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Article

Hydraulic Order and the Politics of the Governed: The Baba Dam in Coastal Ecuador

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Abstract: Mega-dams are commonly designed, constructed, and implemented under governors' rule and technocrats' knowledge. Such hydraulic infrastructures are characteristically presented as if based on monolithic technical consensus and unidirectional engineering. However, those who are affected by these water interventions, and eventually governed by the changes brought by them, often dispute the forms of knowledge, norms, morals, and operation and use rules embedded in mega-hydraulic engineers' designs. Protests may also deeply influence the design and development of the technological artifacts. By using approaches related to the Social Construction of Technology and Partha Chatterjee's politics of the governed, this article shows (i) how protests against the Baba dam in coastal Ecuador greatly influenced the dam's designs, protecting communities' lands from being flooded; and (ii) how, at the same time, techno-political decision-makers deployed hydraulic design as a dividing rule, turning potentially affected communities against each other. We conclude that megadam designs are shaped by the power interplay among governors and governed, with the latter being internally differentiated. By critically analyzing the role of technology development—materializing changing 'political context and relationships'—we show how contested and adapted dam design may favor some stakeholders while simultaneously affecting others and weakening united dam-resistance movements.

Keywords: megadams; social construction of technology; politics of the governed; anti-dam resistance movements; technological design; contested knowledge; Ecuador

1. Introduction

"There is almost nothing, however fantastic, that (given competent organization) a team of engineers, scientists, and administrators cannot do today. Impossible things can be done. [. . .] When these men have imagination and faith, they can move mountains; out of their skills they can create a way of life new to this world"—David Lilienthal, director Tennessee Valley Authority [1] (p. 3).

Megadams are the material epitome and pride of expert, engineering knowledge. Proclaiming their origin as 'technical' has portrayed these works, their promoters and knowledge as if they were neutral, objective, apolitical elements of water management [2]. Such assumptions have consolidated these projects as part of a longstanding dominant paradigm which is universally unquestionable and technically necessary. Hence, scientists, engineers, and technocrats, following their own worldviews and knowledge systems, have designed, constructed and implemented hydraulic mega-infrastructure

to attempt to correct nature's 'imbalances' while governing society [1,3]. Lilienthal's utopian dreams, for instance, when glorifying the Tennessee Valley Authority model that would modernize backward regions' infrastructure through electricity, flood control and multiple water uses, attract industry, and improve the economic and social lives of rural people, resound throughout the world [4–11] and also were key to Ecuador's mega-dam development analyzed in this paper [12,13].

However, in Ecuador as in many places worldwide, these type of projects, their promoters and knowledge frames have not escaped criticism [3,4,14–16]. Apart from academic critique, they have been fiercely contested by those societal sectors who end up paying the price of such undertakings' impacts [17–19]. Together, indigenous communities, peasant federations, environmental Non-Governmental Organizations (NGO), critical scholars and water professionals, urban leaders, among others, are influencing the very structures of knowledge and materials that comprise these mega-projects. On this basis, the objective and technical pedestal traditionally reserved for these projects is increasingly challenged, revealing how its foundations are profoundly social and political. Some scholarly work already shows, though often in general terms, how social struggles eventually 'succeed' in influencing mega dams' designs and knowledge (e.g., [20–22]). A number of examples show 'successful' anti-dam movements [22]. In India, we see, for example: (i) the protest against the Silent Valley Hydroelectric Project in the Kerala region, 1984; (ii) the protest movement against the Bedthi dam project in Karnataka in the early 1980s; (iii) the protest against the mega projects in Narmada river organized by among others the Save the Narmada movement. They resisted in the 1990s and managed to influence the designs of the project. However, the movement did not succeed in stopping the project altogether [20]. In other regions more examples can be found. For instance, "the most successful anti-dam campaign in the United States was the Grand Canyon campaign against the 525 feet-high Eco Park dam in the Green River. This dam was halted in 1963 after six years of construction as civil society groups opposed it" [21] (p. 70). This article seeks to contribute to this work through a detailed account of the anti-dam movement that fought against the Baba dam in coastal Ecuador. We aim, specifically, to understand how and to what extent such 'success' stories challenge dominant rule, and how and which actors are involved in what ways.

In related fields of water control, such as irrigation and drinking water supply studies, dissatisfaction with the poor performance of water control systems designed technocratically has urged inclusion of water users' knowledge in their design. Even though mainstream hydraulic schools and conventional irrigation engineering departments still continue to develop and promote high-tech water technologies in the top-down, old-fashioned ways (now framed as 'inter-disciplinary' since third, natural sciences and economic, disciplines (in particular 'new-institutional economics') have been 'added'); for more than three decades [23], the so-called social turn in irrigation has been making interesting efforts to not just integrate social and technical academic visions in irrigation technology design, but also *co-create* water technology in transdisciplinary ways [24–28]. Beyond influencing the means used to design irrigation systems, this has questioned and challenged mainstream technical engineering knowledge and its pretensions of objectivity, appropriateness, social efficiency, and societal relevance [27,28]. Such questioning has only incipiently expanded into other types of water technologies, even though in particular megadams continue to inform the prestige and pride of water engineering culture and to constitute the planet's most controversial water projects [4].

There are various efforts coming from Science and Technology Studies (STS) and, particularly, from Social Construction of Technology (SCOT) investigations, which have challenged the apolitical and purely technical/managerial conception of hydraulic dams and water technology [29–31]. This approach tell us that technology is not a 'thing' that is separate from social processes, but an essential part of them [31,32]. Departing from such contributions and considering that we are witnessing a new era of mega dams building [33–35], it is urgent to scrutinize them critically. We must understand dams by taking into consideration how rules, norms, discourses, designs, values, and their very material existence are negotiated and contested by 'non-technical' and vulnerable stakeholders.

In Ecuador, conflicts about megadams have not gone unnoticed [12,35]. Since the mid-1900s, racing toward development and modernity, the State has planned and built dozens of megadams on the country's main rivers. No doubt these efforts have brought 'development' to some people and geographies, however these mega projects also have been the cause of far-reaching socio-environmental conflicts and unleashing societal struggles. This article will examine resistance led by the inhabitants of rural parish Patricia Pilar, organized against design, construction and implementation of the Baba multi-purpose dam (Figure 1). Our aim is to understand how mega-projects can be also influenced by those who are/may be affected (governed) by the Baba dam, and how their socio-environmental demands shaped the way technology was materially designed. We argue that dam technology, beyond expressing and materializing expert knowledge and its ideals of progress, is the materialized track record of social struggles and of the interaction among diverse and divergent actors and knowledge systems that face off in contexts and under conditions of unequal power.

After this introduction, the second section gives details about the methodology for research and information analysis. The third section outlines a theoretical framework to understand technology as a two-way social construct and to analyze anti-dam social movements as grounded in the 'politics of the governed' [36]. The fourth section presents the case's empirical data, showing how the dam and the social movement against it unfolded, with societal influence on technical designs and the designs' effects on social resistance. The article ends with a discussion and final conclusions.

2. Methodology

The empirical research presented in this article was carried out in Patricia Pilar parish and its surrounding peasant and Afro Ecuadorean communities, from October 2015 until September 2017. Field work consisted of two visits to the research area. The first visit took place from October 2015 until April 2016. The second was in September 2017. This case study is based on historical and ethnographic research [37,38]. It is also based on an 'ethnography of technology' [37,38]. Water management involves several dimensions: technical, organizational, normative/socio-legal, cultural and socio-economic/political. While it is usual to research these areas separately, it remains a challenge to integrate all those dimensions in an interdisciplinary manner. Technography: the ethnography of technology provides a methodological approach that intends to integrate technological processes as part of human-technology interactions [38]. Particularly, technography allows us, in the case of the Baba dam, to integrate SCOT's conceptual approach with the empirical findings.

Participatory observation, semi-structured interviews, literature and secondary sources review (historical archives, newspaper articles, official reports) were the main data collection methods, including in total 36 in-depth interviews. Interviews included State and hydroelectric company officials, action-researchers, NGO representatives, peasant and Afro Ecuadorean leaders, and critical scholars. Our main selection criteria for choosing interviewees were based on the reconstruction of relevant (diagnostic and process-explanatory) life histories and crucial events. After an initial period of literature review and preparatory field visits, we selected our first contacts in Patricia Pilar, from whom we applied snowball sampling to reach other relevant actors. During field work, interviews were conducted in Spanish, most recorded and transcribed by the authors. The names of all interviewees are pseudonyms.

Interviews and other collected data were classified and analyzed according to two focal points: how the technocratic designs of Baba Dam evolved over time, and how the different actions and resistance events organized by Patricia Pilar's inhabitants and their allies evolved and informed the final designs of the dam. In order to analyze the collected data, we used mapping, qualitative chart building, comparative time-frame analysis and data triangulation.

3. Social Construction of Hydraulic Technology and Anti-Dam Social Movements from the Politics of the Governed

3.1. Megadams: Socially Constructed Technology and Its Hydraulic Order

SCOT (Social Construction of Technology) is a critical approach to technology that comes from the field of Science and Technology Studies (STS) [39]. From that basis it aims to challenge technological determinism [40,41]. The constructivist approach adopted by SCOT treats technology not as an universal truth, built upon scientific facts and provided with neutral, intrinsic properties, but it understands technology as a socio-technical system [42] which is *being constructed* [39] (p. 135). In this line, STS and SCOT scholars have largely shown how water technologies are the result of complex social processes (cf. [29,30,43,44]). Further research needs to be done to scrutinize how the most contested technological endeavors, such as megadams [14], are co-shaped by its ‘non-technical’ protagonists (e.g., dam-affected peoples). There is incipient literature, such as recent articles showing the interesting strategies of successful anti-dam movements in Thailand and Myanmar; but this does not explicitly consider how technology is influenced by social actors and how technology influences local context [22].

In his study on the social construction of dams and dikes, Wiebe Bijker tellingly explains how these technologies are ‘thick with politics’ and embed particular social and cultural patterns, and relationships [30]. He states that “studying artifacts—how they are socially constructed as well as how they shape society—yields crucial insights into the history and development of science and into the history and development of societies” [30] (p. 110). Bijker further suggests that “a focus on the ‘things’ of water management can help us to understand the cultural and democratic makeup of societies and at the same time is important for addressing questions about the further socio-technical development of those societies”. Far from maintaining a deterministic view of technology, assuming that technology is the output of autonomous, linear, one-way, unavoidable development, SCOT attempts to understand it as the outcome of interacting social visions and political encounters, and in turn, with an effect also over the society in which it is produced and embedded [39,45]. “One of the central tenets of this approach is the claim that technological artifacts are open to sociological analysis, not just in their usage but especially with respect to their design’s technical content” [41] (p. xiii).

Such approach does not just relate to (conscious and unconscious) engineers’ and policy-makers’ assumptions and decisions but equally apply to the influence of civil society groups on hydraulic development—whether this is recognized and allowed by government and expert institutions or not. Worldwide, struggles against dams are all different from each other. Their stakeholders are different, their strategies vary from locality to locality, their contexts and mobilization domains are distinct, their timing is unique, their calls to battle are manifold, and they even speak different languages. Nevertheless, these fighters have in common that their actions aim to stop or modify the construction and implementation of a technology. That is, these movements place the dam (and its direct territorial effects)—rather than any other aspect—at the center of their opposition actions. Hence, it all starts with the dam—then societal anti-dam movements expand their objections to related dam-network objects and subjects, such as the promoters of that technology (e.g., governments, builders, financiers, technocrats, and experts), the legitimating discourses (e.g., green energy, the well-being of the masses, development, progress, climate change, and democracy) and the knowledge frames that foster mega-dam development. Therefore, starting from this empirical fact—that the dam is a crucial element of these social struggles—what can the dam itself tell us about the conflict, about its own constitution and about society itself? In this sense, SCOT’s perspective allows us to jointly understand how the Baba dam and Patricia Pilar’s anti-dam movement developed along the time, and which consequences have occurred both in technology and society as consequence of such interrelated developments.

For this, as mentioned earlier, technography is required. Technography is defined as the ethnography of technology. It is an interdisciplinary, interrelating analysis of technology, nature and society [38]. In this particular case it helps to examine the concrete shaping, use, and impact of

dam technologies in social situations, and how they (re)configure livelihoods, territories and create specific water access and control arrangements (see also [45,46]). This methodological approach together with a critical view on technology: considering technology as a *subject* of research enables a different epistemological way to identify and understand conflicts, in which social and political clashes between dam proponents and opponents literally become ‘materialized’. This means that technology is loaded with language, values, norms, practices, and discourses [47].

Technology is socially constructed and politically negotiated or, as Pfaffenberger proposes [45] (p. 244): technology is “humanized nature”, insisting “that [technology] is a fundamentally social phenomenon: it is a social construction of the nature around us and within us, and once achieved, it expresses an embedded social vision, and it engages us in what Marx would call a form of life”. We, thus, argue that technology is molded by power relationships and societal visions and, once it materializes, transforms and affects society on the basis of those intrinsic social and political relationships that inform it [30,40,48,49]. On this basis, we suggest that technology is not a neutral element within megadam conflicts, but constitutes (at least partially) an explanatory element of them.

Based on this ontological position regarding technology, this article argues that a megadam, as the Baba dam, is by no means one-directional or solely influenced by the designers or a single group of societal stakeholders. In fact, dams—as a technology—are not built or implemented without being contested by other societal groups (e.g., rural people and their communities, indigenous peoples) who perceive them as a problem for different reasons: social, environmental, and economic [50]. Although hydraulic engineering models for dams are predefined or “closed” on engineers’ desks, during their design, construction, and implementation phases, several “relevant social groups” [41] (p. 22) are able to influence these models’ criteria. This means that the material product—technology = dam and ancillary works—is not the exclusive result of dominant power and its interests, but also of those who, from more vulnerable positions, contest the dam’s implementation and presence. In this regard, technology becomes a hybrid, comprising different and usually antagonistic visions of what the relationships between society and nature are, or ought to be. The dam is a battlefield—of interests, values, meanings, norms, and discourses. This approach, therefore, enables us to understand how technology is constituted by society, and the effects and function that technology has on society.

3.2. *Anti-Dam Social Movement: An Approach from the Politics of the Governed*

“Several attempts have been made to approach the President of Ecuador, but they have all been fruitless; they continue with the mistaken decision to turn our province into a cesspool, to expel thousands of families from their habitat, and drive us into miserable poverty. Using force is our only chance for the President to realize that Ecuadorians also live here, citizens, with rights and duties, and that it is his obligation to listen to us” (Statement by an inhabitant of Patricia Pilar in resistance, (Diario Digital Ecuador Inmediato, 15 November 2005)).

In many parts of the so-called South, social movements against dams navigate their struggles within a political context marked by their country’s colonial history. Ecuador is a case in point. As part of the contemporary post-colonial project to build the Republic, the Ecuadorian nation-state has planned and implemented hydraulic mega-infrastructure to develop and modernize the country. These government interventions have elicited different reactions from the local population group affected. Although, prior to 2002, there was social mobilization against these policies and their outcomes, they were isolated grievances, which were not even anti-dam per se, because (among other reasons) when their complaints were raised, the dams were already built and operating. Those struggles focused, therefore, on demanding the basic benefits that the State, as the provider of well-being, should ensure.

An example of this is the Daule-Peripa dam, the country’s largest, built in the 1980s. Its implementation affected over ten thousand people and flooded nearly 30 thousand hectares of farms and forests. Up to the year 2017, hundreds of families had received no indemnity yet, but are living under conditions of involuntary isolation, with no access to basic services [12,14,22,51]. Since then, taking the bitter experience of Daule-Peripa’s neighbors as a reference, several local populations

have led anti-dam movements to keep megahydraulism out of their territories, while negotiating with the State and its representatives for a more full recognition of their ‘citizenship’. “Megahydraulism” (see [3]) does not refer solely to the policy of building dams as material expressions, but also covers the system of knowledge, and the institutional, technocratic and financial processes that are legitimized under the dominant approach of ‘good’ governance of water and watershed management.

Key members of the mega dam regime [3], the State and its officials are usually fierce proponents enabling hydraulic mega-projects. Without their consent, promotion and political backing, and that of their government representatives (technocrats, politicians, technicians, bureaucrats) such projects would usually never happen. (See Patricio Silva for a discussion of the differences between technicians, technocrats, politicians, and bureaucrats [52]. For their empirical manifestation in Ecuadorian water and natural resource governance, see [53–56], and for their relationship with divergent Ecuadorian water user groups and the politics of national water governance, see [12,13,27,35,57–63]). In policy practice this entails under-estimating the negative socio-environmental impacts and over-valuing the benefits that such water development projects and mega-constructions will bring [21,56,64,65]. Therefore, as Chatterjee argues, this involvement means the modern State plays a crucial and discriminatory role in relation to this overarching discourse of equality and universal citizenship for “most of the world” [36]. That is, large masses of people who live within the boundaries of the State never see their citizens’ rights materialize. Nevertheless, vulnerable populations’ consciousness-raising about the unequal treatment they get from government officials has given rise to societal movements that are dissatisfied with State policies—in this case, against policies promoting mega-dams. In Ecuador the study of social anti-dam movements must address their relationships with the State. With this premise, it is particularly useful to examine the “politics of the governed” [36] to understand how these social movements deal with the State and its water policies. In his proposal, Chatterjee distinguishes between citizens and populations: the former mobilize in the theoretical (or formal) arena, whereas the latter belong to the political (or real) domain [66] (p. 6), [67]. In practice, this dualism means that those whom the State has not managed to include or totally consider as citizens (i.e., individuals fully enjoying their rights, with demands for equality, actively participating in decision-making by the nation-state, and backed by formal legal arrangements to deal with the State) have a different relationship with that State, in the real domain, on a political basis [66] (p. 8). Instead of acting from the civil society, the latter take action and mobilize from the field of political society—“an arena for negotiation and contestation”, navigating between legal and para-legal issues, appealing to and/or (re)constructing the bonds of “moral solidarity” to make collective demands of the State and its institutions [68] (p. 150). “It is here that most political mobilization takes place and where the state has to find and reproduce its legitimacy as provider of well-being to its citizens” [69] (p. 22). Although political society’s fundamental field of action is para-legal, this does not mean that the governed cannot use laws and civil-society institutions to enable their actions and demands to succeed. It is generally as a political society that the marginalized are able to reorient state benefits, policies, and programs in their favor: by applying, at the right time and in the tactical context “precise pressure on the right points of governmental mechanisms” [68] (p. 139).

So, while officials—since the dawn of the republic—have attempted to consolidate a modern nation-state under the abstract promise of citizen sovereignty and equal rights for all; according to Partha Chatterjee, millions of poor, marginalized people—located at the edges, between the formal and actual realities of that nation-state—“are devising new ways in which they can choose how they should be governed” [36] (p. 77). In other words, “people are learning, and forcing their governors to learn, how they would prefer to be governed” [36], (p. 78).

A successful politics of the governed, “viable, and able to obtain results, entails a considerable dose of mediation” [68] (p. 137). So, the success of a policy of the governed depends, first, on the capacity of particular individuals or groups to mobilize support and influence implementation of public policies in their own favor [68] (p. 132). Next, it depends on the capacity of leaders or mediators to generate societal cohesion by coating “the empirical form of a population group with the moral attributes of a

community” [68] (p. 128). However, even if these requirements are met, success will be situational and temporary. Since political society moves (predominantly) in the political arena, if the political context in which they are acting shifts, it is quite possible that this will keep them from attaining their goals, or from attaining them completely. As we examine in this case of coastal Ecuador, focusing on the politics of the governed helps to understand how and to what extent those affected by large dams as Baba are able to claim co-decision in and on social-political and material-technological dam development, disputing with governors and engineers about ‘the ways they would to be governed’.

4. The Baba Dam: Its Technological Development and the Social Struggle against It

Patricia Pilar is a parish (district) belonging to the canton of Buena Fé in the province of Los Rios. Since 1974, it began constituting as a town on the land sold by one of the large agro-industrial companies. Patricia Pilar got onto the country’s formal political-administrative map on 19 September 1996, after being granted the status of a parish (which in contemporary Ecuador is similar to a secular, public administration district). It is located in the upper basin of the Guayas River, about 150 km southwest of Quito and some 20 km from the top end of the Daule-Peripa reservoir (Figure 1). Like many other towns along Ecuador’s coastal highway, Patricia Pilar is a human settlement born in the heat of colonizing land that was inaccurately termed vacant (*tierras baldías*) during attempts at agrarian reform in the 1960s and 1970s [55,70,71]; and by the expansion and consolidation of large neighboring agri-business plantations (rubber, balsa wood, bananas, or oil palm). The high fertility of their soils and availability of water from the Baba River and its dozens of tributaries made this land’s potential for agriculture very appealing.

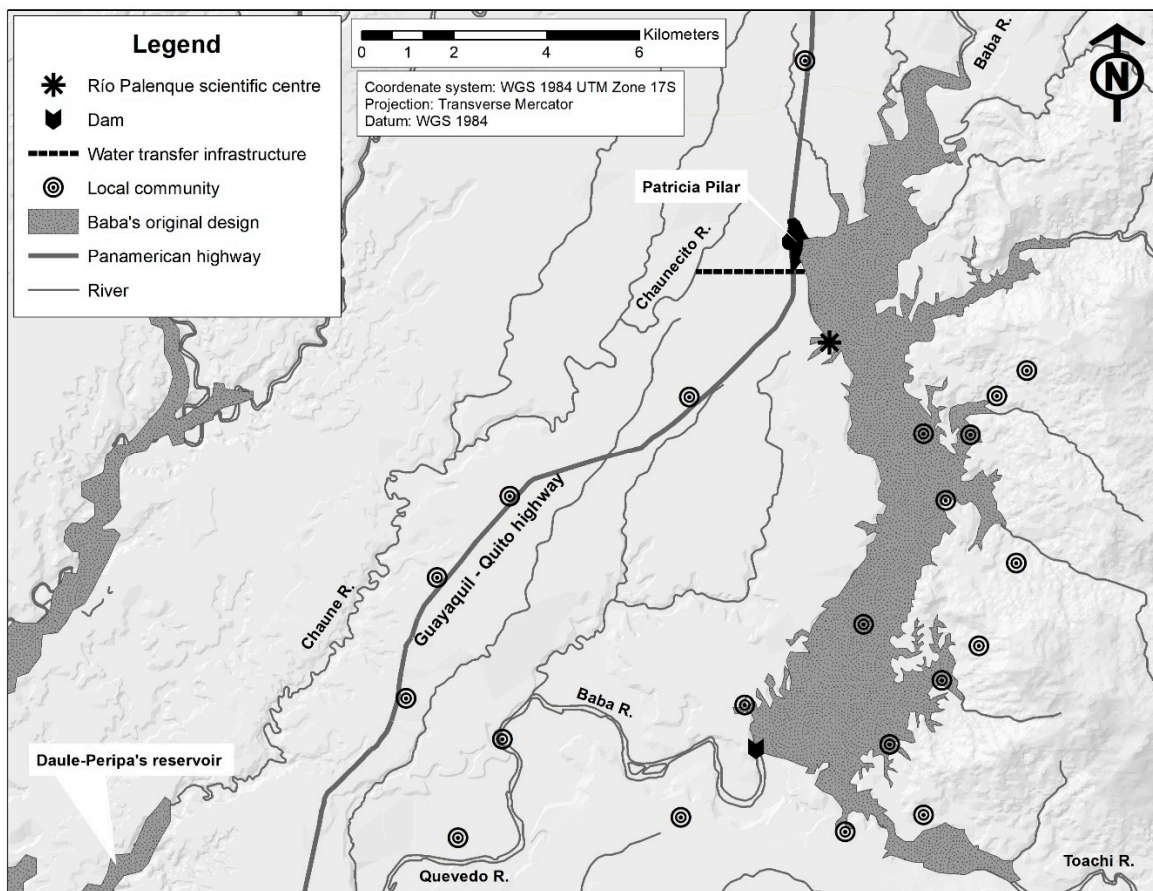


Figure 1. Baba dam’s original design and main affected local communities. Source: HidroPacífico S.A. Prepared by: Juan Pablo Hidalgo-Bastidas.

The zone is a social mosaic of people from various origins, backgrounds and interests. Since the first half of the 20th century, the mix has included small farmers, Afro-descendant communities, capitalist agri-businesses, merchants, and rural workers. The zone has also received people displaced by other dams, such as those affected by the Daule-Peripa dam. Most local people came from the provinces of Pichincha, Manabí, Loja, and El Oro. This built up Patricia Pilar's social, productive and economic structure. Having people in this geographical location from so many diverse places would apparently mean a fragmented society: with no common recent past on which to build a sense of community. However, as we shall explore, situations such as the fight against the Baba Dam reveal that inhabitants are able to build quite strong social cohesion, with significant effects on their own well-being and on decision-making by government officials and technocrats.

4.1. The Original Design, and the Struggle in Patricia Pilar (1977–2005)

As a government's technical expert observed, "all these dams suffer from the same disease: they need to transfer water from other watersheds, because at some point they run dry". (Interview with a technician from the former CEDEGE, responsible for hydraulic mega-projects in the National Water Secretariat (SENAGUA), 15 January 2016). Therefore, when Patricia Pilar was being settled on the banks of the Baba River, plans for the multi-purpose dam project were already being made on desks of the Commission for Studies to Develop the Guayas River Basin (CEDEGE): to resolve the country's serious energy crisis and increase the inflow in the Daule-Peripa reservoir and hydroelectric plant, built with an overestimated design capacity [14,33]. The CEDEGE, from 1965 to 2008, was the governmental agency responsible for managing and building projects to manage water resources in the country's largest watershed, the Guayas River Basin. Designing of Baba project took nearly three decades and ran through several consultant firms. Nevertheless, they never consulted with the people living back then in the zone. After long years of studies, the final designs for the project proposed implementing a dam to hold 600 hm³ with one inter-basin transfer, near the town of Patricia Pilar on the Chauncito River, with an area to be flooded of 3760 ha, a 54 MW hydropower plant, and a dam 55 m high (Figures 1 and 2). One important feature of the dam, as we will show later in the text, was the overflow spillover with a rectangular section (Figure 1).

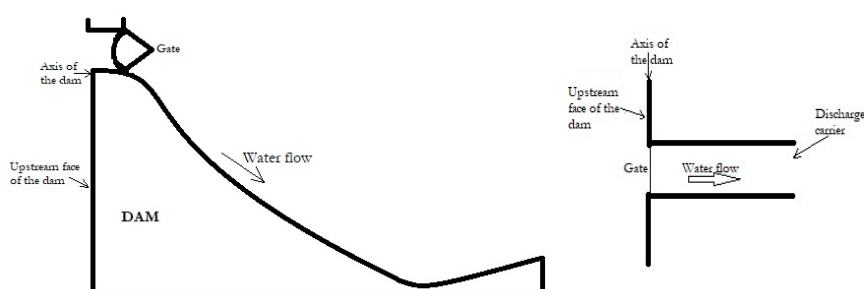


Figure 2. Cross section (left) and upper view (right) of the dam spillover. Elaboration: Juan Pablo Hidalgo-Bastidas.

What designers never expected (or probably under-estimated or ignored) at the time was that this design would affect a large number of communities living along the lower Baba and Toachi Rivers. As the parish priest of Patricia Pilar recalls, referring to a conversation with a CEDEGE's official:

"When they presented the project [before starting the construction phase], they [CEDEGE] said: 'it [the Baba project] was prepared before Patricia Pilar existed'. They meant there were only isolated villages of small farmers. At that time [when the project was being designed], the State did not hesitate to toss these farmers out" (Interview 28 November 2015).

As shown on Table 1, at the time of construction, the effects on the people there were sizable.

Table 1. Socio-environmental impacts and technical specifications of the original design.

Description	Figures
Impacts on displaced population	778 inhabitants
Homes affected by the reservoir	240 homes (including villages)
Infrastructure affected by the reservoir	6 schools/2 churches/6 bridges
Area flooded	3760 ha
Expropriations	4420 ha
Dam height	55 m
Water storage capacity	600 hm ³
Installed electrical generation power	54 MW
Reservoir water quality and public health risk	Reservoir regulated by gates (semi-stagnant water). Severe impact on health.

Source: [72,73].

With the studies ready, CEDEGE engineers applied in 1999 for the National Planning Secretariat to declare the Baba project as a national priority. They argued that it was part of the process of ‘rationalizing’ the use of water resources in the Guayas River Basin, an ideal introduced by the creators of CEDEGE in the mid-1950s (Official letter from CEDEGE Number 1000-E-0435, March 1999). This confirmed, as asserted by the government’s technical expert, that the new project was an extension of CEDEGE’s flagship: the Daule-Peripa dam complex. This priority was granted and ratified by the Secretariat-General of the Presidency of the Republic (Official letter from the Secretariat-General of the Republic of Ecuador Number ODEPLAN-99-605, 28 May 1999), which cast a mantle of legitimacy over the project as a necessary part of the country’s development.

According to CEDEGE, the Baba project’s benefits were multiple. Electrical generation was the first and main benefit expected from building the dam. Electricity generation would take place both in Baba and in downstream Daule-Peripa. The latter would benefit from the extra water volume derived from Baba project. The second benefit was flood control downriver, on the Quevedo River. Third was an increase by thousands of hectares under irrigation. And fourth, it would provide water supply for human consumption [74,75].

Although the project was approved for construction under the technical parameters of the original designs, they changed after prolonged contestation by local communities. As one of the leaders of the social mobilization explained: “the dam building project was interrupted and altered [. . .] because the people rose up against it!” (Interview 16 October 2016). We describe this process with more details below.

Formation and Struggles of the ‘Bi-Provincial Committee for Non-Construction of the Baba-Vinces Dam’

It was 2002. While CEDEGE pushed the project with increasing urgency, Patricia Pilar began hearing rumors that a dam might be built. Having no access to official information, some local leaders and politicians began mobilizing to find out, and warn their people. One of the first leaders involved was the then-President of the Parish Board, Carlos Méndez. He came to Patricia Pilar as a child, with his parents, from the province of Manabí. Over the years, his family purchased land and, with it, power, becoming one of the most well-heeled families in the zone. In the sub-national elections held prior to the conflict, he was elected President of Patricia Pilar parish, making him the local leader, especially for the urban part of Patricia Pilar.

In late 2002, some peasants looked up Méndez and told him, because of his position as the parish representative, what they had noticed about the future project. “These farmers began telling me about it [. . .]. The problem was that technicians came to conduct their studies secretly, without telling anyone, or even misleading people” (Interview 26 October 2015), recalls the politician. After these complaints, Méndez called a meeting of representatives of the 17 communities around the town of Patricia Pilar, to discuss the issue openly for the first time. Méndez was the first leader in charge

of organizing communities and finding out about the project. He also became the first mediator for local concerns, vis-a-vis other stakeholders and the central Government itself. Thus, he sent letters to CEDEGE, to other governmental and non-governmental institutions, to request information about the project and support incipient resistance.

Hand in hand with these actions, by late 2003, local peasants and women organizations contacted Lorena Zambrano. She was a young leader, living in a nearby town, Buena Fe. Her relevant experience was her work with Rural Social Security members in Los Ríos province and as Coordinator of an organization of rural and urban stakeholders in the province. With this organization, years ago, Zambrano had worked with several communities affected by the Daule-Peripa reservoir, seeking reparations from the Ecuadorian Government. Her work with local societal organizations had built up her contacts with several environmental NGOs, other political parties, and human rights organizations. This would also prove to be essential to reinforce the struggles beginning in Patricia Pilar, with her ability to work on multiple scales. Thanks to her contacts with other stakeholders and the people affected by Daule-Peripa, Zambrano, played a fundamental role in the early years of resistance in Patricia Pilar.

At the time, another leader was also outstanding, leading Afro-Ecuadorian communities: Patricio Hurtado. Unlike other leaders and most local peasants, he was born in the zone. He belonged to a family who had been living there for over 100 years. For this reason, he could claim that the Afro-Ecuadorian communities' land should be categorized and protected as ancestral. This claim was supported by the National Constitution issued in 2008. (See Article 60: "The ancestral people, indigenous people, afro-Ecuadorians and *montubio* people will be able to constitute territorial circumscriptions for the preservation of their culture. The groups that enjoy collective property over the land will be recognized as a form of ancestral territorial organization"). Before the conflict he worked on a medium-sized farm (26 ha) owned by his mother, where they grew crops on the banks of the Baba River. Although his own property would not be affected directly by the original dam design, he decided to back Patricia Pilar's resistance and that of other Afro-descendant rural communities there.

By early 2004, as CEDEGE prepared to tender for the project's construction stage, leaders from Patricia Pilar had organized 31 communities. Throughout that year, Zambrano and Méndez did major political work. They were both trusted and backed by communities and had contacts with NGOs, political parties, societal organizations, and labor unions. While Méndez warned political stakeholders external to the parish, Zambrano and other local leaders such as Hurtado organized and participated in meetings with each community to encourage local people to protest against the dam's construction. They worked intensely, especially to build, merge and solidify a community identity among people from different origins or, in Chatterjee's terms, a "moral solidarity". As Zambrano recalls:

"We prepared for several months, with meetings in each community [. . .]. Organizing was not easy, and required long discussions. This organizing is a question of talking things over, like forming a family where everyone can understand each other and make commitments, because otherwise you'll get nowhere!" (Interview 26 November 2015).

Meetings to organize were held in two settings: large assemblies every Sunday in the urban area of Patricia Pilar, and smaller ones during the week in rural communities. General assemblies were held in the central park of the parish, some 500 persons attended regularly. Smaller meetings would gather people mostly from local communities only. One of the peasants confirms this: "Meetings were held in Patricia Pilar, but the main constituency was here in the communities" (Interview 28 October 2015). This statement also shows the feeling that would emerge concretely in the future: the resistance was rooted in rural communities set to be affected by the original project and, to a lesser degree, in the town (urban part) of Patricia Pilar.

Several elements began uniting the local villagers to mobilize. The main ones were the fear of suffering similar impacts to what their neighbors suffered from the Daule-Peripa dam: loss of their

land, livelihoods, neighborhood relationships, and being isolated by the massive overgrowth of aquatic weeds preventing navigation. Memory of the past and roots in the present reinforced the arguments that consolidated collective interest in Patricia Pilar's resistance. As printed in *El Comercio* daily newspaper: "Bad experience with Daule-Peripa warns about the Baba dam" (*Diario El Comercio*, 17 May 2004). This memory was amply used by leaders to motivate protestors. They organized exchange visits with testimonials and life stories from those affected. The results were impactful: the Daule-Peripa experience became the banner Patricia Pilar's people marched under, used to motivate protests against building the new dam.

This social effervescence and moral solidarity enabled the 31 Afro-Ecuadorian and other rural communities to organize under the name of 'Bi-provincial Committee for Non-Construction of the Baba-Vinces Dam'. The Committee became a *de facto* organization, with the sole and main purpose of preventing construction of the Baba dam. It was born and continued throughout the conflict and struggles over the Baba project.

In April 2004, while CEDEGE vigorously pursued their project, the Committee grew even stronger and gained public attention after the first incident between their opposition and the dam technicians. As a local newspaper put it: "Inhabitants prevented soil studies. Approximately 200 residents of the parish of Patricia Pilar went to the site yesterday morning where the Baba Dam is to be built, to prevent the work from continuing" (*Diario La Hora*, 7 April 2004). That action, according to the newly-created Committee and its leaders, was a crucial step to show residents that the dam posed a real, imminent threat.

From then on, the case attracted local players plus provincial, national and international stakeholders. Another organization was formed regionally: the Coordinating Agency to Defend Life and Nature in the Guayas River Basin (COORDENAGUA). Unlike the Committee, comprising rural folk from the 31 communities, the Coordinating Agency had other members outside the zone directly influenced by the dam, almost all provincial organizations (agricultural centers, the association of artisans of Los Ríos, professional drivers, etc.). The Coordinating Agency was led by Julio Moreno, a teacher from a local university, self-identified as a scholar-activist (who had contacts with several NGOs engaging him with international conferences in Guatemala and Argentina about anti-dam movements). He felt that the Coordinating Agency was "... the most visible spokesperson entity. The Committee by contrast was the gatekeeper, to prevent any attempts to placate the people. We [the Coordinating Agency] held press conferences, participated in debates and in public events. That way our resistance had different levels, to achieve visibility and spread our issue around: local, territorial, regional and Latin American visibility" (Interview 16 October 2015, Julio Moreno). This created a platform that did elicit support from other stakeholders but not the total support of local residents, possibly because the Coordinating Agency included discourses extending beyond local, immediate concerns. For instance, Moreno stated in an interview:

"Baba's issues are not isolated, but part of the transformation of the Guayas River Basin. And Baba is not disconnected from transformation of large-scale capital. Baba has to do with the whole project to develop oil palm, teak, and banana plantations. Baba involves the problems with Daule Peripa. It has to do with the issue of agro-fuels. And with the Manta-Manaos multimodal route" (Interview 16 October 2015).

Such broader discourses somehow disconnected the new organization from local villagers' claims and interests. Local villagers' concerns mainly were about direct socio-environmental impacts (e.g., the loss of land, livelihood changes, etc.). The latter concerns, as we will show, were crucial for subsequent re-design of the Baba mega-project. First, local inhabitants were afraid about the area of land to be flooded, which would inundate local livelihoods, isolate thousands of persons and leave large areas of productive land unusable. It would also isolate the protected area inter-community ecological reserve. This area is situated around the Río Palenque Research Station, catalogued as the last relict of primary tropical forest anywhere on the coast of Ecuador. In 1970, the center was established as such by the University of Miami. It was declared a protected area by the national Government. Second,

the stagnant water would be a public health hazard, leading to outbreaks of diseases transmitted by mosquitoes. Third, they were concerned about how uncontrolled buildup of water lily in the stagnant water might affect them. Fourth, they complained that project design did not include adequate, timely community participation. Fifth, the irrigation would not benefit small-scale farmers or rural people, but only large-scale agro-industrial businesses. And finally, local protestors claimed that the dam's projected flood control would not be effective.

In late 2004, based on these concerns, local communities asked CEDEGE officials for more detailed and accurate information about the Baba project; however, these claims were unattended. Neither access to official information nor an open negotiation with the Government was achieved. On the contrary, CEDEGE issued a tender for a private strategic partner to provide financial and technical support to build the project. As well as strongly promoting the project, these disparities deepened the gap between proponents and opponents.

In this context, in mid-2005, an event that intensified protests but also weakened part of the Committee's communities, was the assassination of the Afro leader, Patricio Hurtado. This happened just a few days after he was appointed President of the Committee and gave an energetic speech against building the dam. Despite rumors that the rural leader's disappearance was led by the Baba project promoters, this murder's motives have remained unclear until today. On the one hand, this tragic incident left the Afro communities leader-less and their voice faded in the Committee and mobilizations. On the other hand, protests gained public attention. Besides a growing media attention, local authorities such as presidents of other parishes, mayors, members of Congress and even the Prefect of Los Ríos province showed support for mobilizing against the dam.

In that year CEDEGE chose, as its strategic partner, the Hydropower Consortium of the Coast (CHL). Meanwhile, the Committee and the COORDENAGUA, taking advantage of such social effervescence and media attention, organized several actions to stop dam construction. The most significant action, in the last months of 2005, was blocking one of Ecuador's (and Latin America's) main highways: the Pan-American Highway. That is, the track leading from the national capital, Quito, to the country's largest city, Guayaquil (Figure 1). In this sense, 2005 was decisive for the dam conflict. When local communities' complaints went unheard, the Committee and the COORDENAGUA organized three big highway blockades. The most forceful one was in November 2005. The Committee's former secretary recalls:

"The highway was full of people, everywhere. To figure out the strategy, NGOs and other organizations came from Quito. We were totally prepared. The strike was a success, out of this world!" (Interview 13 October 2015).

This was the climax of the fight. The strike materialized the collective morality that glues together local communities, popular leaders and urban activists. They closed the highway for three days. Even secondary roads were blockaded. Each community organized to get everyone to the Pan-American Highway. Nearly 3000 people took part in the strike. The Government knew that, since this is such an important highway, traffic could not be shut down for long. So, on day three, the police came in violently, by air and by land, to scatter demonstrators. (The increase of acts of State and private army violence against dam opponents is well-described; see e.g., [76]). However, this event had already gotten plenty of attention in the press and international news through the NGOs involved.

After this strike, years of complaints finally reached the ears and plans of government's project proponents. Before the end of the year, CEDEGE decided to change the Baba dam's original designs, taking into account protestors' arguments. The President of CEDEGE at the time announced that "the layout of the Baba dam will change substantially, to affect as few rural people as possible in the province of Los Ríos, who protested publicly last week about this" (Diario El Mercurio, 24 November 2005).

4.2. The Alternative Design, and the Resistance's Division (2006–Present)

The alternative design suggested by CEDEGE's new strategic partner, CHL, differed from the original in various technical infrastructural aspects and its geographical location as shown in Table 2.

Table 2. Socio-environmental impacts and technical specifications of the alternative design.

Description	Figures
Impacts on displaced population	191 inhabitants
Homes affected by the reservoir	41 homes (including villages)
Infrastructure affected by the reservoir	1 school
Area flooded	1099 ha
Dam height	20 m
Water storage capacity	110 hm ³
Installed electrical generation power	42 MW
Reservoir water quality and public health risk	Constant spillover dam without gates. Minimal health impact.

Source: [72–74].

As shown on Figure 2, the dam site was changed to 15 km south of Patricia Pilar. In consequence, the dam would not flood most of the local communities. The dam height was significantly reduced by 35 m, and its hydraulic design changed, from gate regulation with a normal spillway, to a gateless design with a duckbill spillover (Figure 3). Unlike the original design (Figure 2), the alternative design would enable constant flow of water.

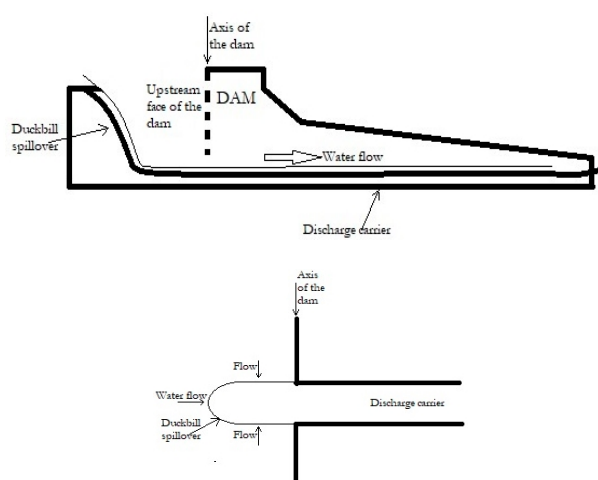


Figure 3. Cross section (above) and upper view (below) of the duckbill spillover. Elaboration: Juan Pablo Hidalgo-Bastidas.

The larger perimeter of the duckbill spillover (Figure 3) in comparison to the overflow spillover (Figure 1) allowed (partially) for the reduction of the height of the dam without significantly affecting the dam technical purposes (e.g., hydroelectricity generation). The change on the design of the spillway also would flood less than one-third of the originally planned area, with a reservoir of running water, to significantly reduce the massive proliferation of aquatic weeds and maintain relatively good water quality. These changes, clearly, incorporated local communities' main socio-environmental concerns into the very materiality of the infrastructure.

As shown in Figure 4, with the alternative design most of the flooded land belonged to large haciendas and agro-industrial companies. Figure 5 makes clear that most of the local communities were not affected by the new project. Only two percent, belonging to small farmers, fundamentally to Afro-descendant communities was affected (see Figure 5).

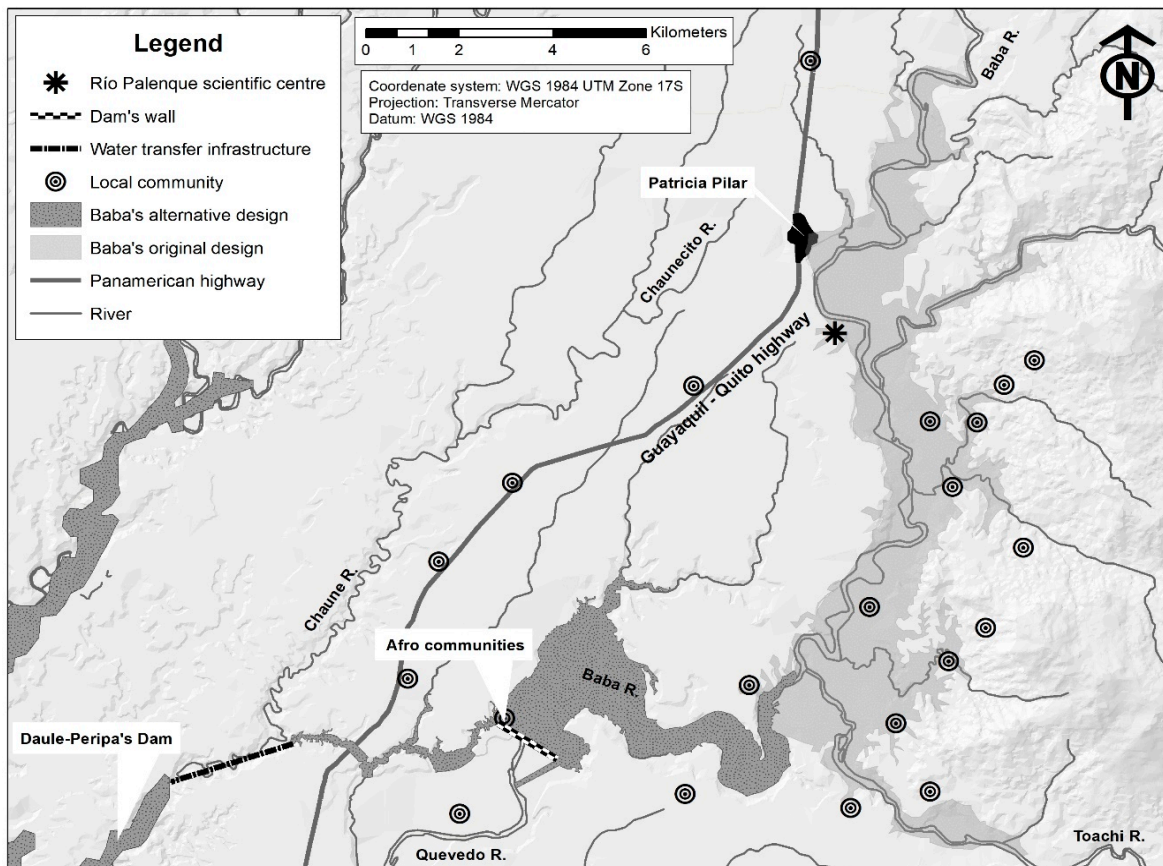


Figure 4. Baba dam’s alternative design and affected Afro-Ecuadorian communities. Source: HidroPacífico S.A. Prepared by: the authors.

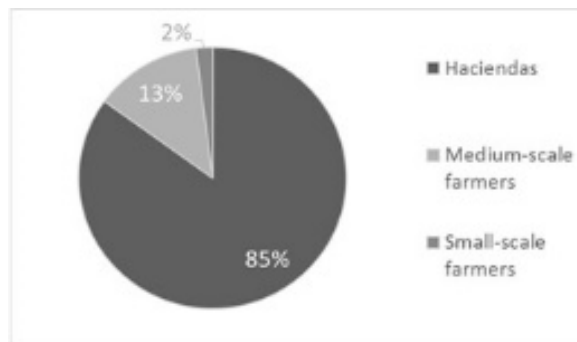


Figure 5. Types of properties affected by the alternative Baba project design [75].

Although the protest was born to stop dam construction, the proposed changes left most protesting peasant communities un-flooded (Figure 4). This made most local communities lose their interest in continuing their struggle: after CEDEGE announced the changes made in the dam design, community support for resistance diminished significantly. University teacher Moreno, leading the Coordinating Agency, said:

“When they took the dam further downriver, it was strategic for them, because we no longer had any way to mobilize people from Patricia Pilar; [. . .] so, it was difficult for the leadership to reconstruct a new discourse backing the struggle” (Interview 16 October 2015).

These changes gave a sense of legitimacy to the governmental authorities to commit to building the project. In January 2006, the project was awarded to Odebrecht S.A. (part of CHL) and in May 2006

the contract was signed to capitalize shares in these private companies. At this event, it was announced that “once the dam is ready, the consortium will operate the new hydropower station for 35 years, during which time it can use the electricity generated for its own companies and sell any surplus to the State. After that period, the project will return to the State” (Diario Expreso, 10 May 2006). As well as revealing the urgency of implementing the project, such statements showed the true scope and use of the project, leaving the initial government agencies’ rationales—i.e., urgent public energy provision and flood control, in combination with irrigation and eventually drinking water provision—unjustified.

There is no doubt that the anti-dam movement exerted a great political pressure over CEDEGE and the government to adopt an alternative project design. As a high-rank CEDEGE official asserted: “Do you ask me if the social protest influenced our decision to change the designs? Yes, of course! They and their coherent demands importantly redirected the design. [. . .] The project was now more expensive, but it significantly diminished the negative socio-environmental impacts” (Interview 27 November 2015). However, such a far-reaching decision to implement an alternative dam design is not based on popular demands only. Besides social and political pressure we argue that it was also informed by rent-seeking relations between government officials and the construction company that was contracted for the job. Although the rent-seeking aspects were not explicitly revealed during field work, an economic audit requested by the Ministry of Energy and Mines in May 2007 disclosed serious financial and economic inconsistencies in the Baba project negotiation process between the government and Odebrecht. (“Estudio Económico y Financiero del Proyecto Multipropósito Baba de Hidronación.” Elaborated by Carlos Cortéz in May 2007). In recent years, Odebrecht’s Latin American corruption scandals have shocked the world because of their depth and broadly networked practices. (See an article published by the Ecuadorian digital platform for research journalism Plan V, on 22 December 2016: ‘The dirty hand of Odebrecht’, <http://www.planv.com.ec/investigacion/investigacion/ecuador-y-la-mano-sucia-odebrecht>. Also see the court proceedings of the United States District Court Eastern District of New York number F.# 2016R00709, pages 7, 16, 19 and 20).

Meanwhile, the impact of changing the dam’s technological design was multiple and ambivalent. Given most communities’ lack of interest in continuing to fight, as they no longer felt threatened, the sense of moral solidarity was lost. In this context, no more large assemblies were held, and there was, for instance, no more interest in blocking the highway. Strategies for resistance changed, from the streets, to the desks of national NGOs and international organizations, which began taking cases to court and urging international agencies to stop supporting the project. Nevertheless, these actions had no favorable results. Further, it was rumored that leaders had wangled individual benefits out of the struggle, which discouraged local communities’ members. This eroded local leaders’ credibility, and ultimately both organizations dissolved, first the Committee and then the COORDENAGUA.

By changing their designs, project proponents gained access to some communities and leaders, already partially de-mobilized. They publicly discussed the project and negotiated positions. These negotiations included land for peasants, especially with the Afro communities who were to be the only ones directly affected by the alternative design. At this stage, the strategies commonly used by promoters of such large projects pried at the cracks and further weakened the social organization. In July 2006, with no approved environmental license, the construction contract was signed for the Odebrecht S.A. Company to build the dam. After several years of construction and delays, the project was proudly inaugurated in June 2013 by then-Ecuador’s President Rafael Correa.

Afro Communities: The Most Vulnerable Faction in the Resistance

Although Afro communities, through their leader, were well-represented at the outset, after the leader was murdered and the alternative design was adopted, they became the most vulnerable members of the weakened social movement. Farmers from other parts of Patricia Pilar, who had marched alongside the Afro communities when protests began, now accused them of being sell-outs, with most of the blame for the dam project’s ultimate construction. However, analyzing the situation in which the Afro-descendants were left after the design change, these communities’ best option for

success was to negotiate effectively, in time, for land from the building company. They no longer had any popular support to resist and, further, the company's technicians threatened that: "if you don't negotiate soon, you will end up with nothing". In that context, the Afro-descendant communities negotiated their lands. One rural woman remembers that situation:

"We heard that, in Patricia Pilar, they [leaders] had already received money, so we were not going to be left behind, as the only village against the dam, like fools. So, we negotiated as well" (Interview October 2015).

Still, they ended up being the most affected population group, losing their fundamental networks and means of subsistence. Although most did receive economic compensation for their land and crops lost, these would not meet by far their loss of collectivity and community-rooted subsistence. Moreover, along with the land, they lost one of their main livelihoods: fishing. And having a huge reservoir a few meters from their homes was no guarantee that many families would have access to water: neither drinking water, nor irrigation water. At this time, large banana plantations and haciendas are the only ones extracting water from the reservoir, because of their location and access to pumping technology. These communities are caught between the questionable benefits offered by the community relations department of the company operating the power plant, and the negative impacts that it brought them.

5. Discussion and Conclusions: Hydraulic Order and the Politics of the Governed

This article has portrayed the process of organization and contestation led by the people of Patricia Pilar and neighboring communities against construction of the Baba multi-purpose dam. This has shown how such mega-projects are material expressions not exclusively of expert criteria, but actually hybrid manifestations that can be structurally influenced by more vulnerable stakeholders who are threatened to become affected. The Baba-dam water planning and implementation process shows that hydraulic designs transcend the technical realm where they are commonly located and discussed. On the contrary, we have shown that they evince contested knowledge, social constructs, in which different types of stakeholders—technocrats, politicians, rural communities, marginalized people, etc.—become political agents with the capacity and claiming the right to participate as such in decision-making and change the so called 'technical' processes.

Local claims, understood as part of the politics of the governed, had a significant effect on development of the Baba project. The pressure brought by social mobilization and resistance managed to insert their interests into the overall project design.

So, their hydro-social notions and knowledge were materialized in iron, cement, and new hydraulic flow patterns. The dam was relocated below the town of Patricia Pilar and below most of their rural communities. The height of the dam was reduced by 35 m, which then reduced the area to be expropriated and flooded by over two thousand hectares. Further, the hydraulic design, implemented with a duckbill spillway, made it possible to lower the water level and enable constant water flow in the reservoir. This change reduced potential negative health issues and the proliferation of aquatic weeds on the surface of the reservoir that would disrupt local water transport routes and obstruct the building of new (or conversion into alternative) water-based livelihoods.

In addition to the social cohesion achieved, and their capacity to upscale their struggle, part of the social movement's gains can be attributed to the geographical location of the protests. Closing one of the main highways from the Coast to the Highlands was fundamental to enhance the Committee's and Coordinating Agency's negotiation and contestation capacities. Their political-geographical location was crucial to be able to bring pressure on government officials.

Nevertheless, this social success reflected in the hydraulic infrastructure is relative, since it displaced its impacts onto the most vulnerable members of the social movement. What happened to the Afro-descendant communities after the mobilizations in Patricia Pilar manifests how every design assumption and choice in dam technology has divergent social and political consequences for the actors

involved, re-organizing them as stakeholders and stakeholders. It shows the importance of including, when analyzing conflicts over mega-dams, not only the history of proponents and opponents, but also their relationship with the genealogy and contents of the technological artifacts themselves. The latter analysis brings to the fore how dam development imaginaries and hydraulic design and building knowledge are political and disputed. It asks for scrutinizing the power relationships informing the design and construction of dam technology, and the effects the latter have over society.

By including both the design process and the design contents of technology in the analysis, the article contributes to the understanding of the motivations and disincentives co-determining the success or failure of a social mobilization. Chatterjee affirms that, when the political context changes, the capacity of political society to achieve success also changes. This article shows that, in conflicts about hydraulic mega-projects such as Baba, this ‘political context’ is not just a matter of disembodied societal relationships or power structures: political context is co-embedded in technology and artifact design. Technology as (partly and momentarily) ‘hardened knowledge, morals, norms, skills, and social relationships’ [26,45,77] significantly affects the development and capacity for advocacy of mobilizers—both in terms of artifacts’ contents and the process of designing, constructing and implementing these artifacts. In Baba, the modified dam design benefitted particular stakeholders (e.g., rent-seeking actors) and undermined collective moral solidarity as well as mediators’ capacity to reassemble the resistance’s discursive framework; framing the social mobilization became a major challenge.

Revealing the social and political foundations of technology design, development, and implementation emphasizes people’s political capacities. This offers options for recognition, participation and empowerment for the governed—those who are characteristically left out as knowledgeable agents in formal hydraulic design processes.

In sum, anti-dam struggles as in Baba show how the socio-political context and dominant relationships steer technology’s designing norms and practices; but also, vice versa, how the technical-hydraulic contents of such technology, in their turn, significantly shape the very socio-political context and impact on locally prevailing socio-economic and cultural-political relationships.

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