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Infrastructure in the Making: The Chao Phraya Dam and the Dance of Agency

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Abstract

The article explores the process behind the construction of the Chao Phraya Dam, the first World Bank-funded water infrastructure project in Thailand, developed during the 1950s. Employing Andrew Pickering's 'dance of agency' concept in examining the process of turning financial and technical assistance into a workable project, I argue that development infrastructure, like the Chao Phraya Dam, provides a space to explore the dialectic operations – accommodation and resistance – of agency and the unstable associations among diverse actors, expertise, institutions, and materials, as well as practices. Recounting the history of the dam in the making, I explore a series of entanglements through different dances of agency, namely initiation, assessment, mobilisation, negotiation, adjustment, confrontation, and settlement. Such a multiplicity of dances inside *and* in the making *of infrastructure reflects the techno-political entanglement encompassing the manifold negotiation and adjustment of conflicting goals, interests, recognition, and cooperation among different agencies. The dam, often portrayed as an engineering achievement of the state, is in fact the result of unanticipated relations and the responses to the temporal emerging forms of practices.*

KEYWORDS: Infrastructure, Chao Phraya Dam, Water Engineering, Dance of Agency, Infrastructural Inversion, Thailand

Introduction

In Thailand, as in many countries where water management is crucial to the development of the state and society, dams are often highlighted as one of the key representations of the state's infrastructural achievements. However, a dam is not merely physical infrastructure created under the agency of the state's bureaucratic and engineering staff. In fact, aside from the impressive appearance of the dam, there stands the internal configuration of transnational development experts and their expertise, and legal-institutional agencies and standards, as well as ecological and mechanical performances (Kim 2010). Suggesting that a dam should be considered a techno-political network, Christopher Sneddon (2015: 147) argued that "perhaps no other technological object has the ability to capture and enrol in its orbit as many biophysical, technical,

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political, economic, and ideological processes and things as large dams do." In other words, a dam is an assemblage of hybrid networks that bring together technologies, materials, human resources, bureaucratic procedures, knowledge, and expertise and associate them under particular spatial and temporal circumstances.

In this contribution, I pay particular attention to the techno-political aspects of infrastructural development *beyond* the work of the state. Unlike James Ferguson's classic study of development project as an *anti-politics machine* (1994), my intention is to look at the development project as something that is itself – to use Wiebe Bijker's term – *thick with politics* (Bijker 2007). A dam, I argue, is not a product of a state apparatus to conceal the politics of its development operation. Rather, the construction and achievement of a dam require multiple kinds of actors, practices, and materials that, when they come together to work, create a kind of politics whose outcome the state cannot manage or even anticipate. Studies of infrastructure have become a key field for understanding not only the state's operation but also the heterogeneous networks and forces that come to define and materialise the techno-political relations of development projects (see, for example, Carroll 2006; Harvey *et al*. 2017; Joyce 2013; Mitchell 2002; Mossed 2003; Mrázek 2002; Mukerji 2009). My intention in this contribution is to show that such heterogeneity of infrastructural assemblage often creates unintended results that no one agency can fully comprehend or completely regulate.

The Dam and Its Dance of Agency

In order to understand the process of a dam in the making, I suggest that we look at it as an example of what Andrew Pickering (1995) called the 'dance of agency.' In his book *The Mangle of Practice: Time, Agency and Science*, Pickering suggested the performative depiction of techno-scientific practice as a field where human and nonhuman agencies come together to form multiple contours and networks, thus creating a series of unintended, unpredictable, and temporally emergent relations. In such real-time association and goal-oriented tuning of distinctive agencies, the plans and objectives of techno-scientific practices are subject to alteration and revision as a result of, and a response to, the material and human entanglements. The dance of agency, argued Pickering, thus takes the form of a "dialectic of resistance and accommodation" (1995: 22). Resistance here denotes "the failure to archive an intended capture of agency in practice," while accommodation signifies "an active human strategy of response to resistance" (1995: 22). In sum, the dance entails goal revision and the alteration of techniques and materials, as well as the rearrangement of framing and procedure between human and nonhuman entities.

The notion of a dance of agency is crucial in understanding the contingent and complicated relations that come to shape the configuration of a dam as a hybrid network of *agency*. In the process of dam-making, certain kinds of

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agency – including bureaucratic administrators, policy planners, politicians, economists, agricultural specialists, water engineers, and development field workers – are mobilised to articulate their knowledge and negotiate their interests. The results of this association can be seen in the forms of plan readjustment, contract revision, and altered technical specification. When we observe the final outcome of these unintended processes, however, we tend to ignore the role and performance – the *agency* – of multiple actors. As Pickering observed, the world of techno-science in practice "is filled not, in the first stance, with facts and observations but with agency" (1995: 6). While the project documents and its concrete outcomes, like the dam, often render agencies invisible, our task is to bring them back and recognise the dance that these hybrid agencies perform.

Pickering suggested that we look at the *dance* of agency as a dialectic of resistance and accommodation. 'Dialectic' here means the responsive move back and forth between activity and passivity. In the case of a dam, administrators can plan the necessary budget, engineers can design the physical structure, the construction company can plan in terms of logistics and management, and the development workers can evaluate the progress of the construction according to the contracted timeline. The actual process of operation, however, often leads to something else. Often, the budget needs to be readjusted, engineers have to alter their initial model, companies negotiate over the unintended rising costs, and the development workers are forced into unnecessary conflicts beyond their initial agenda. Ideally, in a typical assembly line, an agency asserts its specific role in the system. After that it can take a passive role so that other agencies, in turn, will do their jobs. In the actual situation of assemblage, however, one is drawn back and forth into the system, due to the unintended consequences and disruptive activities of other agencies.

Such disruptive complications fall into what Pickering called 'temporal emergence' (1995: 23–24), in which each agency acts as a response to the unknown outcome of interaction, encompassing not only human agency but also the materials in a real-time manner. The temporal emergences create an unstable terrain, while the rhythm of relations becomes inconsistent. In such a techno-political dance, Pickering argued, human and nonhuman agencies are "reciprocally and emergently intertwined" (1995: 21).

I use the notion of a dance of agency here to depict the unruly process in which engineering infrastructure like dams is constructed. I argue that infrastructure should be understood not only in terms of its technical and material assemblage. The sociopolitical and economic agencies are also very significant in shedding light on the struggle over its engineering manoeuvre. When these multiple agencies associate, the networks that form an infrastructure often create unintended circumstances that require individual actors to respond in multiple, and sometimes conflicting, fashions. The materialisation of the infrastructure should be seen not merely as the state's sole achievement in technical planning

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and engineering competency, but also as a success of *heterogeneous* engineering (Law 1987) that resulted in a stabilised network of diverse agency.

Infrastructural Inversion and In the Making

It would be useful to briefly discuss methodological concerns in the study of infrastructure here. Instead of examining the *external* effects of infrastructure *after* its completion, I seek to examine what is *internal* to infrastructure and the internality *during* its process of formation (see, for example, Harvey and Knox 2015; Hetherington 2017; Morita 2017; Mosse 2003). In doing so, I return to a series of basic questions: what is an infrastructure actually composed of? What are the processes of making infrastructure? Who and what should be credited when infrastructure configuration succeeds? And lastly, what is the underlying order – the 'infra' – in what we understand, and often take for granted, as an *infra*structure?

To answer the above questions, I follow the method and conceptual tool of what Geoffrey C. Bowker and Susan L. Star (2000) proposed as an 'infrastructural inversion' (see also Bowker 1994). Looking "inversely" into infrastructure, they argue, is to recognise "the depths of interdependence of technical networks and standards, on the one hand, and the real work of politics and knowledge production, on the other" (Bowker and Star 2000: 34). Following Bowker and Star's infrastructural inversion, I propose to examine an infrastructure "in the making" as a site of temporal experiment and entanglement. The temporality of infrastructure in the making can be illustrated through the process of bringing together distinctive agencies – states, global organisations, financial infrastructures, technical standards, experts, and bureaucrats, as well as machine and materials – in the course of making an infrastructure work. Within such processes, various sorts of ideology, interests, ordering, and expectation are intermingled, disrupted, negotiated, and stabilised. My aim is to open the sealed and perceived-to-be-ready-made technological black box of infrastructure and to analyse the process of such heterogeneous agency configurations and entanglements.

A dam, as infrastructure, can be observed beyond the point of view of its outside, *material* grandeur. Rather, examining the inner workings and heterogeneous composition of infrastructure allows us to explore how things *immaterial* – like scientific calculation, international standardisation, bureaucratic arrangement, and political negotiation – are mediated and made stable into a form of working project. In other words, infrastructure allows for the possibility of exchange over distance, bringing different people, materials, knowledge, and rationalisation into interaction (Larkin 2013). The assembling process of a dam therefore enables us to see the movement of technical assistance and expertise, the plan and promise of development improvement, and the translation of different and conflicting interests, as well as the association of multiple agencies across socio-political space and material-immaterial terrain.

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The Entanglement of Dance

In the following sections, I trace the evolution of the construction of the Chao Phraya Dam. In so doing, I illustrate the dance of heterogeneous agencies in development projects through their techno-political association. The information that follows is derived from archival research based on project appraisal reports, contracts, technical and bureaucratic plans, and personal memos, as well as official letters and communication. The documents were obtained from various sources: the World Bank Group Archives, the National Archives in Thailand, the National Archives in the United Kingdom, the Royal Irrigation Department Library, and the Preserved Collections of the Thailand Information Centre, as well as from various academic and governmental institutions.

The case study below highlights a series of dances of agency in the making of the Chao Phraya Dam. This consists of initiation, assessment, mobilisation, negotiation, adjustment, confrontation, and settlement. Within each of these dances, the story depicts Pickering's 'temporal emergence' (1995: 23–24), which involves unintended complications as well as incomprehensible consequences and actions. The series of entanglements illustrated below are by no means unusual to development processes of infrastructural construction happening worldwide. Yet exploring them from the global-local perspective of infrastructure in the making reminds us that the materialisation of any engineering project and workable development infrastructure often, if not always, comes as a result of association and entanglement *beyond* the control of a state or any agency.

The Dance of Initiative

The very first dance started with initiatives. Initiatives bring ideas, things, people, and expertise together to create a possible cadence for multiple agencies to move along. The initiative of "modern" water development in Thailand began in 1902 when Homan van der Heide was hired by King Rama V to study the feasibility of water management in his country's central plain. Combining his Western-trained knowledge with locally collected data in a mangle, the Dutch engineer produced a report suggesting the construction of a dam on the Chao Phraya River close to Chainat Province (Brummelhuis 2007). However, the government's need to divert capital to the construction of railways and other projects, put the initiative on hold. Van der Heide had started the fundamental rhyme, but there was not yet enough rhythm for other agencies to dance along.

Another dance of initiative resumed under the name "Chao Phraya Scheme" after World War II. In late 1946, Thailand's Royal Irrigation Department (RID) came up with an 88-page Feasibility Report on the Irrigation System Construction Plan 1947–1953.[1] The report gave information on socioeconomic background, the justification of financial investment, and the necessity of irrigation

[1]NA SR 0201.30.1/1, The Chao Phraya Dam Construction Plan, 16 December 1946, pp. 1–4.

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development in Thailand. The report also presented a technical and physical description of the infrastructure. The infrastructure would consist of sixteen sluice gates, logging sluice, fish ladder, a navigation lock, and hydroelectric generators. While there was no detailed study, a rough estimate stated that the dam could generate hydroelectric power up to 3000–6000 kilowatts (RID 1946).

Apart from the dam as the core infrastructure, the scheme also consisted of thirteen other related projects on canals and water management systems for agricultural areas, nine of which had already undergone the process of land redevelopment. A pre-war estimate in 1946 put the cost of the project at the equivalent of 133 million baht, covering over 2,648,969 acres of land with an irrigation system. This is significantly larger than the long-laid-out plan of central plain water management proposed by van der Heide.

In terms of project capacity, the Chao Phraya dam was initially planned to directly serve 2,332,674 acres of farmland. Within this project, the construction included 58 large, 100 medium-sized, and 3165 small-sized irrigation structures, making a total of 3324 structures. The work also includes excavation of 2000 kilometres of canals. The projected investment cost, however, rose from 133 million baht to 667 million baht after the war. The annual return on the project was estimated at 41 million baht, which would mean the investment cost would be recouped within three years. This initiative from the RID specified that the construction period would not exceed seven years.

The initiative suggested that preparations for the project begin in 1947. A small rhythm would start from the necessary survey, such as grid and topography mapping and the outlining of canal routes, along with the calculation and design of the Chao Phraya Dam and irrigation buildings. In addition, the RID needed to mobilise engineers, technicians, and administrative personnel to dance along after the preparation started. At the time, the RID had 1253 personnel and needed another 2553 for the upcoming work. Most of the new personnel were to be trained domestically, while others were to be trained abroad. If all went as planned, the construction of the dam would begin in 1948 and finish in 1953 (RID 1946).

Finance needed to be mobilised and turned into concrete works of other agencies. At the beginning of 1948, the RID requested budget approval from the cabinet. The requested budget would be allocated to four different expenditures: surveying irrigation canals; training civil engineers and mechanics; clothing for the thirty irrigation engineers who would be sent for training in the United States; and temporary construction. All these proposed expenditures, plus miscellaneous expenditures, amounted to 3.3 million baht.[2] After the budget was submitted to the cabinet meeting in March 1947, however, only expenses for

[2]NA SR 0201.30.1/1, The Budget for Special Expenditures in Preparation for the Chao Phraya Irrigation Project, 6 February 1947.

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the survey of canal lines and for temporary construction were approved.[3] While the RID was ready to accommodate the infrastructure initiative, there was material and non-material resistance in the form of limited budget, manpower, knowledge, and equipment. This initial dance of agency demands another step in which the dam needed to associate itself with the world of multiple assessments in order to justify international financial and technical support.

The Dance of Assessment

In order for the project to carry on, the dance needs to be reworked in order to accommodate multiple kinds of assessments using technical, standardised indicators (Bowker and Star 2000; Rottenburg and Merry 2015). On the one hand, agencies such as development institutions often employ quantitative and cost-benefit analyses of productivity to justify financial support from development agencies. On the others, quantification, as Theodore Porter (1995: 85) suggested, is also in itself a powerful agency of standardisation. The expert's standardised criteria and conceptual practices can be understood as what Pickering called 'disciplinary agency' – a field of disciplined human practice (1995: 92). With the introduction of disciplinary agencies into the dance, developmental economics and other transnational expertise could associate with Thai bureaucracy and engineering. With that accommodation, another round of the dance can begin.

To consider the financial loan, the bank required an internationally recognised feasibility study of the project. The Thai government put its trust in its long-time ally, the United States, through the US Bureau of Reclamation (USBR), to conduct the study (RID 1957). In addition to the USBR's study, the bank also sought expertise from irrigation consultant W.N. McLeod, who joined the bank's two-month mission to Thailand at the beginning of 1950 (World Bank 1950a). In July of that year, the bank's loan department released a technical report based on the findings of McLeod stating that the overall project was well conceived.

The main purpose of this technical report was to justify the cost-benefit and mechanism in order to ensure the project's financial return. For example, the report highlighted that the funded project was expected to solve the problem of inconsistent and uncontrollable water from the river by ensuring water supply with the use of a barrage, canals, and a distribution system, and consequently improve the yield of crops in the area covered. It was estimated that for the target area of about 2,260,000 acres, the annual increase in the production of paddy in the central plain could reach 840,500 metric tons, and an additional 100,000 metric tons for soya beans. Both of these agricultural improvements were expected to boost internal consumption and annual export. The surplus value of the project was expected to reach the equivalent of 60 million US

[3]NA SR 0201.30.1/1, The Budget for Special Expenditures in Preparation for the Chao Phraya Irrigation Project, 10 March 1947.

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Dollars (USD) – more than three times the cost of the project (18 million USD) (World Bank 1950a, 1950b). These calculations were based on the association of heterogeneous expertise in numerous fields, including irrigation hydrology, agronomy, agricultural science, economics, and demography.

In addition to economic and engineering assessments, the evaluation also extended to personnel and organisational considerations. The report highlighted that the RID itself was headed by "a capable and energetic Director-General assisted by some efficient men" (World Bank 1950a: 13). The capable director-general in question was Xujati Khambhu, a respected 'bureau-technocrat' who built his legendary works of water management through his close link with Western development and engineering networks (Sangkhamanee 2010). According to the bank, Xujati and his efficient staff could be considered a well-equipped, accommodating agency. There was, however, a matter of some concern. "Were these key-men to abandon their posts prior to the completion of the project," the report questioned "whether the work could be finished in a satisfactory manner" (World Bank 1950a: 13). The concern points to the fact that the RID was at that time entirely dependent on these few difficult-to-replace engineering men (see also Sangkhamanee 2017). If the physical infrastructure was to be built, a kind of formal administrational management needed to be developed and assembled in order to transform this individual-based endeavour of dance into an institutional one.

Despite the concerns, a final report signed by Eugene Black, the then-president of the International Bank for Reconstruction and Development, recommended that the bank grant Thailand loans totalling 25.4 million USD, of which the irrigation project would require the biggest portion, 18 million USD (World Bank 1950c). Four days after the recommendation, the loan agreement (36-TH) was reached (World Bank 1950d), thus paving the way for the irrigation project. As one would expect, the loan carried conditions. Thailand was required to fulfil the conditions in order to guarantee the success of the construction of the project, and thus the ability to repay the loan with a term of 20 years and an interest rate of 4 per cent per annum. One of the important conditions stated in the loan agreement was that Thailand had to hire an international consultant company, another important agency, to supervise the planning and design, construction, and operation of the project.

The dam came to a point at which the financial institution demanded the association of even more agencies into the dance. This move was simultaneously accommodating and resisting. With such conditionality, the Chao Phraya Dam and the RID could take part in assembling the infrastructure only by accepting the involvement – and the dance – of additional actors in the construction.

The Dance of Mobilisation

At this point, we see that the World Bank, as a loan provider, was not the only one to mobilise various agencies, knowledge, and expertise in assessing the viability of the project. On the recipient side as well, there was a need to mobilise alliances in

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order to materialise the infrastructure. This was a necessary step, partly due to the conditionality attached to the loan, and partly as the RID's own strategy to enable itself to complete the project. The dance of agency here requires mobilising multiple networks of company, machine, and technology, as well as legal procedure, and setting them up to form a move of accommodation. But as Pickering (1995, 2015) reminded us, the dance of agency is full of temporal emergence in which many forms of resistance can also occur. The Chao Phraya dam is no exception. As we shall see below, the dance of mobilisation started to reveal the contingency and dialectic relations among diverse agencies.

Following the loan agreement, the RID called for international bidding to select a capable contractor to supervise the construction of the dam (World Bank 1950d). After a call, nine companies from the United States, the United Kingdom, France, the Netherlands, and Thailand engaged in the bidding. In March 1951, the bidding selected J.G. White Engineering Corporation to be the contractor for the project supervision. The company was referred to by the RID selection committee[4] as "having great expertise in the construction of this and other configuration of dams, both in the United States and other countries".[5]

In the bidding, J.G. White Co. asked for 438,640 USD for construction work within a four-year timeframe. If the construction period needed to be extended, the contractors' fee would increase to 548,300 USD. This amount was low compared to other firms participating in the bidding.[6] The result of the bid was forwarded to the World Bank representative, who deemed the company satisfactory (World Bank 1953). The RID then forwarded this decision to the cabinet, which consequently approved the decision to award J.G. White Co. the contract.[7]

Aside from the bidding for a contractor, the RID also called for several bids for equipment for the dam construction and the RID's newly upgraded workshop. The call attracted considerable attention from various agencies, with as many as 1153 companies engaged in the bidding. The large number of machines and equipment and of applicants required as many as fourteen rounds of meeting before a decision on the results of the tender was reached.[8] In the end, 101 companies were chosen to supply machinery and equipment, including the companies from the United States, Germany, the United Kingdom, Belgium, Denmark, Sweden, and the Netherlands. The total price of the order amounted to more than nine million USD. The selection of the machinery was co-supervised by two of the World Bank representatives, who inspected each specification of machines on the list.[9]

[4]NA SR 0201.30.1/3, The Chao Phraya Dam Tender Evaluation and Selection, 6 February 1951.
[5]NA SR 0201.30.1/1, The Contract of Dam Supervision and Construction in Chai Nat, 10 March 1951.
[6]NA SR 0201.30.1/1, List of the Bidders, 10 March 1951.
[7]NA SR 0201.30.1/1, The Chao Phraya Dam Tender, 31 May 1951.
[8]NA SR 0201.30.1/1, The Chao Phraya Dam Tender, 10 April 1951.
[9]Ibid.

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For the preparation of contracts, the RID devised a measure to penalise companies in case the contract was breached – such as the case of wrong specifications of purchase or failure to deliver goods on the specified date – requiring companies to give a bond as deposit to ensure a timely delivery of goods. The World Bank representatives, however, proposed something different, pointing out that "these companies have high reputation and are trustworthy" and that "in the past, countries that had borrowed from World Bank and had purchased the goods in this same fashion had never demanded any penalty or deposit".[10] With such intervention from the bank, the RID Committee then decided to delete the terms from the contract. Even in the inspection process, the World Bank representatives saw that the ordered equipment were "standard materials" and therefore did not require any special inspector, which would cost an additional two per cent.[11] This was the first sign of the resistance and complications that were to come in the process of the dam's construction.

The RID decided that pursuing contract negotiations through the exchange of letters was too time-consuming. The Contracting Committee asked for approval from the cabinet to authorise Xujati to travel to the United States to negotiate and sign contracts with the companies. This was considered an add-on task, since Xujati had planned to travel for a round of negotiations with the World Bank on the loan for the Chao Phraya project and the upcoming hydroelectric dam.

Apart from ordering a vast amount of equipment, the RID reached an agreement with the World Bank to order 170 cargo ships and tugboats, which would be purchased from a Japanese shipbuilding company for less than one million USD. For this, the RID specified the details of the order and distributed them to companies wishing to participate in the bidding. After six weeks, seven companies applied to the tendering process, with the lowest bidder offering to do the work for one million USD. This was significantly lower than the approximately two million USD offered by other companies. However, when the company was vetted, it was not found to be trustworthy.

Choosing other bidders, though, was out of the question, since the price was too high. Therefore, the RID pivoted, starting negotiations with a British company. That company offered to build the ships for 1,216,000 USD. However, the first fleet would be ready only in February or March of the following year (1951); thereafter, four to six ships would be sent per month until the order was filled. At this rate, the RID estimated that it would take at least four years for it to receive all of the purchased ships, which would be too late for the construction. Another British shipbuilding company, this one in Hong Kong, asked 1,481,000 USD. Though this bid was higher than the first, this company could produce ships faster – 20–25 per month. Nevertheless, this

[10]Ibid.
[11]Ibid.

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company had problems delivering the goods to the RID, due to an uncertainty that shipments of metal materials from England would come in time.[12]

As neither British company was an appropriate choice, the RID had to reconsider the deal with Japanese companies. This time, it negotiated directly with Nihon Boeki, one of the largest shipbuilding companies in Japan. The negotiation lasted four rounds before reaching an agreement to reduce the price from 2,025,872 USD to 1,570,000 USD. This deal assured that all ships would be delivered within five to ten months. The Japanese company also agreed to accommodate the RID's two engineers to observe the building process at the shipyard and to cover all related expenses, apart from traveling costs. This was an offer the RID could not refuse, especially in this critical moment where all the mobilisation of resources for the construction of the dam was laid out and readied.

The condition that the infrastructure had to go into operation within seven years meant that all operations in every phase had to be efficient and precise. While resistance emerged from the plan, the role of the RID was to find a way to make distinctive agencies come into accommodation as quick as possible. The dance of mobilisation here suggests that temporal emergence plays a crucial role in allowing a suitable association of heterogeneous agencies and materials to mutually establish themselves. The dance might take several rounds and adjustments. But the crucial element in such a mobilising dance is a process of translating multiple interest into concrete strategies and operations. The successful moves and adjustment between human and machinery agencies allowed for fine-tuning until the interactive stabilisation took place.

The Dance of Negotiation

The stability seemed to be temporary, and thus another round of the dance happened in June 1951, when Xujati travelled to Washington, DC, to negotiate the details and sign a contract with J.G. White Engineering, the company selected to supervise the dam construction. The trip was also planned for negotiation rounds at the World Bank headquarters with other suppliers selected for the procurement of equipment. One month after his departure, however, Xujati had to extend his stay in the United States for an additional month. After this extended period ended in August, Xujati noted the complications that had arisen in settling the contract and asked the Thai government to let him extend his stay for yet another month.

The main reason for the long delay was the unsettled negotiations with J.G. White Engineering. Xujati was displeased to find that the company's draft contract was highly unfavourable to Thailand. According to the draft, the company raised the total payment from 438,000 to 491,000 USD; the salary of engineers would increase depending on the duration of the construction; and the contractor's fee, which was fixed at 55 per cent, would also increase. Furthermore, the Thai government had to pay the company's insurance costs, and the duration

[12]NA SR 0201.30.1/1, The Chao Phraya Dam Tender, 9 May 1951.

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of the construction was unspecified. The latter three conditions would greatly compromise Thailand's interests by causing increased time and cost. Furthermore, J.G. White Engineering stated it would not pay for the bond and refused the guarantee clause requiring it to send personnel to supervise and fix any infrastructural problem within one year after the construction was completed. In addition, according to the contract, if the Thai government terminated the contract on the basis of dissatisfaction with the work, the government had to pay the company a fine, yet if the company initiated the termination, the company did not have to pay the government a fine. Finally, the company announced that the RID had not ordered enough equipment and asked the Thai government to procure more.[13]

Xujati consulted with Oppenheimer, a World Bank lawyer, and Saitzoff, a World Bank loan department expert who assisted in preparing the dam's technical report, and asked J.G. White Engineering to revise the contract terms. The company drafted a new contract, but Xujati considered it to have "changed only the language while its essence remained unchanged".[14]

As a result, Xujati refused to conclude a deal with J.G. White Engineering and contacted Keir and Cawder Ltd., a British contractor, who had won second place in the tendering process. Negotiations with Keir and Cawder were far more promising.

The contract with the new company specified a fixed total price of 485,000 USD, which would not increase even if the construction took longer than expected. The new company also proposed two types of guarantee clause. The first was that after the construction was finished, the company would station two engineers there for one year to transfer knowledge to Thai officials. The second condition reflected the Thai government's request that within one year after construction was completed, the company would be responsible for any damage and would have to send engineers to fix it. Moreover, the company set the period of construction at three to four years, which was very fast. Most importantly, Keir and Cawder would assign Frank H. Greenhough, who had experience from the construction of Esna Barrage in Egypt, as the chief engineer to supervise the construction. The company and Xujati also agreed that the equipment purchased by the RID was sufficient and that it was unnecessary to procure any more.

As soon as the negotiation between Xujati and the representative of Keir and Cawder was completed, Xujati reported back to the Ministry of Agriculture in order to send a "very urgent letter" to the cabinet to inform them of the change of contractor.[15] The World Bank also supported the Thai government's

[13]NA SR 0201.30.1/1, Business Trip to Sign Contracts for Construction Equipment Purchase, 11 August 1951.
[14]Ibid.
[15]NA SR 0201.30.1/1, Invitation for Tender of the Chao Phraya Dam Construction and Supervision, 11 August 1951.

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decision to make a contract with Keir and Cawder.[16] The cabinet approved the new contract on 27 August 1951. Four days afterward, Keir and Cawder officially signed a contract with the RID.[17]

The Dance of Adjustment

In order to mobilise all of the human and nonhuman agencies into a concrete operation, a structural plan for the dam needed to be drawn up. This is an important process that Pickering called a 'mangle of practice', in which success in temporal structuring depends very much on human and nonhuman dialectic relations of accommodation and resistance (1995: xi). The workable infrastructural plan can be understood as a temporal stabilised result of the mangles that take a series of efforts to adjust and modify hybrid agencies of humans, machines, materials, finance, discipline, and bureaucracy combined.

For that important matter, the RID sought assistance from two senior design engineers from the USBR to supervise the layout and design of the project. Xujati, acting in the capacity of the director-general of the RID, supervised the whole project management. Reflecting the condition of the World Bank's loan agreement, the RID had to hire a consultant engineer from an experienced firm or other organisation to review and approve the design blueprint (World Bank 1950c). To comply with the loan condition, the RID contacted the USBR in order to hire it as a plan inspector. The USBR was chosen for two practical reasons. First, since the design of the dam and distribution system used the same model as the USBR, inspection and approval would be convenient. Second, hiring a private consulting firm was more likely to incur higher costs. Even though the World Bank was willing to lend 200,000 USD for the service, avoiding this expense was helpful in budget management.

In mid-December 1951, the USBR agreed to review the layout and design plan for a fee of as low as 15,000 USD.[18] Moreover, the Bureau was ready to start this inspection process as soon it was paid the fee.[19] At this crucial moment, the disbursement for a project whose loan was not yet approved by the World Bank required a very lengthy procedure, especially for a project as large as the Chao Phraya Dam. For this reason, the ambassador and the cabinet agreed to allow the Thai embassy in Washington, DC, to make an advance payment in order for the USBR to initiate the review of the blueprint immediately. Later, the RID would have to pay the Thai embassy back by buying 15,000 USD in foreign currency from the Bank of Thailand. This

[16]NA SR 0201.30.1/1, Invitation for Tender of the Chao Phraya Dam Construction and Supervision, 29 August 1951.
[17]NA SR 0201.30.1/1, The Chao Phraya Dam Construction of Keir & Cawder Ltd. Company, 24 November 1952.
[18]NA SR 0201.30.1/2, Review of Dike Construction Plan in Chai Nat, 18 January 1951.
[19]NA SR 0201.30.1/2, Payment for the Review of Dam Plan in Irrigation Project, 20 December 1950.

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amount would then be returned to the RID as soon as the World Bank loan took effect.[20] The financial and multi-institutional agencies had already been moving around along with the dance before the real construction of infrastructure even started.

After the review, the USBR approved the plan for the dam design. However, the USBR strongly suggested that hydroelectric generators be added to the infrastructure, since it would yield a high rate of return on the investment and would create additional benefits for the construction of the dam. They suggested that if the dam were to begin its construction in 1952 and start operating in 1955, then the design of turbines for hydroelectric generator needed to start as soon as it was feasible. This was in order to be able to open for bidding in mid-1952 and to give the supplier at least two years for the turbine production (USBR 1951). Unexpectedly, adding another material agency like hydroelectric generators would later create a tumultuous dance of resistance.

Even though the RID was acquainted with the design of irrigation dams, the idea of hydroelectric power infrastructure was still very new. For this reason, when Xujati went to negotiate with companies in the United States in 1951, he also invited the USBR to design this part of the infrastructure along with other things. Moreover, Xujati also requested that the USBR accept into a generator-design workshop ten Thai engineers who received a scholarship from the Mutual Security Act (MSA) and were on an internship in the United States at the time.[21] The USBR asked for 119,000 USD as a design fee. The RID planned to pay off this additional cost from the amount left over from the World Bank loan, which was a result of the cost of hiring Keir and Cawder at 200,000 USD less than initially calculated.

The USBR commissioner, Michael W. Strauss, made an additional suggestion that the RID send eighteen engineers for training on the design of hydroelectric infrastructure. The RID had no objection. It allowed ten Thai engineers who were at the end of their MSA scholarship to continue the training on hydroelectric engineering and sent in eight other engineers from Thailand to join them from July 1952 to December 1953 – an eighteen-month period.[22]

In March 1953, nine months after the design training with the USBR started, the engineers made some requests to the RID. These requests concerned the stipend from the Thai government, which, they claimed, was insufficient for living abroad. These engineers were paid 200–300 USD a month, depending on their rank. The stipend would cover accommodation, food, the domestic commute, health insurance, and other living expenses. The engineers highlighted the problem regarding the high cost of living and "the needs for expenses to

[20]Ibid.
[21]NA SR 0201.30.1/2, The Detailed Design of Hydroelectric Generator in the Chao Phraya Dam, 21 November 1951.
[22]NA SR 0201.30.1/2, The Detailed Design of Turbine and Hydroelectric Generator in the Chao Phraya Dam, 21 July 1952.

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participate, at an equal level, in social events with foreign engineer colleagues."[23] Furthermore, the request pointed out the wide gap between the stipend given by the Thai government and that given by MSA, which "troubled and disheartened the officials who had to work far from home."[24] On these grounds, they requested that the cabinet increase sponsorship by 271,925 baht (approximately 21,754 USD), drawing from the country's Economic Development Fund.

As December 1953, the last month of the training, approached, it emerged that the engineers still had various other subjects to learn. The remaining lessons would delay these engineers' trip back to Thailand.[25] Seeing this as a necessity, the RID asked for approval from the government to extend the training period by three months and included the observation of work on various US dams at the end of the training.[26] To ensure well-rounded knowledge and expertise on the subject, the RID also asked for permission to send the engineers to observe dam operation in Europe for fifteen days on a stopover on their way back to Thailand. This proposal required additional funding of 535,650 baht (42,052 USD).

In October 1953, while the eighteen engineers were participating in the hydroelectric training for the Chao Phraya Dam in the United States, another project between the USBR and the Thai government was underway. The USBR, upon the request of the RID, sent a group of experts to conduct a feasibility study of the Yanhee Hydroelectric Dam on the Ping River, a western tributary of the Chao Phraya River. The experts reported that the proposed Yanhee Dam – which would become the country's largest hydropower source – could produce up to 140,000 kilowatts of electricity, sufficient to meet the country's industrial needs at that time (World Bank 1957a, 1957b). This new information made the National Energy Authority reconsider the installation of hydroelectric generators at the Chao Phraya Dam. Having both power plants would create an oversupply of electricity, and calling off the construction would also save a fair amount of money for the project.[27] In the end, the cabinet cancelled the construction on 25 November 1953.

The Dance of Confrontation

After the necessary resources had been mobilised, human resources prepared, and physical structures revised, came the actual dance of infrastructural assemblage. This process of technical association – turning materials and machines into a concrete infrastructure – should be perceived as the most technical process of the project and hence involved less resistance. However, things did

[23]NA SR 0201.30.1/2, Request of Additional Stipend for Irrigation Engineers, 25 March 1953.
[24]Ibid.
[25]NA SR 0201.30.1/2, The Detailed Design of Turbine and Hydroelectric Generator in the Chao Phraya Dam, 6 November 1953.
[26]NA SR 0201.30.1/2, The Detailed Design of Turbine and Hydroelectric Generator in the Chao Phraya Dam, 27 December 1953.
[27]Ibid.

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not go as expected. Dam technicality is always embedded in the politics and personality of engineers. As we shall see, the technicality of typical material assemblage turned out to be the most resistant dance of agency.

Keir and Cawder signed the contract with the RID on 31 August 1951 and sent seven engineers to supervise construction at the end of 1951. However, the first problem of many occurred a few months into the construction. The contract stated that Keir and Cawder would assign Frank H. Greenhough, a chief engineer, to supervise the construction for the whole process. However, after he was stationed in Thailand, Greenhough spent a great deal of time out of the country. What made matters worse was that one of the acting chief engineers was found to be in constant conflict with Thai engineers. The record by the RID engineer stated as follows:

> Since the engineer of Keir and Cawder assumed that Thai engineers in all departments did not know how to work, all of his orders were so detailed that it gave rise to conflicts in practical matters. The company's engineer was not familiar with Thailand and the attitude of its people. He does not follow opinions and advices of the Director-General of the RID and Thai senior engineers who came to inspect the work. For example, once he had been asked to establish a weekly and monthly construction program for Thai engineers in order to avoid any personal conflict, he did not comply.[28]

Apart from the failure to fulfil the conditions of the contract or follow the advice of Thai officials, Keir and Cawder's acting chief engineer also acted disrespectfully towards Thai engineers and officers, alienating the two sides. As the note stated:

> The personal conflict is very important because Keir and Cawder's engineer often acted rudely, which most Thais would consider insulting and offensive. Though it was incomprehensible verbally at first, the vulgarity was eventually understood. For bodily composure, there were head slapping and the use of foot to explain the work. These acts are so often on display that Thai senior officials had to explain the attitudes of Thai people. This, too, was to no avail and the rudeness continued.[29]

Besides personal conflicts, the discord also involved technical engineering matters. For example, some important technical work was neglected, and sometimes damage was caused. The equipment and construction materials were used without planning and were wasted, in a manner unfit for a proper engineer. The less important work, on the other hand, was hurriedly finished. For instance:

[28]NA SR 0201.30.1/1, Memorandum on the Works of Keir and Cawder Company, 24 November 1952.
[29]Ibid.

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> The installation of large fuel tanks was not done, so the RID had to use multiple smaller tanks to distribute the fuel. The cement silo, which should have been built to transport cement before the wet season, has not been built. The port for cargo transportation that should have been constructed was not yet so, thus increasing the cost of and slowing down the logistics of materials. The thing that Keir and Cawder's engineers cared about the most, apart from digging the soil, was personal gratification, for example, asking to rush the instalment of air conditioner and electric wire for refrigerator […] despite the fact that they were already receiving special treatment better than any Thai engineers.[30]

There were also reports of other events indicating that Keir and Cawder's engineer did not have sufficient expertise and caused great damage to the infrastructure. The numerous technical failures led to a questioning of the foreign engineers' presumed superior expertise over their Thai counterparts. The Thai engineer's record states the matter clearly:

> Very close to wet season, the company's engineer still did not know how to station the water pump until the Director-General of the RID had to advise the method, running the work six weeks behind schedule […,] Due to insufficient knowledge, the engineer made mistakes, such as having installed wrong-sized power and pump machines, making the machine function below its full capacity. Then he blamed the machinery purchased from America for not performing as advertised – an act which is equal to putting blame on Thai government for having blindly ordered such machine […,] The other major mistake was digging the soil for construction not according to the plan, which could endanger to the building, as the RID has established a committee to investigate the matter. [In addition,] the crucial work of soil work was delayed. Out of the total 2,500,000 cubic meters, only 150,000 cubic meters were finished during the past ten months. At this rate, it would take 40 years to finish.[31]

Nine months into the conflict, which resulted in project delays, Xujati saw that this problem could not be left unresolved. Finally, he proposed that Keir and Cawder's entire staff take a paid holiday at a beachside residence for three months, with all expenses covered by the RID. During this time, the RID would send Thai senior engineers to supervise the construction. If after three months, the results showed that Thai engineers were more capable of doing the work, this would serve as evidence that the delays in construction were due to Keir and Cawder's inability and not the laziness or inability of the lower-ranked Thai staff. If this turned out to be the case, the director-general

[30]Ibid.
[31]Ibid.

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reckoned it would be only appropriate that the company be the one to terminate the contract, "hoping that they would have a remaining sense of shame and dignity to terminate the contract by themselves."[32]

In May 1952, Xujati brought this proposal to P.J. Stirling, a member of the Board of Keir and Cawder who came for an inspection in Thailand. Refusing to accept the proposal, Stirling instead asked for three months for the company to redeem itself. At the end of October 1952, Greenhough returned to Thailand and promised that he would thereafter be based in Thailand. Moreover, Greenhough proposed that he would oversee the site in Chainat for three weeks and might ask to send six company engineers back to Britain. The company would then send one engineer as a replacement to work closely with him, meaning only the two of them would engage in construction supervision.

Even though Greenhough's proposal showed guilt over past mistakes, this proposal was not something the RID could accept wholeheartedly. The main problem was that Greenhough based himself mainly in Bangkok while only occasionally visiting the construction site in Chainat. The RID came up with a proposal saying that it would give the company three months to redeem itself. During this time, Greenhough had to base himself at the Chainat construction site until the date specified in the contract, and the company had to replace all the current engineers with better personnel as soon as it was feasible. If the work did not improve after the replacement of the engineers, the company would be obligated to terminate the contract, and the RID would pay only one month's salary. If the company did not comply with these conditions, the previous proposal would be applied, sending all company staff on a fully paid, three-month holiday.

The proposal by the RID to have the company terminate the contract did not come out of the blue. Even though it had invested so much in the dance of the tendering and selection process for the contractor, in reality, the RID already had other underlying intentions. It believed that even if the contract with Keir and Cawder were terminated, the RID would be able to continue the construction by itself. The RID was confident from the beginning that its senior engineers could construct the Chao Phraya Dam alone, but the conditions of the World Bank loan required otherwise.

In this dance of confrontation, we have seen how the resistance between human agencies functioned through the mobilisation and association of materials and non-materials such as the discourse of professionalism, the condemnation of machinery, and the contestation of expertise. While Pickering stresses the fundamental dialectic relations between human and nonhuman, the case I just described depicts the entanglements between human agencies that employ nonhuman agency as the source of their performance.

[32]Ibid.

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The Final Dance of Settlement

Apart from the conflicts on personal and technical works, the RID and Keir and Cawder also had legal and organisational disputes.[33] This was due partly to the deficiency of human agency, and partly to the addition of material agency, the hydroelectricity generators, into an already stabilised structure of the dam.

The contract between the RID and Keir and Cawder specified that the project commence on 1 September 1951, with the condition that the fee be fixed at 95,650 British Pounds (GBP). No more than seventeen personnel would participate in construction supervision, resulting in RID payment of no more than 77,700 GBP within a 42-month period. If the construction took longer than specified in the contract, the RID would not provide additional payment for any services or salaries of the personnel. If construction finished early, the cost savings would be split between the RID and the company.

In reality, Keir and Cawder gradually sent in its staff to start operation around the end of 1951. In addition, the situation had become worsen after ten months as, in June 1952, the company asked for a revision of the contract terms. The new contract, as proposed by the company, would start on 1 September 1952. It also requested full payment for the past ten months in addition to the amount specified in the previous contract. The company claimed that the machinery ordered by the RID had not arrived on time due to the Korean War, hindering the operation and thus delaying the process. Eager to move the project forward, the RID reluctantly approved postponing the date of the contract and paying the company for its additional time.[34]

Another conflict arose in late 1953, when the RID decided to change the physical structure of the Chao Phraya Dam. This became an issue after the decision to build Yanhee Hydroelectric Dam, which required massive sums of money. To lower the cost of the ongoing construction of the Chao Phraya Dam, the RID had to change the dam's design by omitting the hydroelectric generator along with other structures, such as the fish ladder and logging sluice. Aside from this, all concrete foundation pillars were replaced with floating foundations. Though the company accepted the changes, the process delayed operations considerably.

Only after mid-1955 could Keir and Cawder speculate that the construction would not finish by the time set in the already-postponed contract. With such a delay, the company requested that the RID increase the contractor's fee by 119,000 GBP. The demand was based on the grounds that the construction had changed since the time the contract was signed, and the cost of construction had increased. This demand was unacceptable to the RID, since in its view, the

[33]NA FO 371/129635, Dispute Between Keir and Cawder Ltd. and Government of Thailand Following Construction of Chainat Dam, 1957.
[34]NA SR 0201.30.1/12, The Dispute between Keir and Cawder Ltd. Company and the Royal Irrigation Department, 21 January 1957.

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company was only responsible for supervising the construction. In other words, the company had nothing to do with the increase in the project's cost. Because this was not a breach of contract, it did not require any further service from Keir and Cawder. As a result, the RID insisted that the firm was not entitled to more payment and stated that it would not pay the demanded increase.[35]

The changes in the dam design, the duration of construction, and the contractor's fee combined constituted a serious conflict. After many futile attempts to settle, both parties agreed to appoint an arbitrator. To settle the dispute, the company insisted on two points. The first was that the RID pay an additional fee of 119,000 GBP. The second was that the RID pay the salary from 1 January to 15 August 1956, which was the date most of the construction work of the Chao Phraya Dam finished. This period was considered beyond the payment period, according to the contract (42 months), in addition to the 13,350 GBP the company had previously overpaid the RID. Furthermore, as the deliberation of the arbitration approached its conclusion, Keir and Cawder made two further demands. One was that the RID return to the company the retention guarantee that the RID had been holding according to the contract terms. The second demand was that the RID pay half of the cut salary to the company as per the contract.

The RID claimed it never intended to refuse to pay the fee mentioned in the latter two demands but that it had to keep the retention guarantee until the arbitration gave its adjudication. That was because there were still other fines for damages that the company owed the RID. This payment the RID referred to was the collapse of a wooden dyke designed and supervised by the company; the damage cost two million baht. Arbitrators on both sides began their deliberation on the dispute on 10 August 1956. In their December 6 adjudication, the two arbitrators did not agree on even a single issue, as summarised below (Table 1).[36]

As the arbitration could not reach any agreement on all counts, the RID and Keir and Cawder decided to take the matter to the World Bank to decide. The president of the World Bank appointed William Mitchell to settle the dispute. While deliberations were in progress, both disputing parties pulled strings with the World Bank Board.[37]

Ultimately, the judge of the World Bank decided that the RID had to pay Keir and Cawder a total of 34,642 GBP or two million baht. This amount was less than that determined by the company's arbitrator, 62,858 GBP, but was still more than that determined by the RID, 950,000 baht. The decision of the World Bank representative was final, and thus the Thai government had to

[35]Ibid.
[36]Ibid.
[37]NA SR 0201.30.1/12, The Dispute between Keir and Cawder Ltd. Company and the Royal Irrigation Department, 25 January 1957.

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Table 1. Summary of adjudication over Chao Phraya Dam conflicts.

	Issues	Challenger	Amount	Adjudication of RID's Arbitrator	Adjudication of the Firm's Arbitrator
1	Additional fee	Firm	119,000 GBP	The RID does not have to pay	The RID pays 40,830 GBP to the Firm
2	Salary and additional payment	Firm	13,350 GBP	The RID does not have to pay	The RID pays 8627 GBP to the Firm
3	Retention guarantee	Firm	29,608 GBP	Not within the dispute, no adjudication	The RID pays 29,608 GBP to the Firm
4	Half of the saved salary	Firm	Half of the saved salary	Not within the dispute, no adjudication	The RID pays 12,435 GBP to the Firm
5	Damage cost of the wooden dyke	RID	Two million baht	The Firm pays the RID for the losses of 600,000 baht	The Firm does not have to pay
6	Arbitration fee	Both	—	The Firm pays fee to the RID for 450,000 baht	The RID pays 6000 GBP to the Firm
		Total		The Firm pays 1,050,000 baht	The RID pays 97,500 GBP

hurry to pay the company to avoid any further charges for interest. In the end, the payment had to be drawn from the national reserve under the control of the Ministry of Finance.[38]

Considering all these mangled dances of heterogeneous agencies, Chao Phraya Dam can be seen as a kind of 'extrastatecraft' – a site of multiple, overlapping, or contested forms of authority where domestic and transnational jurisdictions collide (Eastering 2014). In other words, as the case above well depicted, the Thai state, through its RID, was only one of multiple agencies in the series of unanticipated dances turning temporal emergence into a realisable infrastructure.

Conclusion

The Chao Phraya Dam was officially completed in January 1957, about six years and three months after the loan agreement was signed. On 7 February 1957, King Bhumibol and Queen Sirikit inaugurated the infrastructure that stands

[38]NA SR 0201.30.1/12, The Payment Following the Verdict of the Arbitrator on the Dispute between Keir and Cawder Ltd. Company and the Royal Irrigation Department, 5 November 1958.

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across the bend of the Chao Phraya River. This is yet another twist of the dance that associated the monarchy with turning technical infrastructure into a national symbolic achievement. The statement addressed to the king and the queen by then-Prime Minister Plaek Pibunsongkram addresses many important topics, such as the technical specifications of the dam, the source of financial and technical support, and the benefits the country would get from such engineering grandeur. The socio-technical entanglements that I have just depicted, however, have been left unaccounted for in the narrative, as it failed to recognise the dance of agency. In other words, the temporal emergence and complicated entanglements beyond technicality have now become an *invisible* 'infra'structure of this *visible* stabilised structure and symbol of remarkable engineering achievement.

Overall, the historical account above depicts the tendency of development projects to go beyond the authority and control of a single agency. The case shows that the perception of technological diffusion and development dependency – portraying modernising projects of development as often being done in a unilinear fashion from North to South – obscures the process and agency of local struggle, mediation, and strategic intervention. The dance of agency in the Chao Phraya Dam suggested a look into the entanglements of ideas, people, relations, and materials in global-local networks to create a hybrid form of engineering practices and infrastructure production.

The socio-technical entanglements that I have portrayed also underscore the importance of looking inversely into the infrastructure, both that visible and invisible to us, to understand its hybrid relationship of agency – knowledge, money, technology, people, agenda, and practices – in making up a concrete development project. The case of the Chao Phraya Dam suggests that we go beyond viewing science and technology as magically imported from somewhere else; it sheds light onto "alternative views of how scientific ideas and technologies are created, move, change, and adapt" (Madina *et al*. 2014: 1).

In fact, the analysis of infrastructural inversion added to the understanding of such complexity of infrastructural transaction. Even for the movement of ready-made technology like a dam, the association of hybrid actors is always there in associating the materials and non-material agencies and arranging them into an "interactively stabilized" infrastructure (Pickering 1995, 2012). When looking from an infrastructure-in-the-making perspective, we can see the multiple efforts of different ontological agencies in translating and associating various forces beyond the state's capacity and control.

The case of the Chao Phraya Dam's construction reminds us that infrastructure is neither an achievement of the state's engineering manoeuvres nor an imported magical assemblage of technology but consists of contingently dynamic, associated and at the same time disassociated, relations of different agencies. It is a result of technological and political engineering aligning and entanglements based on unanticipated relations and actions of dynamic agency.

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The goal of the dance of agency is, as Pickering suggested, to find "the balanced point, liminal between the human and nonhuman world" (1995: 7). The Chao Phraya Dam is a case in point in affirming that inside the standing infrastructure resides the flux of emergences and a series of dances of human and nonhuman agencies.

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