or contest norms and rules regarding authority, production, and allocation of resource" (Kerkvliet, 1995: 400; see also Kerkvliet, 1990: 8-11).

The next section delves further into the analytical framing of the research. We briefly review the literature on water bureaucracies with a particular focus on SLBs, and we highlight the relevance of these perspectives in the Vietnamese context. The two sections that follow it draw from about 40 key informant interviews[3] in the Bắc Hưng Hải (BHH) polder,[4] combined with an analysis of the published and grey literature on the multilevel arrangements that govern the Red River Delta hydrosocial machine.[5] The section after that provides a brief overview of the main changes in the irrigation and drainage governance framework of the BHH polder since its creation. This is followed by a section which further delves into the daily practices of SLBs and how they shape the realities of irrigation and drainage in the polder. In line with the literature on the topic, we show how SLBs play a key role in the intermediation between water, infrastructure and people and how they engage in a constantly evolving balancing act between enforcing and circumventing formal rules. Such 'bricolage' can be seen as a form of 'everyday politics', one that reflects an ethics of office that is made up of a commitment to both public service delivery (in this case water management) and maintenance the central position of the bureaucracy.

STREET-LEVEL BUREAUCRATS AND INTERFACE ANALYSIS IN VIETNAM

In the middle of the last century, Karl Wittfogel (1957) published an influential yet much criticised "hydraulic hypothesis", in which he makes the link between large-scale irrigation systems and the emergence of centralised authoritarian states. In the decades since, many scholars have interrogated the relationship between water infrastructure and political authority, exploring how control over water resources can reinforce state power and influence governance structures (see Bichsel, 2016, for a recent synthesis on the topic). In these processes, the role played by the administrations in charge of overseeing state-led irrigation development has been of particular interest to critical social scientists, including in this very journal. Molle et al. (2009) famously dubbed them 'hydrocracies' to denote their technocratic – even authoritarian – nature, which is self-justified in the pursuit of a so-called 'hydraulic mission' with which they would have been entrusted for the benefit of all. Scholars further highlight that irrigation – and water bureaucracies more generally – are grounded and driven by values such as efficiency (Wade, 1985; Hanak, 2009), control (Wester et al., 2009; Molle, 2018); and masculinity (Liebrand, 2014; Zwarteveen, 2017), as well as by a trust and belief that water challenges are best addressed through techno-managerial interventions and, more specifically, engineering. This would make Irrigation bureaucracies impervious to change. Together with their willingness to exert and retain power, this would explain the poor records of Irrigation Management Transfer and Participatory Irrigation Management reforms (Wade, 1984; Rap, 2006; Suhardiman et al., 2014), including in Vietnam (Asian Development Bank, 2012; Huynh et al., 2021), as both of these types of water management question the very primacy of the administration that was meant to enforce them.

[3] We anonymised the names of people, but kept the real administrative names of the places we worked so that the reader could navigate the region's geography. It is important to note that during the summer 2025, some administrative restructuring has happened in provinces, districts and communes in Vietnam. Names of places may have changed at the time this paper is published.

[4] A polder is a piece of low-lying land that has been reclaimed from the sea or from a river and is protected by dykes.

[5] Interviews were held mostly in the provinces of Hưng Yên (districts of Khoái Châu and Phù Cừ) and Hải Dương (districts of Bình Giang and Gia Lộc). Data collection consisted of semi-structured and in-depth interviews, participant observation, and shadowing in pumping stations, households and along canals; it also included several follow-ups with some SLBs. In addition, and even though they are not the focus of our analysis, we also conducted more than 30 interviews with farmers in order to cross-check the information we got from the SLBs and 'follow the water' all the way down to the fields it irrigates.

Though some of these authors have delved into the specifics of how irrigation reforms unfold in different contexts, they tend to draw general lessons as to how bureaucracies work as a whole. A complementary view is to take 'people', that is, the bureaucrats themselves, as an entry point for the analysis. In Vietnam, an emerging literature attempts to challenge the conventional portrayal of a monolithic and all-powerful Vietnamese bureaucracy. Historical and anthropological analyses include those of Kerkvliet (1995, 2005), who proposed the concept of "everyday politics" to understand the workings of Vietnamese state institutions. Such analyses have provided valuable insights into the interactions between commune, district-level state agents and members of rural communities, including in the irrigation management sector (see, for example, Huynh, 2016). Similarly, emerging critical research on decentralisation (Minh Lam Chau, 2020) and disaster management (Christoplos et al., 2017) emphasises the dynamic roles of the 'local officials' who navigate administrative, political and technical challenges, and hence shape the realities of policy; scholars such as Benedikter (2016) and Gainsborough (2010), on the other hand, show how personal agendas at different levels are key to understanding the functioning of the Vietnamese state and the persistence of a centralised power, even in the wake of the Đổi Mới reforms.[6]

This work resonates with the notion of street-level bureaucrats (SLBs), a term that was first coined by Lipsky (1980: 3) to designate, "public service workers who interact directly with citizens in the course of their jobs and who have substantial discretion in the execution of their work" (see also Hupe et al., 2015). Since then, there has been much debate on the very definition of SLB (see, for example, Maynard-Moody and Portillo, 2010; Maynard-Moody and Musheno, 2022). In this paper we see them, broadly speaking, as agents who are (at least partly) payed by the state and who, "conduct the everyday work of bringing policies into being on the ground" (Holstead et al., 2021). It is beyond the scope of this paper to review the literature that has engaged with this concept since its introduction 40 years ago (for this, see, for example, Brodkin, 2012; Gofen et al., 2019; Holstead et al., 2021). We limit ourselves here to identifying some key aspects that are useful for our analysis. Going beyond a focus on SLBs' role in public service delivery (disbursing subsidies, ensuring water supply and drainage), we stress the creativity and tensions (Clement et al., 2024) that accompany their role of 'intermediation' between multiple 'interfaces' – two notions that have long been used in the field of the sociology and anthropology of (rural) development.

In his seminal book entitled, *Encounters at the Interface*: *A Perspective on Social Discontinuities in Rural Development*, Norman Long (1989) introduced the notion of interface to define the sites of interactions and negotiations between different social actors, institutions and cultural frameworks within development processes; Long highlighted that these are sites of social discontinuities where different values, interests and knowledge systems meet (see also Arce and Long 1993, 2000). Together with the work of scholars such as Jean-Pierre Olivier De Sardan, Giorgio Blundo, and Thomas Bierschenk (Olivier de Sardan, 1995; Biershenk et al., 2000), such analyses form the basis for what has come to be known as 'actor-oriented approaches' to (rural) development (research). In unpacking the 'social life' of development projects, this type of analysis takes as its starting point the individual and the mundane rather than the institution (while still acknowledging the framing influence of the latter). These approaches have informed the SLB literature and inspire our own enquiry into the daily encounters between water, infrastructure and people in BHH.

Both actor-oriented approaches in general, and the SLB literature more specifically (Dubois, 2012; Sevä and Sandstrom, 2017), highlight the creativity and tensions that go with the SLBs' daily activities of mediating between national policy frameworks and local realities. Clement et al. (2024), for instance, show how French agricultural advisors navigate the complexity of reconciling top-down directives with the bottom-up realities of farming communities. Clement and her colleagues illustrate how the advisors are faced with the conundrum of promoting policies that may clash with both their understanding of

[6] Đổi Mới is a term associated with the law and policy reforms that have led to the liberalisation of the Vietnamese economy starting from 1986.

farmers' needs and their own individual values. Indeed, the issue of alignment between an SLB's values and those they perceive are embedded in policies is often central in shaping their daily practices and arbitration they make (see, for example, Sevä and Jagers, 2013; Holstead et al., 2023; Piotrowska, 2024). Closer to our case, Huynh (2016) shows the complex interplay between local irrigation bureaucrats and farmers in the Mekong's Cần Thơ irrigation system; Huynh highlights the negotiation processes and compromises that accompany the implementation of irrigation and drainage management. Weger (2023), also in the Mekong Delta, further describes how what he calls "intermediary actors" (such as researchers and extensions agents) are required to pursue state development targets while at the same time turning to informal relationships and interactions to advance critical perspectives on these targets. The author shows how this balance is shaped by the simultaneous pursuit of both private and public interests. Similarly, in a study of water distribution officers in the Chinese province of Yunnan, Pia (2016: 4) shows how SLBs are driven by an "ethic" of work that is a comprised of both individual and "systemic" values – the latter revolving around the idea of "serv[ing] the people".

SLBs often operate in weak institutional settings and under "highly precarious working conditions" (Peeters and Campos, 2023); these two factors provide further impetus for them to pursue continuous and strenuous negotiations and improvisations that are often at odds with their formal mission. Pia (2016), for instance, highlights how SLBs who are responsible for collecting water distribution fees that are essential to maintaining irrigation infrastructure can also turn a blind eye to the fact that the poorest do not pay; this occurs despite the chronic financial shortages and persistent difficulties in operating the system that result. In a similar way, Mai Nhật Minh (2024) shows how overworked provincial irrigation bureaucrats in Vietnam's Long An Province short-circuit the country's formal political hierarchy in order to deal directly with water distribution issues at the village scale. May and Winter (2009) and Funder and Mweemba (2019) further highlight that SLBs constantly walk a very thin line and that tipping to either side (formal institutional frameworks or local practices) may lead to conflicts. To sum up, in practice SLBs go much beyond fulfilling their administrative responsibilities to navigate the complex realities they face. In the words of Covey (2023), talking of "national development experts", they are "one-man bands" who are able to partially solve institutional weaknesses thanks to their capacity to improvise (see also Masood and Nissar, 2021).

Street-level bureaucrats' routine improvisation can be captured by the term 'bricolage' – a French word that refers to informal resourceful practices. Blijleven and Van Hulst (2021: 288), for instance, use this term when describing how Dutch public servants engage creatively with the funder to redirect provincial funding from one project to another in order to keep implementation on track despite institutional constraints. Funder and Marani (2015) further illustrate how Kenyan environmental officers rely heavily on personal networks and informal arrangements to conduct their work. One particularly striking example they provide is when SLBs were entrusted with the responsibility of organising an informal agreement between farmers and fisherman around Lake Jipe as to which land could and could not be cultivated. In doing this, they were able to build on their own legitimacy and on their relationships with local associations, without ever having formal approval or a legal mandate from their superiors.

For irrigation and water scholars, this patching together of informal and formal regimes of legitimacy and this reference to bricolage will echo the work of Cleaver (2002); it also resonates with the work of Kemerink-Seyoum et al. (2019) on sociotechnical tinkering, which reminds us that SLBs in the irrigation sector navigate not just *social* interfaces (as in Norman Long's terminology) but *sociomaterial* interfaces. Critical irrigation research has indeed long demonstrated the intertwined nature of the social and technical dimensions of irrigation. It has notably shown that infrastructures are not made up of merely inert objects, but rather are material expressions of how people perceive their environment, internalise social norms, and follow tacit operational routines. They are embodiments of patterns of practice that shape both their design and their everyday use (see, for example, Bolding et al., 1995; Vincent, 1997; Aubriot, 2010; Aubriot and Riaux, 2013; Ivars and Venot, 2019). In the field of irrigation, materiality and

infrastructures do indeed matter, and SLBs care for them sometimes as much as they take care of their own homes (Chitata et al., 2023: 8).

We share this deep appreciation for the hard work that SLBs do to make complex hydrosocial machines such as the Red River Delta 'work'. In what follows, we examine the daily practices and ethics of street-level bureaucrats who are entrusted with the practical day-to-day aspects of public water management in the Bắc Hưng Hải (BHH) irrigation system, the largest polder of the Red River Delta. Before doing so, however, we provide an overview of the historical and current water governance framework in the BHH polder.

THE BẮC HƯNG HẢI POLDER: A COMPLEX HYDROSOCIAL MACHINE

A bird's eye view of irrigation and drainage governance in Bắc Hưng Hải

SLBs do not operate in a vacuum and their practices are often deeply rooted in history. We thus first offer a brief historical overview of the water governance institutions that provide the backdrop against which SLBs operate in BHH today.

Historically, irrigation management in the Red River Delta was the prerogative of local villages, with the central state focusing on maintaining dykes to mitigate flooding (Do Duc Hung 1979, 1997). Following the country's independence in 1954, the state assumed greater control over irrigation; it established large-scale schemes to distribute water across the Red River Delta, sometimes making use of gravity distribution systems that were built during the French colonial period. Crucially, the Vietnamese state undertook a major project to complete the system of dykes protecting the Delta, creating 30 polders throughout this vast marsh of about 21,000 km², including the Bắc Hưng Hải polder (Fontenelle, 2004). The polderisation and endykement logic was grounded in the idea of water control. It necessitated the building of pumping stations along the main rivers to both irrigate and drain the polders. Their construction depended on the relative elevation of land and streams, which changes depending on the time of the year. In the mid-1970s, Irrigation and Drainage District Enterprises (hereafter referred to as district enterprises) were created under the control of the ministry in charge of irrigation at the time. They were entrusted with the responsibility of operating and maintaining the secondary canal network and related pumping stations (Fontenelle, 2004).[7]

From soon after independence until the mid-1980s, the agriculture sector was collectivised, with farmers and irrigators organised in 'teams' that belonged to communal cooperatives. Strictly applied in the Red River Delta, the cooperative system began to face resistance from farmers in the early 1980s. This progressively led to the decollectivisation of land, agricultural activities, and irrigation in the wake of the Đổi Mới reforms (Yvon-Tran, 1994). The small 'local' pumping stations that dot the landscape of BHH are testimony to this progressive shift; these had multiplied as electrification in the delta progressed and as villages competed to access it. Pumping stations were not only a way to gain autonomy from the centrally managed irrigation and drainage system; they were also a means to claim priority access to electrification (Do Hai Dang, 1999). This multiplication of stations further complexified water flows and their management (Fontenelle, 2001a; Bui Kim Dong, 2006).

In 1984, the Bắc Hưng Hải Company (BHHC) was established in an effort to address the need to coordinate water management across districts. Its role was to oversee the management of the main canals that cut across the polder and the 12 sluice gates (the red diamonds on the map in Figure 1) that allow control of their water levels. District enterprises continued to operate infrastructure autonomously at the district scale (Fontenelle, 2001a, 2001b, 2004). The fact that BHH spanned several provinces was a

[7] In Vietnam, a district is an 'intermediary' administrative unit made up of several communes, and a province is comprised of several districts. The BHH polder spans several provinces which complexifies its governance.

key justification of the BHHC's creation, the rationale being that irrigation management would not be affected by administrative dynamics and reconfigurations. The BHHC was put under the authority of the ministry dedicated to irrigation, and later was shifted to the Ministry of Agriculture and Rural Development (MARD).[8] The Vietnamese government funded major infrastructure in 1984, but the BHHC was expected to collect irrigation fees from farmers in order to "cover their water diversion, irrigation and drainage operation, maintenance and depreciation costs"; this was articulated in an August 1984 national decree (Fontenelle, 2001b: 21). Irrigation fees were to be collected by commune-level cooperatives, then transferred to district enterprises and from there to the BHHC. Fontenelle et al. (2007), however, showed that the company sustained a deficit from its creation to the end of the 1990s due to limited public investment and weak enforcement of irrigation fee collection. Discrepancy between operation and maintenance needs and available financial resources is one of the key tensions SLBs face in their daily activities (see the following sections).[9]

In 2005, Irrigation and Drainage Province Companies (hereafter referred to as province companies) were established in response to persistent budget deficits, the BHHC's limited capacity to oversee operations across all districts of the polder, and the increasing role and power that Vietnam's provincial administrations had assumed (Fritzen, 2002). These entities were established in each province via provincial decrees and were tasked with coordinating the work of district enterprises, which became branches of the province companies (see Figure 3 for a graphical representation of the interactions between these two wheels of the BHH machine). As stated by one of our interviewees at the Xuân Quan main sluice gate, the BHHC's role currently consists mostly of ensuring sufficient water levels in the main canals, "without taking care of what happens beyond the district enterprises' sluices". BHHC officials are largely disconnected from local irrigation and drainage issues, which are the remit of district enterprises and their staff (street-level bureaucrats) whose involvement we describe in the next section. We first delve further into the functioning of the BHH hydrosocial machine.

A maze of canals and pumps

The BHH polder is the only polder of the Red River Delta that cuts across four administrative provinces: Hà Nội, Bắc Ninh, Hải Dương and Hưng Yên; this characteristic makes its governance particularly complex. BHH covers a total of more than 214,000 hectares (ha) (BHHC, 2021), with an interlacing network of canals and thousands of pumping stations. According to the Vietnamese nomenclature, canals are classified from Level 1 (main, visible on Figure 1) to Level 4 (on-field), but this simple classification does not do justice to the complexity of water flows and their management in the BHH polder.

Indeed, relative water levels determine in which direction water flows and whether a given canal functions as a supply (irrigation) or a drainage canal. Actual water levels are the result of SLBs operating a multitude of interconnected sluice gates and pumping stations. To paraphrase Biggs et al. (2009), BHH is a complex hydrosocial machine.[10] Taking the Hải Dương province as an example, there are more than 700 pumping stations in the part of the province that falls within the BHH polder (Figure 2). The polder is then further divided into several sub-polders that are delineated by the main canals. In these sub-polders, water flows from the main canals into a network of secondary canals that can be either supplied by gravity via sluice gates or filled by large irrigation pumping stations (equipped with 2 to 8 engines with a capacity of 1000 to 2500 m^3/hour). On those secondary canals, smaller pumping stations (with engines

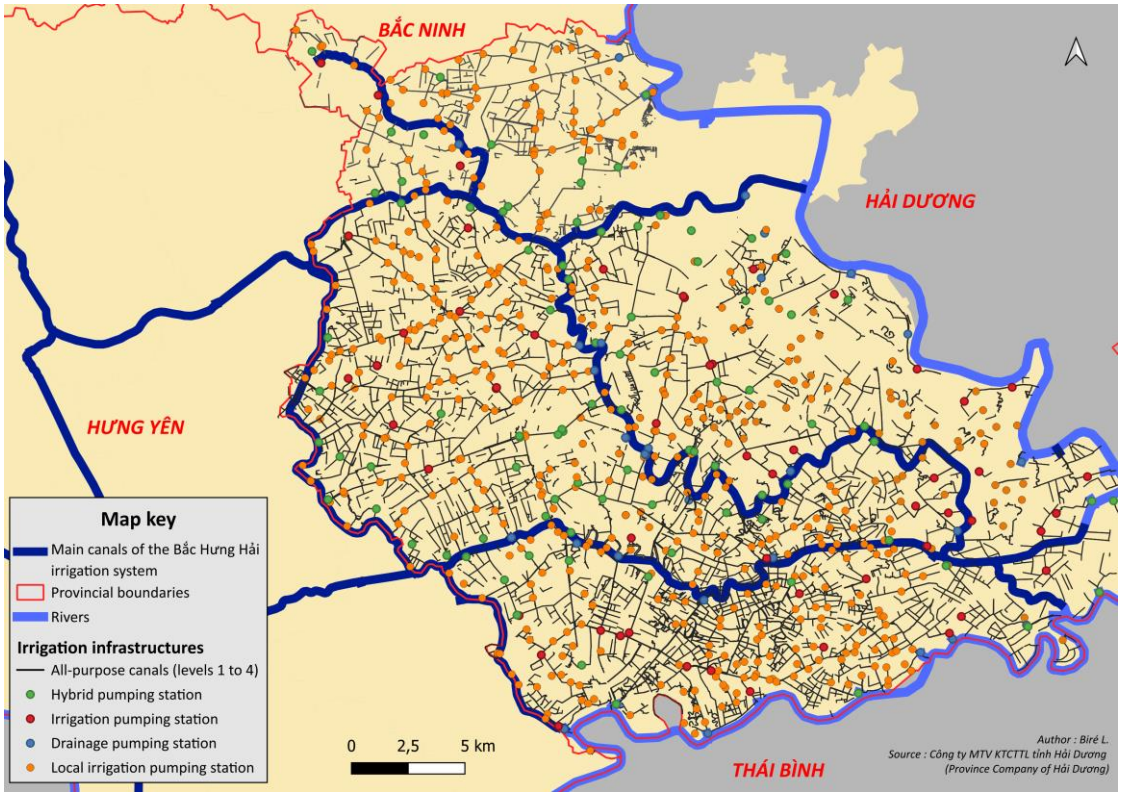
[8] At the time of our fieldwork, MARD was still in charge of irrigation and drainage management; however, a law on state restructuring and efficiency was enacted in January 2025 by Tô Lâm, who has been the General Secretary of the Vietnamese Communist Party since the summer of 2024. This law aims to merge MARD with the Ministry of Natural Resources and Environment (MONRE). Names in this paragraph may very well have changed by the time this paper is published.

[9] Since the 2017 water law, irrigators are no longer liable for irrigation fees.

[10] The 'machine' is dependent on water releases from hydropower plants located upstream on the tributaries of the Red River. In addition to producing electricity, notably for Hanoi, water releases are key to maintaining freshwater flow in the downstream reaches of the delta, in that way limiting saline intrusion.

Figure 1. Major sluice gates and main canals of the Bắc Hưng Hải polder.

Figure 2. A maze of canals and pumping stations in Hải Dương province (Bắc Hưng Hải polder).



having a capacity of 700 m^3/hour) further pump water into elevated tertiary canals that generally supply on-field canals by gravity. Some pumping stations can irrigate fields but also drain surplus water out of the sub-polders, and it is not rare to see drained water being re-pumped for irrigation in a sort of closed loop. Generally built between the 1960s and the 1980s, the buildings and equipment of the pumping stations are in variable conditions, with some in a dilapidated state while others have been recently rehabilitated. It is a common practice to 'upgrade' former irrigation stations to also drain water.

Gears of public agencies and bureaucrats

In Vietnam, irrigation and drainage management is a public matter. State organisations at different administrative levels are involved in the management of the maze we described in the previous section, as are officials from different government branches. Figure 3 plays with the image of the hydrosocial machine in an effort to represent the complex interactions between these.

Since their creation by the central Vietnamese state, district enterprises have been particularly responsible for the operation and maintenance of the infrastructure in their respective areas in compliance with national policies; this includes canals, sluice gates and pumping stations. Each district enterprise oversees a number of irrigation 'clusters' (called *cụm* in Vietnamese). One cluster generally covers five to seven communes, each served by one to three pumping stations. A cụm can thus have between 10 and 15 pumping stations for an average command area of 1000 ha. Most pumping stations distribute water to a single commune, but this is not always the case.[11] Each cụm is under the responsibility of a manager (*cụm trưởng*), who supervises several teams of workers that are operating local pumping stations and sluices. Station workers coordinate with water guides (*nông giang*) to distribute water.

Province companies were established as public entities in 2005. Their responsibility, as they see it, is to calculate water needs on the basis of the information provided by district enterprises about the agricultural area under their respective jurisdictions. They also report their maintenance and rehabilitation needs to the MARD through the water resources division of the provincial Department of Agriculture and Rural Development (DARD), which is itself under the authority of the Province People's Committee (see Figure 3). The companies' budgets are split between operation (to pay staff and electricity), maintenance (yearly repairs and cleaning of pumping devices), and rehabilitation. The planning bureau of the province company elaborates a yearly rehabilitation plan based on the demands from irrigation cluster managers that are transferred via the district enterprises. According to our interviews, funds are mostly managed by the province companies, which receive a yearly subsidy from the Vietnamese state. Province companies directly cover the expenses of the district enterprises they oversee (staff, insurance, electricity, maintenance and renovations). District enterprises themselves only manage a small budget that is dedicated to fixing infrastructure in case of emergency; their funds can only be used for repairs of less than 20 million Vietnamese Dong (VND, approximately US$780).

A significant shift took place in 2017 when a new water law suspended the payment of water fees by farmers (Government of Vietnam, 2017). Even if district enterprises and province companies had always faced difficulties recovering these fees, they were not negligible, especially in a context whereby province companies had seen a steady decline in their yearly state subsidies.[12] The end of water fees has come at the expense of maintenance and rehabilitation. District enterprises are under further pressure as well, as their electricity budget (calculated on the basis of the area declared to be irrigated) is evaluated according to 2017 electricity prices, even though these have increased since then. This decrease in public funding has practical implications. District enterprises are officially meant to submit a list of their maintenance

[11] SLBs think in relation to administrative boundaries, though these do not always exactly match with the hydraulic boundaries of the area for which they are responsible.

[12] Between 2020 and 2024, for instance, the district enterprise of Phù Cừ saw its corresponding budget decrease by more than 20% (from interviews at the province company of Hung Yên and at the district enterprises of Phù Cừ and Khoái Châu).

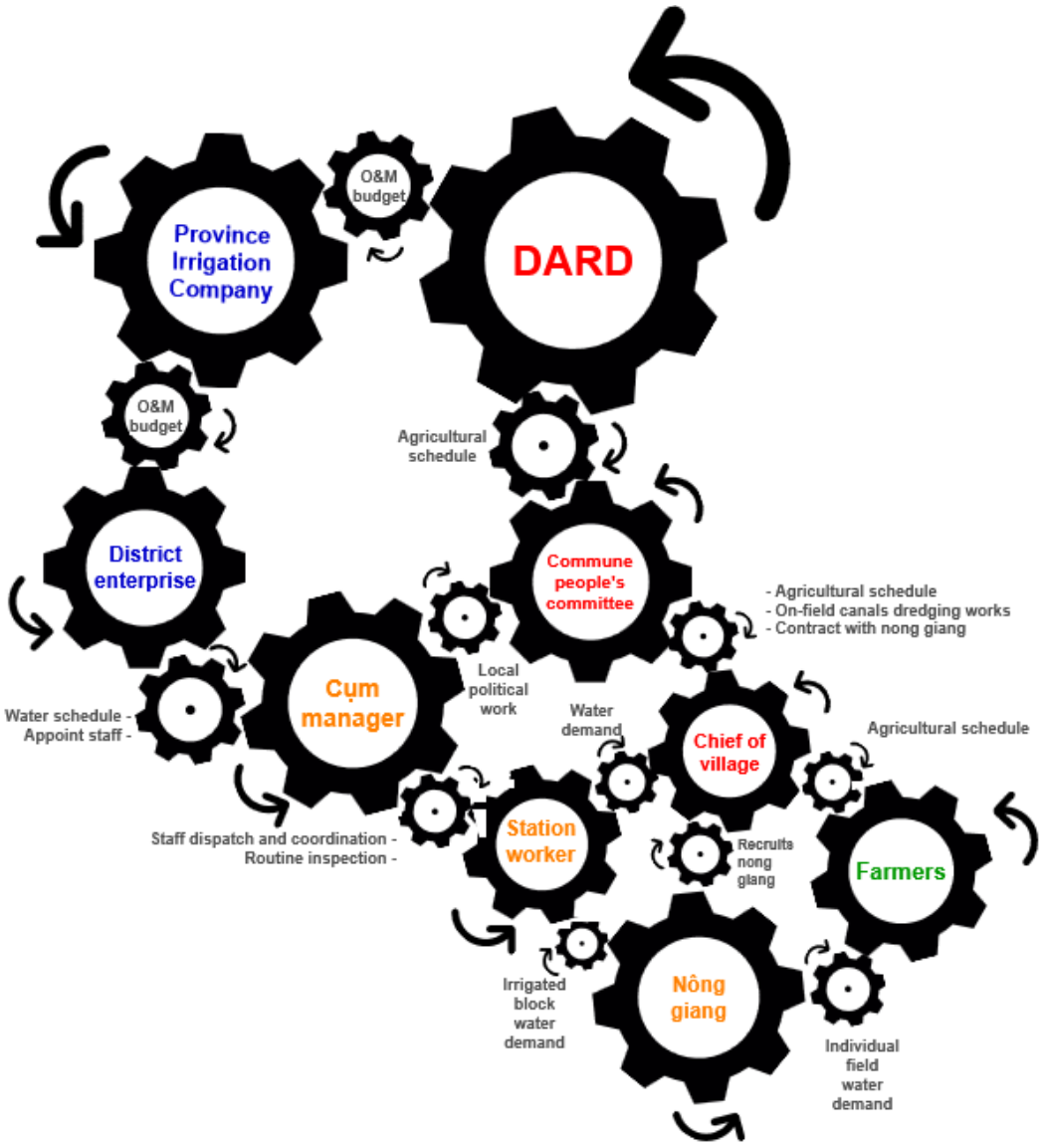
and rehabilitation needs for approval at the beginning of each year; in practice, however, district planning offices contact the province company's planning office whenever infrastructure breaks down and ask to include the repair costs in the following year's plan. The 'plan' thus becomes, in essence, a record of expenses for maintenance and repairs that already took place.

Planning, even so, is key to the functioning of the Vietnamese bureaucracy; we thus take a small but important detour towards agricultural planning, as it partly shapes the functioning of the BHH hydrosocial machine (see Figure 3). In Vietnam, agricultural activities are formalised in 'plans'; these act as short-term public policy tools to regulate agricultural production at the provincial (DARD) and district level (Bureau of Agriculture and Rural Development, or BARD). Every season, agricultural staff from the communes and from BARD and DARD meet to discuss and determine the spatial distribution of crops down to the commune level. It is on the basis of such plans, aggregated at the provincial level, that province companies communicate their anticipated water needs to the DARD's irrigation division; their operational budget for electricity is also calculated on the basis of these plans. Such plans for cropping are not imposed on farmers, who still have some room to choose what they do and do not grow;[13] however, they do lay the basis for an agricultural schedule whereby the DARD specifies dates for preparing the fields, transplanting and harvesting (Figure 3). Though only partially followed, these agricultural schedules are key; together with the electricity needs of Hanoi and neighbouring cities, the needs to limit saline intrusion and dilute pollution, as well as weather events, they contribute to shaping agricultural practices, hence the operation of thousands of sluices gates and pumping stations used to maintain water at given levels in the different stretches of the BHH canal network. As is often the case when there is a need for multilevel coordination, information regarding agricultural plans rarely flows smoothly. Communal officers in charge of agriculture are meant to be officially notified about the agricultural schedule during meetings with BARD officers; our interviews show, however, that they often get this information informally from the president of the commune people's committee. One of our interviewees mentioned that she had no choice but to write it down in a notebook and then to communicate it later to village chiefs and station workers. Officers often have a hard time navigating the archives of their communes for past plans; this is due to a lack of organisation, understaffing, and frequent turnovers in the local administration. This fact, and the above anecdote shared by the interviewee, are illustrative of the daily constraints and adjustments that are made by SLBs to make the BHH hydrosocial machine work.

Figure 3 does not offer a static flow chart that may give the (false) impression of a neat delineation of both responsibilities and hierarchical relations; rather, it plays with the image of the machine to bring to the fore the multi-layered interdependencies that we hinted at above and upon which hinges the functioning of BHH. It provides a visual background against which to read the following sections; these further delve into the daily practices and hard work that make SLBs active engines rather than mere passive cogs.

[13] In effect, the 'plan' is often a formalisation of what can be observed in farmers' fields. Land identified in the plan for conversion from rice to fruit trees, for instance, has often already been converted by the farmer, or else the farmer has already indicated their interest in doing so to the local authorities.

Figure 3. A visual representation of the BHH hydrosocial machine.



Note: The colours used are for different 'types' of actors; orange = the SLBs who constitute the core of our analysis; blue = the organisations specifically dedicated to drainage and irrigation management; red = decentralised administrative authorities at different levels; green = farmers; BHH = Bắc Hưng Hải irrigation system; DARD = Department of Agriculture and Rural Development.

BEYOND COGS IN A HYDROSOCIAL MACHINE: SHAPING WATER MANAGEMENT, DAILY

In this section, we show how SLBs are more than cogs in the hydrosocial machine; indeed, they shape the daily realities of water governance in the BHH polder. We identify three categories of actors that act as street-level bureaucrats there.[14] First, they are 'leaders' of irrigation clusters (cụm trưởng) who supervise the operation of several irrigation stations; they pursue objectives that are defined in terms of area to be irrigated, electricity consumption and infrastructure maintenance, all of which are defined by their

[14] This is not to say that SLBs are limited to these three categories of activity or that staff from communes and the district are not also SLBs. We focus here on actors that explicitly and exclusively deal with irrigation and drainage.

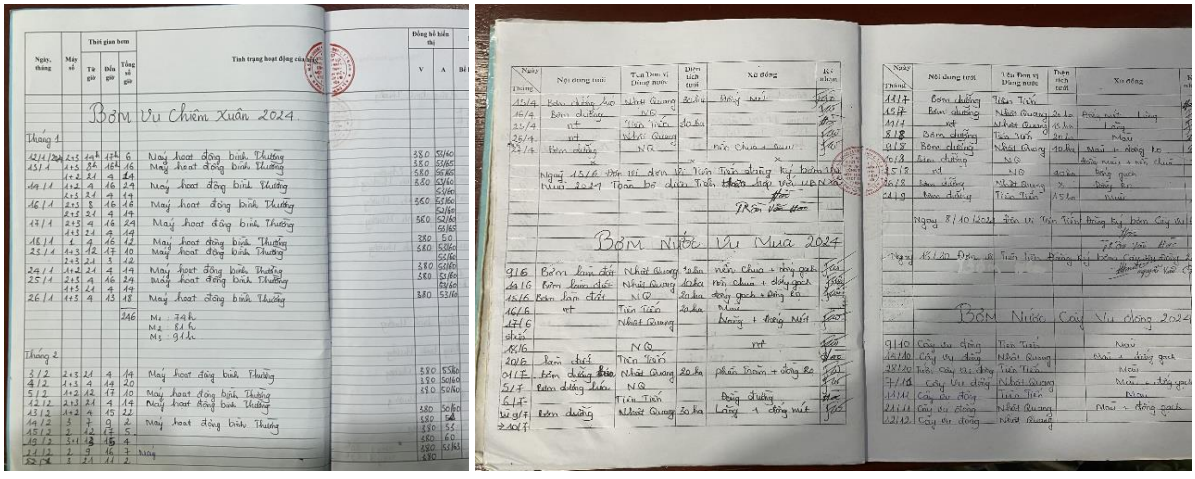
superiors in the district enterprise. Second, they act as station workers who operate pumps day and night to meet villagers' water demands; they also deal with the materiality of a degrading infrastructure and with the need to keep electricity consumption at its lowest for cost reasons. Third, they are water guides (nông giang) who collect water demands from villagers and ensure that water is conveyed to farmers' fields; they also operate sluice gates and tinker with bunds using whatever they find lying around along tertiary canals. In many countries of the world, such water guides are a common feature of irrigation systems and are not necessarily associated with bureaucracy; given their importance in the functioning of the BHH hydrosocial machine, however, we decided to include them in our analysis. Indeed, to a certain extent nông giang *can* be seen as SLBs, even though they are first and foremost farmers. Rather than being bureaucrats per se, they are well-respected members of the community who have generally been co-opted by the chief of their village to ensure water distribution; however, they are paid by the state to ensure water delivery, very much like the situation in Korea that was document by Wade (1992).

In the next sections, we engage with three dimensions of SLB realities in BHH. First, we shed light on how cụm managers and station workers schedule water distribution. We observe the constant adaptation that this involves as they balance farmers' needs and requests with constraints imposed by their administrative hierarchy, including keeping electricity consumption as low as possible. Second, we highlight the continuous "sociotechnical tinkering" (Kemerink-Seyoum et al., 2019) in which SLBs engage in order to operate and maintain the infrastructure for which they are responsible. Finally, we describe the key role played by the pumping stations themselves. We show how they are much more than a set of buildings and electric engines; they are also living and working places where hydrosocial relationships are nurtured.

Distributing water: Scheduling, keeping electricity cost low, and guiding water at night

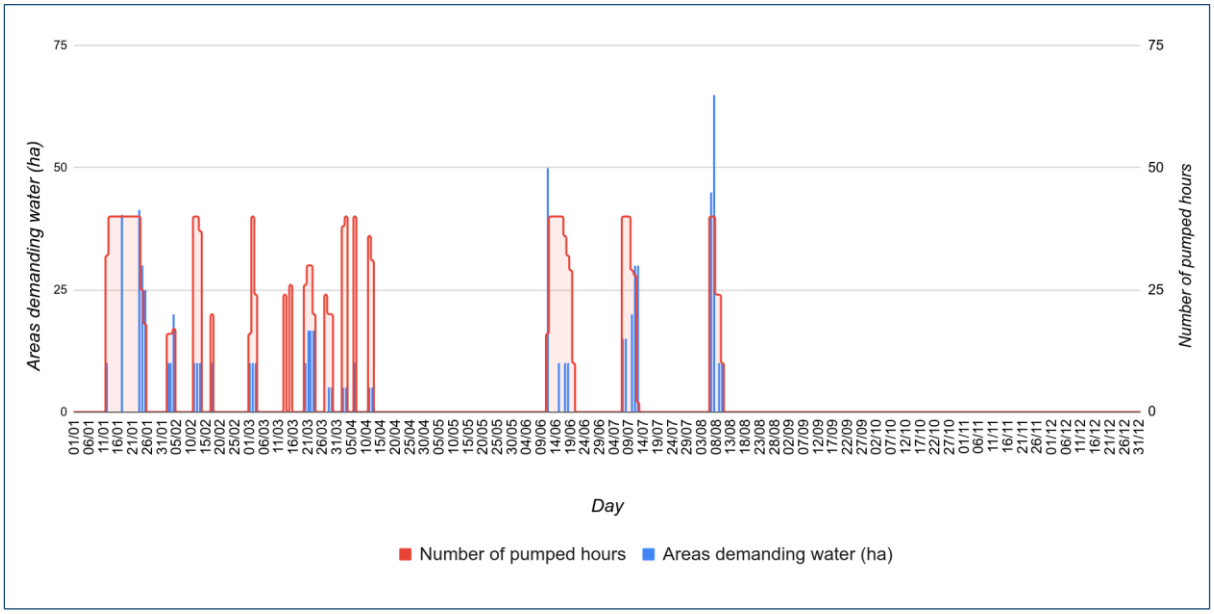
To understand how water reaches farmers' fields, one needs to turn towards the two logbooks that can be found in every pumping station of BHH. In the first logbook, pumping station chiefs record every request for water, which are generally received from a nông giang; they further record the reason why it was requested (*đổ ải* for flooding fields, *bơm dương* for a punctual request to 'support' crop water needs), the area to be irrigated, and its location (that is, the specific irrigation block for which water has been requested). In the second logbook, pumping station chiefs record the dates and times at which the different pumps are switched on and off (see Figure 4).

Figure 4. Logbooks from a pumping station; left: water demands for June and July 2024; right: effective pumping times for January and February 2024.



The notebooks we examined in the pumping stations we visited show that in most cases pumps are activated the day a demand is made, or the following day (Figure 5). During our discussions, however, several chiefs of station told us that because of pollution from surrounding industries they often had to wait days or even weeks to pump water. They also mentioned that, less frequently, pumping could be delayed due to low water levels in the canals from which the water is pumped. Indeed, there are rules that set minimum water levels below which engines cannot be switched on; also, station workers are generally able to monitor canal water levels via gauges that have been installed in the vicinity of their station.

Figure 5. Example of water demand and pumping logs in 2024 for one pumping station.



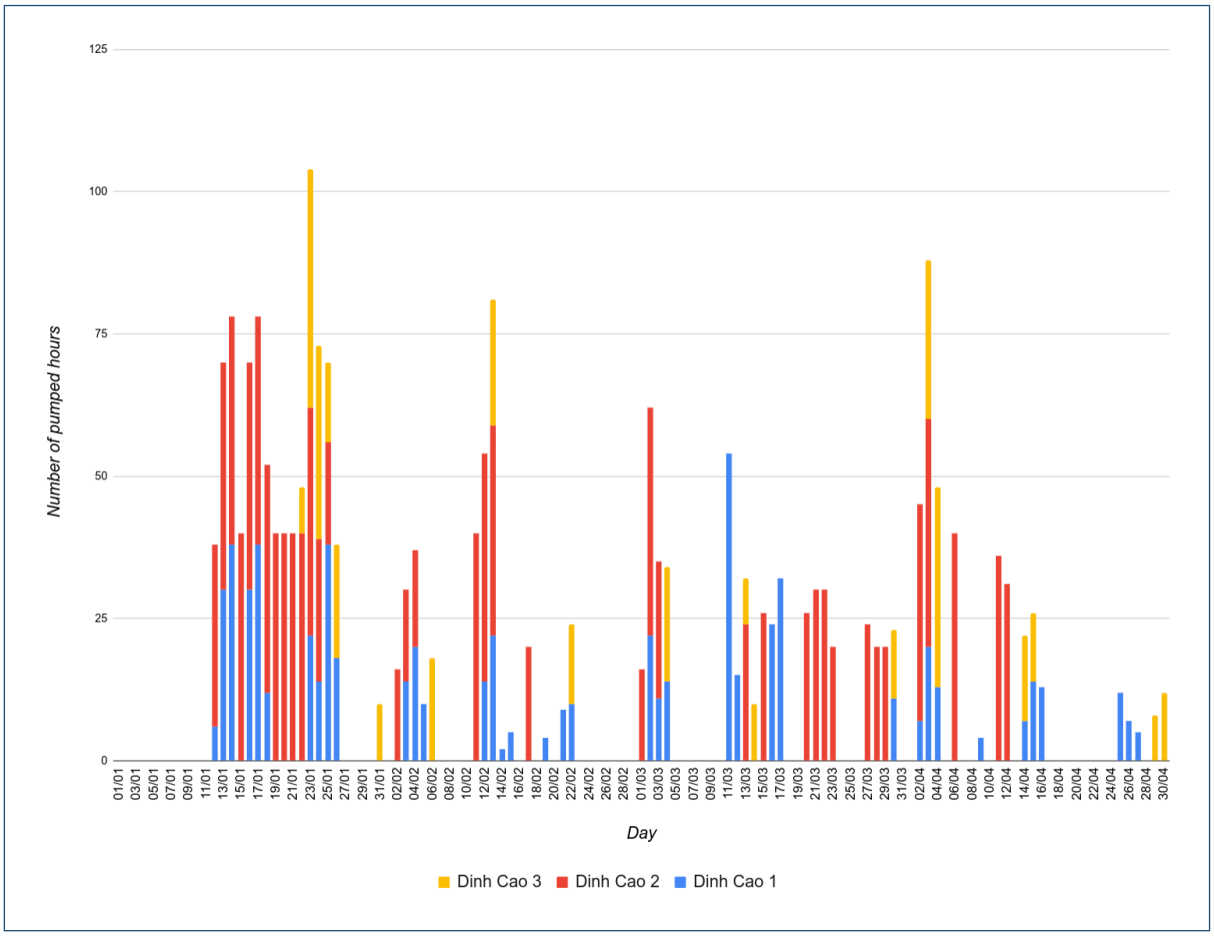
Note: ha = hectares.

When they activate pumps, SLBs strive to match the amount of water pumped to demands along the canals. Activating pumps, however, is not always a straightforward matter and is a learned capacity of SLBs. "As the chief worker of my station, I take many factors into account before activating the pumps", explains Ms Linh, who is the chief worker of the Thái Dương pumping station. As an example, she refers to an interaction from the previous morning, when two nông giang had called her to ask for water for several irrigation blocks. The first nông giang requested water for the same day to irrigate an area close to the station; the second nông giang requested water for the next day, for an area located further away from the station and slightly elevated. Instead of immediately meeting the demand of the first nông giang, she decided to start pumping on the second day. Her reasoning was that irrigating the higher and more remote village first, and then the second village, would minimise flood risk in the latter and avoid having to drain the surplus water.

Water distribution is constantly adjusted. Even if regular patterns from one year to another can be identified, there is also variability at the margins. The operation times of the Đình Cao 1, 2, and 3 pumping stations further illustrate this point. These three stations are 50 metres apart and pump from the same primary canal. An analysis of their pumping logs reveals a system of rotation between the three stations. In 2024, the three stations pumped for a combined total of 99 days (Figure 6). Of this total, all three stations operated simultaneously on 9 days (10% of the time), two stations pumped concurrently on 38 days (30%), and the rest of the time (52 days, 61%), only one station was active. When looking at the 9

days when the three stations operated simultaneously, we further see that out of a total of 216 hourly pumping slots recorded, the three stations pumped simultaneously for 65 hours (30%), two stations pumped at the same time for 110 hours (51%), and a single station pumped alone for 41 hours (19%).

Figure 6. Number of pumped hours in each pumping station of Đình Cao, January-April 2024.



Station workers' need to balance farmers' water demands with keeping electricity consumption at its lowest is key to understanding their daily practices, and the district enterprise evaluates their capacity to do this effectively. If electricity consumption is too high, an audit of the station can be launched; in that case, district enterprise staff come to the station, assess what the problem might be, and can suspend the workers if they are not performing well. According to the chief of the Đoàn Thượng pumping station, suspension of station workers needs to be avoided as much as possible since their salaries are already quite low and being suspended could put their family in dire straits. Every month, the district enterprise checks the logbooks and rewards the station chief who has managed to save electricity while still irrigating the required areas. Such rewards take the form of 'good worker' certificates (see Figure 7); these are not mere pieces of paper, they are symbols of someone's undeniable good work and value and have acquired cultural significance. *Giấy khen* (Certificates of Merit) are indeed distributed to individuals who work well and follow the rules, sometimes from kindergarten until late in life.

Figure 7. Example of a 'good worker' certificate hanging on the living room wall of the Kim Phương pumping station (Tiên Tiến commune, Phù Cừ district).

As mentioned above, electricity costs are indeed a major concern for district enterprises, given ever-decreasing subsidies and rising electricity prices. In this context, station workers operate pumps during off-peak hours, mostly at night when working conditions can be particularly difficult. In some stations, we observed a bed set up in the machine room. Ms Linh, from the Thái Dương station (Bình Giang district), explains that when a machine has a problem the workers rest in the machine room as close as possible to the faulty engine; from there, they can listen to the sounds it makes so as to shut it down as quickly as possible if the problem persists or worsens. Night pumping is not only constraining for station workers, but also for nông giang. Mr Phan Anh, a former nông giang of Duyên Linh village during the collectivist period, reminisced that,

> It has always been a hard job, to be a nông giang. During the collectivist period, electricity was unreliable and the pumps were breaking down all the time. But we were closer to farmers, more than nông giang are today, because we had to irrigate the fields directly, not only lead the water to on-field canals. We were elected every year during village councils, by villagers themselves, while today nông giang are chosen by the chief of village directly.

A sense of pride emerges from the way he talks about the past, but the position of nông giang in the village has changed since then and the prestige that came with it has vanished. This is further explained by Mr Quyền, both a nông giang and a farmer from Đình Cao commune;

> No one wants to do this job anymore: you have to get up early, or come home very late at night. Since it is not well paid,[15] and it is necessary to combine it with another activity, it is difficult to recruit new nông giang.

Depending on the commune, nông giang are enrolled via a written or oral contract and are paid from the district enterprise's budget as non-permanent staff. Since retiring nông giang are not replaced (for

[15] Twice a year (that is, once for each rice season), nông giang are paid 6 million VND (approximately US$230) for guiding water to an area that ranges from 70 to 100 ha.

lack of either funds or candidates), the remaining ones oversee ever larger irrigated areas; in Phù Cừ district, for example, the number of nông giang is now half of what it was in the mid-2010s. It is not rare for a nông giang to oversee a command area of up to 100 ha, made of blocks of 5 to 15 ha. The nông giang open and close sluice gates along tertiary canals, but that is not all; they also build up and remove small bunds of soil, stones or sand bangs so that water flows into or out of the fields in their command area. In this way they 'tinker' with the infrastructure – an issue we now turn to.

Operation and maintenance: A story of sociotechnical tinkering

"We don't have enough money, so we wait until the canals collapse to ask permission to repair them. From experience we don't get maintenance funds in cases that are not considered emergencies". This was told to us by Tuấn, a 15-year employee at the infrastructure planning office of the Phù Cừ district enterprise. As he said this, he lost the jovial smile with which he had greeted us as we entered the office. The laughter of his colleagues at their workstations also stopped; they had been amused by our questions until then, but now only the clatter of the ceiling fan punctuated the heavy silence that had settled over the room. In 2024, the district enterprise budget was mostly used to pay salaries (52%) and electricity costs (25%), with infrastructure maintenance and renovation only amounting to 7% of the total allowance.[16] Interviews conducted at other district enterprises (Khoái Châu, Bình Giang, Gia Lộc) revealed a similar trend. Lack of resources for operating and maintaining infrastructure is the daily reality of SLBs, especially cụm managers and station workers; one way or another, however, they need to make these infrastructures work.

Every day, station workers spend several hours checking the integrity of the canals in which they pump water and that are under the responsibility of the district enterprise. They take pictures with their mobile phones and report to their cụm trưởng any holes, cracks or logjams they are not by themselves able to clear. Workers may turn a blind eye to certain types of damage, particularly when they consider it to have been done for legitimate reasons. A case in point is the secondary irrigation canal just outside the Duyên Linh pumping station. The station worker tells us that farmers breached the canal because they needed more flow than what was designed to irrigate their slightly elevated fields. She did not report it and the local nông giang, Mr. Duy, manually plugs the breach once the fields have been irrigated. As Cleaver (2018) puts it in more general terms, this constitutes a "fix" to a system that had led to de facto unequal water distribution. This epitomises the type of sociotechnical tinkering that occurs on a daily basis in the BHH polder; a similar situation is also documented by Mai Nhật Minh (2024) in the case of Đức Hòa district (Long An province) in the south of Vietnam.

Every day, village by village, the nông giang travels the command area they oversee, assessing the water needs in the different irrigation blocks and calling or paying a visit to the pumping station to ask for water for the corresponding areas. The nông giang often stays at the pumping station for a bit, socialising with the workers around tea or meals, informing them about what they see happening in the command area, and generally discussing village news. Once the station worker has approved the nông giang's request for water and informed his/her cụm trưởng, the nông giang clogs the mouth of the output pipes to create a vacuum so that the station workers can switch on the pumps. He then follows the canals, opening and closing the sluice gates and blocking on-field canals, so that the water will get to the fields that need to be irrigated and will not escape.

Station workers and nông giang are not the only ones to spend long days and nights along canals and in farmers' fields. Đô is the cụm trưởng of the southern irrigation zone of Gia Lộc district in Hải Dương province. He wakes up at home at 5: 30 am and rides his motorbike to the Phạm Trấn pumping station near his house, which he considers to be the headquarters of his cụm. He eats breakfast there and chats with the chief worker of the station, Ms Hường, who is also his wife. Like any other day, he then visits the

[16] The remaining 16% covered various expenses, particularly insurance and office supplies.

different stations that are due to operate that day. Cụm trưởng have to deal with the practical consequences of lack of coordination across ministries, such as between road construction and irrigation management. This problem of asynchronous plans between different ministries has been documented by Huynh Thi Phuong Linh (Huynh, 2016) in the Mekong Delta, and more generally by Minh Lam Chau (2020). Indeed, during his rounds, Đô checks not only the pumping stations that are under his purview but also the construction sites; many small roads are under construction in the BHH polder to facilitate access to rice fields by agricultural machinery, and larger power lines are being installed to support industrialisation. Mr. Hai, cụm trưởng of Lê Lợi, explained to us that in the early 2020s the construction of the highway linking Hà Nội to Hải Phòng had impacted the command area he oversaw. He told us that the construction company had rebuilt the main canals and culverts along the highway but not the smaller canals, which farmers had to finance themselves. Mr. Hai had helped farmers rebuild some of these canals, but they remained more vulnerable than before to intense rains, as the canal bunds could not be consolidated as thoroughly as they had been before the highway construction. When major works like these damage the network of canals that bring water from the stations to the fields, the cụm trưởng has to find alternative sources of water. This may involve hiring a construction company from the district enterprise's budget, although, as mentioned above, resources are limited and this is generally only possible in case of 'emergency'. Alternatively, they may convince villagers to do the work themselves if smaller canals are impacted, or they may install temporary and weaker pumps along neighbouring drains and canals.

Street-level bureaucrats are not only maintenance workers; they are also caretakers. As Chitata et al. (2023) put it, SLBs feel they "belong" to the irrigated scheme with which they are entrusted and that the latter "depends" on them. In BHH, it is not rare to observe or hear stories about the decrepitude of infrastructures. Arriving at the Công Đồng station (Đồng Quang commune) during a routine visit with Đô, we found the pump up and running, but the worker there explained that the pump had started making an unusual noise shortly after it was switched on. Hearing this, Đô went into the machine room and after a while managed to remove some waste that had been stuck in the system. Such repairs are not his responsibility, but rather are under the remit of station workers, however Đô explained that he feels obliged to carry out these tasks. He linked it to being a "good leader" and to the need to "preserve public money". As Pia (2016: 124) put it, Mr. Đô has an "ethic of office" that consists of balancing the needs of service recipients with justifying the existence of the bureaucracy itself. This hinges on using available resources to craft workable responses to contextual tensions, in our case between farmers' water needs and limited means.

From the pumping station, one can 'follow' the sociotechnical tinkering process down to the canals and sluice gates. As Quyền tells us, pointing down to a wooden plank two metres high and 75 centimeters wide, which he uses to block the water flowing along a tertiary canal (Figure 8),

> I've been asking the district enterprise to build a sluice gate here for years… When the pumping station pumps for my village, which is at the head-end of the canal, if we don't do anything, everything flows to the village at the tail-end [it has a lower elevation]. We've cobbled together this wooden gate to hold back the water and give the farmers time to use it.

To operate this sluice, two people have to go down into the canal, often at night, when it is already full of water and solid waste. Quyền has also piled sandbags at the end of another canal 500 metres away, to compensate for the old drainage sluice gate that has long been leaking.

Figure 8. Quyền, nông giang of Đình Cao village, and the sluice he tinkered with to stop water from flowing away.

Caretaking also takes the form of collecting waste from canals and the intake basins of pumping stations. "Practically every day, I put on high boots that go up to my thighs and plastic trousers to protect my clothes, and I go down to the station basins to collect the waste" explains Ms Thùy, chief worker of the Kim Phương pumping station (Tiên Tiến commune). With growing urbanisation and industrialisation, solid waste collection has become a major issue in maintaining the irrigation and drainage infrastructure, so much so that Ms Linh, from the Thái Dương pumping station, explains that the provincial company of Hải Dương has set daily waste collection quotas for each station. She tells us that she does not remember the volume she is supposed to collect each day, but she thinks she is above the quota given the amount of time she spends on this task.[17] According to our interviews, picking up waste used to be the job of specialised workers hired by the district enterprise, but this has not been the case for years and station workers are now responsible for it.

In addition to dealing with infrastructure, SLBs are also confronted with political interference. Mr Minh is the owner of a 700m² field that lies at the very edge of the command area of Duyên Linh station, close to Tồng Phan station's command area. He recounts the following story:

> In 2016, or 2017 I don't know exactly anymore, there was very little water in my area, and some of the crops were regularly lost because the sprouts would die for lack of water, which arrived too late. Once, the president of the district's People's Committee passed on the road that overlooks our area, and asked why on one side the fields were green and on the other water was missing. When it was explained to him that our area was far from the pumping station on which it depends, he went on a phone call and in the days that

[17] Time spent collecting waste varies greatly depending on the time of year. In the summer season, when there is heavy rain, station workers can spend hours picking up trash that is washed down from upstream, while in the winter-spring season the workload is much lower as there is less water flowing in the system.

followed, a new canal was dug by a public works company to bring water from another station belonging to the commune of Tồng Phan, 200 metres from my field.

This story highlights the difficulties some farmers face in accessing water, but here we focus on what such adjustment means for SLBs. Mr Duy, the nông giang of Duyên Linh village, now has to guide water from a pumping station that normally serves land in other villages, and which is managed by people with whom he does not normally interact. This is a source of uncertainty for him and for the farmers meant to receive water from Tông Phan station, as he cannot know for sure when the water will come and therefore cannot inform the farmers as to when they can expect it.

The capacity to navigate multiple interfaces between different administrative agents, more and less influential farmers, and infrastructure is central to the work of SLBs. This is shown by Silva-Novoa Sanchez et al. (2019: 10) in Moamba (Mozambique), where irrigated schemes are "always in-the-making". Much of the intermediation that this entails takes place in a specific arena, the pumping station.

The pumping station: More than a workplace, a hydrosocial arena

If there is a place that allows one to grasp the realities and daily practices of street-level bureaucrats, it is indeed the pumping station. As clearly shown by the small description with which we started the paper, pumping stations are not mere buildings in which a set of electric engines can be found; rather, they are hydrosocial arenas, they are living and working places where clothes hang to dry and gardens are cultivated, at the same time as the practices of water governance are being shaped (Figure 9).

Figure 9. The inner courtyard of Duyên Linh pumping station, with clothes hanging to dry and salad greens growing next to the path to the engine room.

The stations were built to accommodate workers' long shifts; they have bedrooms, washing machines, refrigerators and all the necessities for cooking. As a station worker tells us while preparing us a welcoming cup of tea, "we have everything we need to eat; we bring our rice and cook here". She will be retiring at the end of the year after more than 30 years working at various pumping stations in the Phù Cừ district (province of Hưng Yên). She explains that she will miss this place and the sense of sisterhood she has nurtured with the two other workers. She told us that she will also miss the feeling of working for the common good, as all here depend on the water distributed by the pumping station.

The pumping station is a place for waiting; once the pumps are running there is not necessarily much to do. From early March to late April (winter-spring season), and from July to September (summer season), when there is little need for irrigation, the pumps are only activated a few times a month. Station workers are less busy, but they still need to be present at their pumping station to take care of the infrastructure. According to the regulatory rules of the province company, there must be at least three workers per station so that a 24-hour day can be organised into three shifts, with two people working while the third one rests. The monthly schedule is outlined on a piece of paper that hangs on the wall in one of the rooms of the pumping station office. These shifts are organised by the pumping station's chief worker and validated by the cụm trưởng. In reality, workers stay at the station much more than their working hours and the shift schedule mostly serves to organise a rotation of responsibilities between workers, particularly during the January and June peak pumping times.

While workers are generally assigned to one station, they are sometimes reassigned by their administrative superior to lend a hand at other stations suffering from (wo)man power shortages. Workers may fall ill, for example, or some may be on maternity leave (70% of pumping station workers are women), or some stations may simply require more (wo)manpower due to heavy irrigation or drainage demands. Particularly during the peak rainy season, large drainage stations, often with more than a dozen pumps, need several more than three workers to carry out all the tasks at hand; one priority is the need to collect waste so that engines are not damaged. Such dynamics contribute to the sense of belonging to a community, which we felt during our interviews; however the community feeling also stems from the fact that irrigation management often is a family issue. Indeed, some pumping stations are home to entire families, from infants to grandparents. Workers are often over 45 years of age and often took over from their parents after obtaining a certificate in industrial machine operation with a specialisation in electrical techniques or related domains. Today, however, it is rarer for children to follow in their parents' footsteps and many are turning to studies in nearby towns that offer broader prospects than irrigation and agriculture.

Pumping stations are also where decisions over water management are made and where the workers and manager of the cụm meet regularly. Once a month, for instance, the workers from the Nhật Quang – Đình Cao – Tiên Tiến cụm meet at the Đình Cao 1 pumping station (Phù Cừ district). During this meeting, they share difficulties and advice while the cụm trưởng passes on key information that he has received from the district enterprise regarding rehabilitation activities, weather forecasts and/or potential difficulties around water distribution. This is not only a work meeting, however; it is also a moment of conviviality that is part of the social fabric. These meetings often involve sharing a meal and, as we observed at the Phạm Trấn pumping station (Gia Lộc district), different people come and go including communal police, hydraulic worksite managers, elected officials from communal people's committees, cooperative directors, or even district enterprise managers. People toast and discuss various matters of life with the cụm trưởng, whose ability to conduct his work well depends on connecting people. Once it is time for tea and the table has been cleared, and once the surprise of sharing a meal with foreign researchers has been forgotten, lively conversation ensues. Everyone expresses the constraints they face, from the issues of lack of investment and dilapidated infrastructure to a logjam in a canal that needs to be removed in the next few days. Sharing meals allowed us to grasp SLBs' high level of uncertainty regarding the future of the irrigation system they belong to and shape. SLBs are worried by the lack of resources and (wo)manpower and by the potential further cuts linked to the new "efficiency policies"

promoted by the government. They talk of potentially resigning if other tasks are added to those already weighing on their shoulders. Sharing these moments is reminiscent of stories told by anthropologists of water. As Pia (2016: 121), for example, described the canteen of water service office employees in a rural Yunnan town,

> Located on the roof of the WSO [Water Service Office] building, the canteen is the place that sees many people come and go, where meals and alcohol are shared, where little is said about water but which nevertheless constitutes the scene for resolving political issues, and for creating links.

The pumping station thus embodies the sociomaterial interfaces that SLBs navigate on a daily basis and through which the BHH hydrosocial machine is enacted in practice.

CONCLUSION

The Red River Delta is perhaps best described as a complex hydrosocial machine whose most visible components are a dense network of canals, engines and sluice gates and whose less visible 'engines' are the street-level bureaucrats who make it work on a daily basis.

The SLB literature stresses the role of intermediation and the constant adjustments, craftmanship and tensions that go with the task of translating national policies into practices (Hupe et al., 2015; Sevä and Sandstrom, 2017; Clement et al., 2024). As such, it echoes the water research literature on institutional bricolage (Cleaver, 2002) and sociotechnical tinkering (Kemerink-Seyoum et al., 2019). Taken together, and echoing actor-oriented approaches to (rural) development more generally, this allows one to go beyond a monolithic understanding of the 'state' and its 'bureaucracy' – which in water research is often captured by the term 'hydrocracies'.

Our engagement with the SLB literature is thus first and foremost a way to 'flip the gaze' from what bureaucracies are (or are meant to be) to how they work in practice (see also Brodkin, 2015). Our focus in this paper has been on the individuals who constitute these bureaucracies; we show how street-level bureaucrats such as cụm trưởng, station workers, and nông giang constantly navigate competing demands; they work to meet farmers' needs for water, maintain ageing infrastructure, and cope with limited financial and human resources.

Our contribution to the SLB literature, however, goes beyond documenting a series of micro-adjustments made in the face of complex and ever-changing realities. First, and in line with irrigation and water scholarship, we show that SLBs navigate sociomaterial (rather than just social) interfaces that involve farmers, local politicians and local administration staff, as well as canals, sluice gates, pumping engines and water itself. Pumping stations epitomise these sociomaterial interfaces; they are not only collections of buildings and electrical engines, they are also arenas where people come and go, nurture relationships, and shape water governance.

Second, and following Pia (2016), we think of SLBs' continuous adjustments as "ethical fixes". In the words of Bear (2015), this means that, "the contradiction of austerity capitalism [is] temporarily 'fixed' not through large-scale processes, but through small-scale, piecemeal ethical solutions". In our context, these ethical solutions manifest as spontaneous pump repairs by cụm trưởng, as station workers turning a blind eye to certain canal degradations they see as legitimate, and as nông giang placing sandbags in front of leaking sluice gates. These "ethical fixes" add up and combine to an "ethic of office" that is grounded in a strong commitment to the public good, but also to maintaining the centrality of the bureaucracy, its professional norms, and its values. Echoing works of other scholars (see, for example, Liebrand, 2014; Zwarteveen, 2017), there are indeed clear signs of masculinity within BHH, such as the higher number of male agents in province companies, district enterprises, and among cụm trưởng. In contrast, however, there are more women among station workers and they perform tasks that are seen as undesirable such as collecting trash or working difficult hours. Such hierarchisation of tasks and responsibilities and of the depreciation of women's position in the hydrosocial machine is often

internalised. One female worker at Duyên Linh station, for example, felt that it was normal for women to conduct these tasks as "they do not require much thinking"; she contrasted them with 'men's' activities such as fixing faulty engines. We also observed a dual relation to engineering, however, which is one of the pillars of masculinity in the irrigation sector (see Zwarteveen, 2017, on what is a 'good' engineer). According to that perspective infrastructure is omnipresent, but rather than seeing it as a means of controlling water and people, SLBs display care – if not attachment – towards it and towards those who use it (see also Chitata et al., 2023; Domínguez-Guzmán et al., 2022). We argue that this defines a particular form of "everyday politics" (Kerkvliet, 1995) that combines care and control.

Our study provides a partial snapshot of water management practices in the Red River Delta today. It pays specific attention to relations with administration while pushing into the background other types of relationships such as kinship, even though the latter are likely also crucial to the functioning of this hydrosocial machine. The Bắc Hưng Hải polder, situated midway between the economic hubs of Hanoi and Hải Phòng, embodies many dynamics that raise questions about its future; these include the accelerating shift from agricultural to urban and industrial land and the related changes in social relations, the combination of land division and consolidation with the steady decline in rice yields on small family plots, and the difficulty in finding young people who want to take over farming from an ageing generation. These trends will inevitably lead to a restructuring of irrigation and drainage services. Street-level bureaucrats will continue to play a major role – as they have done throughout history – in shaping how this will play out in practice, but how this will unfold remains to be seen.

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