

Contending Strategies, Collaboration among Local Specialists and Officials, and Hydrological Reform in the Late-Fifteenth-Century Lower Yangzi Delta

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Received: 6 September 2009 / Accepted: 31 May 2010 / Published online: 16 July 2010
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Abstract In response to the failing mechanisms of hydrological management in the Lower Yangzi Delta in the fifteenth century, some officials and local specialists collaborated to form a new strategy, which was in opposition to that used in the conventional practice, to solve the problems. Regular maintenance approach was adopted to replace crisis–response approach, and building polder dikes was prioritized higher than dredging major waterways. In doing so, they not only brought precedents under scrutiny to work out feasible policies but also focused on the issues of institutional coordination, fundraising, and mobilization of labor. The reform, which they carried out by redefining responsibilities of the state and the people and by redistributing duty to the influential and wealthy, enabled the state to play a more active role in hydrological management to better benefit local society.

Keywords Hydrological management · Local specialist · Local knowledge · Collaboration · Lower Yangzi Delta · Ming dynasty · Jiangnan

1 Introduction

The period spanning the late fifteenth century and the first half of the sixteenth century witnessed a rapid deterioration in the hydrological management of the Lower Yangzi Delta (hereafter, Jiangnan 江南; for its location, see Map A). As scholars have demonstrated, one of the major reasons for this change was the local elites' indifference to both their formal responsibilities to the state and their informal obligations to the populace. Another reason was the passivity of government officials responsible for public works and their decreasing ability to enforce laws and rules. In short, the mid-Ming is usually described as a period when hydrological management was left unattended by both local elites and officials (Fan Jinmin & Xia

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Map A China, with special attention to the major river systems and the location of the Lower Yangzi Delta (the red part)

Weizhong 1993; Feng Xianliang 2002; Hamashima Atsutoshi 1982; Kawakatsu Mamoru 1980; Peng Yuxin & Zhang Zhengming 1992; Perdue 1982, 1987; Schoppa 1990, 2002a, b; Wang Jialun & Zhang Fang 1990; Will 1985).

Most large landholders did tend to avoid their duty: in that, the picture that scholars have painted is largely accurate. However, what has been missing from their analyses are two significant elements: the voices of local specialists and the intellectual and practical efforts made by the officials in charge of hydrological matters. These two elements are important because they were critical to a new approach and a new order that arose during this period, redefining the role of the state. Once we see this, we can no longer describe the mid-Ming as a period primarily characterized by interest-driven local elites and incompetent officials. Rather, it was a time when officials strove to solve hydrological problems with the assistance of local specialists.¹

Among the officials active in debates over hydrological management, Yao Wenhao (1455–1504) was perhaps the key figure in the mid-Ming reform movement. Yao was a *jìnshì* (metropolitan graduate) of 1484. His first appointment was as secretary of

¹ As these local specialists were able to read and write, and since their views were appreciated by those in power and consequently had practical impacts on local affairs, they certainly could be considered local elites. Nevertheless, to refer to them simply as local elites would marginalize a significant aspect of their activities: the production of hydrological knowledge. This kind of activity set them apart from the elites who gained their influence by wealth and political power. As this paper will show, these specialists were respected not for their achievement in civil service examination but precisely for their hydrological knowledge. Therefore, I call them “local specialists” rather than “local elites” to emphasize their unique qualities.

works, overseeing the building of granary boats. Later on, he was promoted to serve as Changzhou's 常州 assistant prefect. When Vice Minister of Works Xu Guan 徐貫 (ranking 3a, fl. 1457–1502) arrived in Jiangnan to take charge of the region's waterworks, Yao submitted a series of policy recommendations, all of which were accepted. Xu regarded Yao so highly that he recommended him to the emperor. So Yao was appointed director of works (ranking 6a) in 1496, supervising hydrological management in Jiangnan (Shao Bao 1983, *bie ji* 15a–16a; Zhang Guowei 1983, 10:35b). During his tenure, Yao recognized the inherent problems with standard practices and decided to reform the system. To that end, Yao scrutinized the precedents set by his official predecessors. He drew inspiration from local specialists who provided him with insight into the local situations, alternative strategies, and how to make crucial adjustments. By incorporating local specialists' knowledge into his reforms, Yao acceded to their request that the state play a more active role, which they considered indispensable for the improvement of the hydrological situation.

Through a close reading of a series of scholarly and institutional actions in the late fifteenth century, I will examine the process that permitted officials and local specialists to formulate a new and comprehensive strategy to water management.²

2 Taking a Stance on Prioritization: “Polder Dike Building” versus “Major Waterway Dredging”

One of the major challenges that Yao Wenhao faced when he set out to reform the state's management of water resources was prioritization. Precedents from the Song to the Ming dynasty presented him with two options: polder dike building (hereafter, diking) and major waterway dredging (hereafter, dredging).³ While Yao's decision was influenced by a debate between two Song hydrology specialists, he was keenly aware of the changes that had taken place over the three intervening centuries. As Wang Jiange (2009) has recently shown, land reclamation and population increases had reduced the drainage function of major waterways by Yao's time. Yao was aware of this change, as were local specialists. However, Yao's predecessors were not cognizant of this and they put emphasis on “dredging.” That is the reason that Yao decided to incorporate local specialists' views and scrutinize earlier precedents in his development of a new strategy.

2.1 The Prioritization Problem in the Song Dynasty: A Debate between Jia Dan and Shan E

When Yao Wenhao compiled his book, *A Collection of Documents about Zhexi Hydrology* (*Zhexi shuili shu*), he had a Song predecessor in mind. His preface and outline (375 words) mention Jia Dan 賈壘 (1038–1103) three times. However, Yao's tone was disapproving—he remarked that Jia's hydrological views were

² For the locations of the counties, prefectures, lakes, and waterways under discussion, see Map B

³ A polder is an area of land surrounded by dikes. It is usually a marsh or lake before it is turned into arable land. People build dikes first, then drain the water, and finally dig ditches within and without the polder for drainage and irrigation. Therefore, building polders is a way of reclaiming land in low-lying areas.



Map B Counties, prefectures, lakes, and waterways in the Lower Yangzi Delta in Ming China (Based on Tan Qixiang 1982, 49)

totally off the mark. This denunciation echoed the critique offered by Shan E 單鏞 (1031–1110), a hydrological specialist and one of Jia’s contemporaries.⁴ Yao’s preface thus recalled a heated debate that offers a clue to understanding Yao’s attitude.

At the core of the contention between Shan and Jia was the prioritization problem: should the state devote its resources to diking or dredging? In *Essays on hydrological management in Wu* (*Wuzhong shuili shu*), Shan criticized his opponent’s diking strategy as “most foolish” and explained that Jia’s chief mistake lay in his prioritization of diking: “Even though there is deep water, Jia Dan still wants to have people build polder dikes. However, when water sits on the land and stagnant water is not drained, building polder dikes will narrow the channels. When water is rapid and abundant during spring and summer, the polder dikes will overflow. Not only will polder dikes be destroyed, but houses will also be inundated.” Shan’s alternative proposal was to “begin by removing the silt at the mouth of the Wusong River 吳淞江,” then “build a one-thousand-span bridge” to

⁴ I will not analyze the context from which Jia’s and Shan’s views emerged, nor will I discuss every aspect of their thought. Rather, I will focus on how Yao and his contemporaries conceived of Jia’s and Shan’s ideas, and how Yao’s attitude toward them affected his policy. On Jia Dan, see Ikeda Shizuo 1940. On Shan E, see Nagase Mamoru 1983, 493–533. For both of them, see Sudo Yoshiyuki 1969; Wang Jialun and Zhang Fang 1990, esp. 340–2; Liang Keng-yao 1997. For a detailed discussion of the context surrounding Jia’s and Shan’s debate, see Mihelich 1979.

replace the Long Bridge 長橋 (Shan 1983, 10b).⁵ After all the stagnant water had been drained, people would be encouraged to build polder dikes. Su Shi (1037–1101) supported Shan’s plan and memorialized the emperor, recommending its feasibility. He underlined what he considered the key: the Wusong River had to remain unobstructed. According to Su, the Long Bridge was an obstruction. To solve this problem, the silt at the river mouth had to be removed and a new bridge of one thousand spans should be built to replace the Long Bridge (Su Shi 1983, 59:15b–17b). Su and Shan thus shared a view that prioritized dredging over diking.

In opposition to Shan’s and Su’s view, the chief advisor of Wang Anshi 王安石 (1021–1086) on hydrological matters, Jia Dan, offered his own analysis. He attributed the failures of the last 30 to 40 years, which witnessed flood after flood, to incorrect prioritization. In his own words, “For a long time, those with strong opinions knew about ‘draining water’ but not about ‘managing fields.’ However, ‘managing fields’ is the root 本, and the root should be attended to first. ‘Draining water’ is the branch 末, and the branch should be considered secondary” (Zhang Neiyun and Zhou Dashao 1983, 8:20a). He then quoted the advice of Fiscal Commissioner Wang Chunchen 王純臣 (fl. 1050s–1060s) to elaborate on his notion of managing fields: “Polder dikes should be built, and they should be interconnected in order to [protect the fields from] the wind and waves. Then there will be no flood damage. If polder dikes are not built, it will be useless to try to completely drain the river water” (8:20b). Jia concluded that Wang’s advice was “the most accurate.” Jia clearly viewed diking as the top priority. He pointed out that when floods occurred, if polder dikes were higher than the water surface of a channel, then water could not flow over into the polders. It would be confined within channels. Consequently, the water surface in the channels would be higher than that in the rivers; the water surface in the rivers would be higher than the surface of sea; and, naturally, the flow would be rapid and the water would run from channels to the sea via rivers (8:16b–17a, 25a). Polder dike management was unquestionably the most critical part of Jia’s plan.

2.2 Ming Priorities: Official Predecessors versus Local Specialists

Yao Wenhao reached back to the Song debate over diking and dredging because it anticipated a conflict in which he was embroiled. On one side were his official predecessors, who upheld the Shan-Su plan, and on the other side were local specialists, who favored the Jia-Wang strategy. Assessing the debate between Jia Dan and Shan E, he entered into a dialog with their Ming epigones and, at the same time, demonstrated his own stance on the prioritization problem.

One of the central government officials whose view Yao Wenhao could not ignore was Qiu Jun (1418–1495). A high-ranking scholar-official, Qiu had published a weighty book, *Supplement to the Extended Meaning of The Great Learning* (*Daxue yan yi bu*), only 10 years earlier. The emperor sponsored its publication in 1488 and

⁵ According to the description provided by Shan E and Jia Dan, the Long Bridge was more like a dam than a bridge. Its original function was as a path for those who walked on it and pulled the granary boats from the south side to the north side of the Wusong River. Its designer failed to take into consideration the concern regarding how to ensure unobstructed flow of the river. As such, the Long Bridge caused a tremendous silt-up problem. See Shan E 1983, 2b–3a; Yao Wenhao 1984, 72. A bridge of one thousand spans would not have obstructed the flow of the river and, thus, solve the problem.

had it distributed to the nation's schools.⁶ An entry in the book records a hydrological project that was part of Wang Anshi's reform program, a project in which Jia Dan played a pivotal role (Zhou Shengchun 1991; Nagase Mamoru 1983, 535–563). But Qiu immediately inserted Su Shi's condemnation of the project as an attempt “to improve hydrological conditions on a *fabricated* 鑿 basis” (Qiu Jun 1983, 14:25a–26a; emphasis mine). Su believed that the state's comprehensive project would disrupt the locality. He questioned, “Why did the state want to go to all this trouble when nothing needed to be done?” Qiu obviously agreed with this assessment: carrying out a big enterprise “on a *fabricated* basis” (he echoed Su's words) would “generate troubles, disturb people, lead to lawsuits, and provoke complaints” (Su Shi 1983, 51:15b–16b).

In addition to the weight carried by Qiu's views, Yao also had to consider the stance of his predecessor, Xu Guan. In 1494, Xu had incorporated Shan E's ideas into a grand project. The first two actions he undertook were to have people dredge the shallow riverbed around each abutment of the Long Bridge over the Wusong River to let water flow readily out of Lake Tai 太湖 and to have them remove all the marshes around the junction between Lake Tai and the Wusong River (Zhang Guowei 1983, 10:34b).⁷ These corresponded to the first and third actions to be implemented in Shan E's plan (Shan E 1983, 16b–17a). As for the objects of his project, Xu named a number of waterways in his report, but he mentioned no polder dike. In short, Xu Guan's project considered dredging more important than diking.

Shi Jian (1434–1496) of Suzhou Prefecture 蘇州府 and Jin Zao 金藻 (fl. 1480s–1490s) of Songjiang Prefecture 松江府 stand out for their frequent contributions to discussions of local water projects. Even though neither held an official degree or title, their hydrological knowledge was highly respected. Grand Coordinator Wang Shu 王恕 (1416–1508) so appreciated Shi's expertise that he recommended him to the emperor, who in turn invited Shi as his “guest of honor” in 1480 (Shi Jian 1983, *juan shou*: 1a, 5a–6a). Grand Coordinator Si Zhong 侶鍾 (fl. 1466–1510) “respectfully consulted” him in 1491 “on matters of hydrological management” in Jiangnan (Shen Qi 1996, 4:21a–b). As for Jin, Minister of Justice Bai Ang 白昂 (1434–1503) and Vice Minister of Justice Dai Shan 戴珊 (1437–1505) were both impressed by an essay he wrote in 1495 on Jiangnan's water control projects. They wrote him letters of recommendation and encouraged him to visit Xu Guan. Furthermore, Jin and Shi impressed not only the officials but also their fellow local literati. The Hanlin Bachelor and Songjiang native Gu Qing (1460–1528) was struck by Jin's insights and decided to write a farewell note to provide him with support (Gu Qing 1983, 16:11b–13b). Junior Supervisor of the Household Wu Kuan 吳寬 (1435–1504), one of Shi's lifelong friends, described him in 1496 as knowing everything about the current state of local water control (Shi Jian 1983, *juan shou* 3a).

The widespread recognition of Shi Jian's and Jin Zao's expertise is significant for three reasons. First, their low social status as non-degree-holders did not prevent their view from being shared by degree holders and high-ranking officials. This fact proves that Shi's and Jin's advice could not be defined as simple reflection of the view of those in low social status. Second, as I will show, Shi's and Jin's ideas could

⁶ For discussion of this book, see Chu 1976, 1984, 2005; Lee 1984, 2005.

⁷ For correct dating of these actions, see Li Dongyang et al. 1966, 90: 3b, and 92: 6b–7a; Zhang Guowei 1983, 14: 5a–8a.

conceivably cause grave inconvenience to landholders. Since Wu Kuan and Gu Qing did own land, their support for Shi and Jin shows that not all local elites were driven by the narrowest of material interests. Third, when it came to hydrological matters, it was knowledge rather than social status that decided whose voice should be seriously considered. Since Shi and Jin were widely recognized for their hydrological knowledge, Yao Wenhao had to take their views into consideration.

Shi Jian's attitude towards these two strategies can be seen in the sequence he used to present his methods to solve the problems of water management in his essay "A Discussion of Water Management in Wujiang County" (Wujiang shui yi). The first method he mentioned was building polder dikes. He stressed its importance by praising three early Ming officials for leaving the people with strong dikes which protected their fields from "serious damage caused by floods." Shi then introduced his second method, which he called "investigating where waterways branch and lead." He named a number of waterways and pointed out that their common problem was siltation. The solution was to dredge them in order to make sure that "water had the right course to follow" (Shi Jian 1983, 6:10a–13a). Judging from the sequence of his presentation, Shi implicitly gave diking priority over dredging.

Whereas Shi's position regarding these two methods was implicit, Jin Zao's stance was unequivocal.⁸ In his "Discussion of the Management of the Three Rivers" (San jiang shui xue), Jin first observed that conventional practice usually gave high priority to the dredging of waterways and downplayed the importance of maintaining polder dikes. He then contended that managing polder infrastructure had to be completed first. The dredging of major channels and three rivers would wait until the dikes had been improved (Gu Yanwu 1997, 4:27b). He explained the advantage of this method in terms of efficiency: the easiest work would be done first, and that work was sufficient to protect people's lands from "fifty to sixty percent of flooding" (4:27b–28b). That is, diking should take priority over dredging.

The difference between officials and local specialists was evident. While officials tended to consider dredging as the more urgent task, local specialists opted for diking. In the face of this divergence, Yao Wenhao not only reviewed the strategies of the distant past, but also carefully edited his book, *A Collection of Documents about Zhexi Hydrology*, to express his own opinion on the prioritization of hydrological tasks.

2.3 Yao Wenhao's Position: Editing Documents, Selecting Precedents, and Choosing Diking over Dredging

If we looked no further than the preface of Yao's book, we would conclude that he stood with his official predecessors. As if simply reiterating Qiu Jun's point, Yao denounced Jia, stating that his strategy "missed the core principles" and was "fabricated"—the same language Qiu had used (Yao Wenhao 1984, *fan li* 2, *ti* 1).

⁸ The text of Jin's essay can be found in several books, but none of them provides a complete version. After reading all of them, I have decided to rely on the version in Gu Yanwu's book as the basis to judge the way in which Yao edited Jin Zao's text. See Gu Yanwu 1997, *yan bian* 4:25b–31a; Yao Wenhao 1984, 111–115.

But when we look at the entire book, considering how he edited and recorded the documents in his book, we are bound to reach the opposite conclusion.

Most of the documents included in Yao's book were memorials—from the Song, Yuan, and Ming dynasties. Nevertheless, this was more than just a compilation of texts. As Shao Bao (1460–1527) noted in his preface to another work by Yao on hydrology, even though “the sages’ accomplishments and the worthies’ teachings had all been labeled successes,” the differences between the past and the present, between locations, and between geographical features made blindly applying old techniques to the current situation impossible (Shao Bao 1983, *qian ji* 13:8b). Judgments were necessary. And making judgments on the basis of precedent was exactly what Yao did in his book. He told his readers: “This book has forty-seven documents. [I] had reasons to record them and had reasons to edit them. It was not randomly done” (Yao Wenhao 1984, *fan li* 2).

Yao adopted four principles in editing his book. Two of them are most pertinent to this paper: (1) reliability of perspective: a work based on a correct view would be included, while a work based on an incorrect view would not; and (2) selective inclusion: only correct opinions in a work would be included (*fan li* 1). He endorsed these principles with several concrete examples. If one compares the original form of a text he cited with the version that appeared in his book, it becomes apparent that Yao modified these texts to suit his own opinions about whether to dike or dredge.

To shape his presentation of how to prioritize, Yao intervened heavily in Jia Dan's memorials. After he had said that Jia's ideas had to be completely ignored, Yao conceded that Jia had two good points, which he had “succinctly preserved” in two documents (*ti* 1, *fan li* 1, 2). One of the documents in which Yao Wenhao inserted Jia Dan's statement was a Yuan document, “Notes on the Management of Rivers and Lakes by the Directorate of Waterways and Fields” (*Dushuiyongtiansi ji jiang hu shuili*), which contained Jia's analysis of the obstruction of the Wusong River (72–73). Jia's point was plain: the Long Bridge was the main problem. While this sounded similar to the third action that Shan urged officials to take, Jia's analysis of the problem was different. In Shan's view, the Long Bridge itself was the problem. The solution would be to tear it down and build a new 1,000-span bridge (Shan E 1983, 17a). In Jia's view, the Long Bridge was indeed a problem, but three factors worsened the situation: (1) people's throwing more stones into the river to make the bridge wider and more convenient for travelers, (2) soldiers' placing abatises between abutments to block the entry of enemies, and (3) fishermen's setting bamboo fish traps around the abutments. Rather than building a new bridge, Jia recommended prohibiting these practices (Yao Wenhao 1984, 72–73). Yao preserved Jia's view in this Yuan “Notes,” and he also included Shan E's view in a different section (11). His inclusion of both revealed his stance: Jia's solution was just as valid as Shan's. This equal validity was not as simple as it might seem, because to replace the Long Bridge with a new bridge had a rather high priority in Shan's “dredging” strategy—the third action in nine actions he recommended. Giving Jia an equal position to comment on the issue of the Long Bridge undermined Shan's authority.

The second document Yao chose to preserve Jia Dan's view was written by Zhu Changwen (1041–1100), a native of Wu County 吳縣, Suzhou. One of the chapters of Zhu's three-juan book, *Sequel to the Illustrated Records of the Wu Area* (*Wujun tu jing xu ji*), recounted several major Song water projects and cited Jia on different

methods for the management of highland and lowland fields. Zhu accurately conveyed Jia's policies (Zhu Changwen 1999, *xia* 4b–5a; Zhang Neiyun & Zhou Dashao 1983, 8:12b–13a). But Yao interpolated into Zhu's text a crucial statement by Jia: "Managing the fields was the top priority, and draining water was a low priority" (Yao Wenhao 1984, 22).

This quotation is significant for two reasons: (1) this statement was indeed vital to Jia's strategy, because it was the point where Jia-Wang and Shan-Su departed from each other. (2) Since the statement actually did not occur in Zhu's original text, Yao's decision to insert it here reveals a commitment to Jia's core idea. He even sweetened Jia's forecast. Jia was convinced that his plan would take 5 years to tame Suzhou's hydrological problems (Zhang Neiyun and Zhou Dashao 1983, 8:21b). Yao was even more confident: he had Jia saying, "It can be expected that within three years all fields in Suzhou will be safe" (Yao Wenhao 1984, 22). Yao was making a strong point: by managing dikes, ditches, and minor channels, most of Jiangnan's problems would be solved. As for major waterways, while not unimportant, they were not so critical. Thus, Yao's editorial efforts amounted to an implicit yet unmistakably firm attack on Shan's analysis.

Yao Wenhao's denunciation of Shan E is further evident in how Yao edited Shan's text. He systematically omitted Shan's discussions regarding how to prioritize work on water projects. For instance, Shan maintained that to dredge the Wusong River and to build a new bridge in place of the Long Bridge were "works of the top priority" (Shan E 1983, 12a–12b). However, this phrase did not appear in Yao's book. In addition, the entire passage in which Shan criticized Jia's diking strategy was not included (10b).

Regarding the building of polder dikes, Yao included the "high and thick" principle advocated by Ren Renfa 任仁發 (1254–1327), also emphasized by Jia (Yao Wenhao 1984, 62).⁹ He developed his own "five standards of polder dikes" (Zhang Guowei 1983, 15:12a–12b), the first attempt to provide a clear set of metrics for polders since the early fourteenth century (Yao Wenhao 1984, 81). Yao's suggestion diverged from the Yuan model in three significant ways. First, Yao preferred thicker dikes. For instance, when a polder was the same elevation as the surface of the water on the other side of the dike, he wanted the widths of the dikes to be 1.4 *zhang* 丈 (1 *zhang* ≈ 3 m) at the bottom and 0.7 *zhang* at the top, whereas the previous standards only required 1 *zhang* at the bottom and 0.5 *zhang* at the top. Second, Yao recommended higher dikes. While the previous standards considered a dike built 7.5 *chi* 尺 (1 *chi* ≈ 30 cm) above the surface of the water as sufficient, Yao stipulated that all dikes be built 8 *chi* above the water level.¹⁰ Third, the previous standards did not deal with lands that were lower than the surface of the diked water, but Yao established a standard for such dikes. All three differences

⁹ Ren Renfa was the vice supervisor of the Directorate of Waterways in the early fourteenth century. Jia Dan's emphasis on "high and thick" polder dikes appears everywhere in his essays. For instance, he said the purpose of dredging waterways deep and wide was to get as much earth as possible to build "high and thick" polder dikes. See Zhang Neiyun and Zhou Dashao 1983, 8:16b.

¹⁰ For the conversion of the Ming measures to modern equivalents, see Wu Luo 1981, 66, and Qiu Guangming 1992, 104–105. For the conversion of the Song volumes to modern equivalents, see Qiu Guangming 1992, 263.

show that Yao followed Jia Dan's recommendation that dikes be built thick and tall (Shi Jian 1983, 6:10a–10b).

In siding with the Jia-Wang diking strategy, Yao also stood by the opinions of local hydrology specialists. His stance on prioritization was crucial not only because it differed from that of his predecessors, who supported the Shan-Su dredging strategy, but also because, as will be discussed below, his decision pointed to an approach to hydrological management that was diametrically opposed to that which had been adopted by his fellow officials.

3 Choosing between Two Strategies: Crisis Response versus Regular Maintenance

As evidenced by how he presented the arguments of previous hydrology specialists on prioritization, Yao Wenhao clearly favored Jia Dan and Wang Anshi's diking strategy. In doing so, he endorsed the position of local specialists. Yao's receptiveness to their ideas can also be seen in his intention to formalize communication between those specialists and local officials. Even though Yao himself was recognized as an experienced official in hydrological management, he did not rely solely on his own experience and authority. One of the six recommendations in his 1496 memorial was to "hold meetings to discuss hydrological matters." In his view, all seven of the prefectural agricultural officials and four to five local hydrology specialists should be invited to attend. They would arrive in the early winter and stay in Suzhou for one month to "deliberate the benefits and concerns" and "formulate outlines for construction projects." The rationale for this annual meeting, as Yao explained, was to familiarize officials, who "were from outside prefectures," with the local situation (Li Dongyang et al. 1966, 115:4a). Clearly Yao hoped to give local specialists a more important role in decision-making. Because knowledge of waterworks was not a prerequisite for being appointed as an agricultural official, the technical input and hydrological information that local specialists provided at such meetings would become crucial for policy formulation. Although his proposal was rejected by the Ming government, and no such meetings ever took place, it is clear that Yao still actively sought the advice of local men with special understanding of how best to maintain waterways (Li Dongyang et al. 1966, 115:4b; Shi Jian 1983, 5:29a).

Given Yao's inclination to embrace the views of such locals, we might wonder why he was interested in a memorial with a very different message. Xia Yuanji 夏原吉 (1366–1430), minister of revenue in the early fifteenth century, recounted his own experiences in a document entitled "A Complete Account of Xia's Hydrological Management" (Xia zhongjing gong zhi shui shi mo). Xia had taken on the dredging of the Wusong River and of several other major waterways. Only after the flood waters were completely drained did he attend to polder dikes (Yao Wenhao 1984, 91–93). The inclusion of this memorial in Yao's book suggests, at first glance, that he was open to adopting the dredging strategy. Upon closer examination, however, we must conclude that Xia was selected to represent a convention that local specialists opposed and Yao would not follow. This was an example of the crisis response approach, whereas Yao and local specialists preferred regular maintenance.

Xia Yuanji had arrived in Jiangnan in 1403, soon after a series of devastating floods (Yao Wenhao 1984, 91; Yang Shiqi et al. 1966, 19: 2a, 21:1b, 22:1a–2a, 27:1a; Tsai Taibin 2002). Xia's appointment was hence made in response to an emergency situation that required problem-oriented actions. Under these circumstances, Xia decided that to prevent further flooding it would be necessary to “dredge the Wusong River and some major channels, make sure that all the silt is removed, and convey the floodwaters to the sea” (Yao Wenhao 1984, 91). Xia's practice was followed by most of the officials assigned to Jiangnan. For instance, in the mid-fifteenth century, floods occurred in 1454, 1456, 1457, and 1459. The first was severe and described as a deluge (Shen Qi 1996, 2:16b–17a; Zhang Guowei 1983, 8:14a–14b). Qian Pu 錢溥 (1408–1488) and Fan Chun 范純 (fl. 1450s–1470s), both natives of Songjiang Prefecture, blamed constant flooding on the century-old obstruction of the Wusong River. When Grand Coordinator Cui Gong 崔恭 (1409–1479) undertook a remedial project in 1459, he ordered that a new course for the river be dug, since it was considered too silted up to dredge (Zhang Guowei 1983, 25:4b, 5b). In 1465, 1466, 1467, 1469 and 1471, floods again damaged this area. (Shen Qi 1996, 2:17a; Zhang Guowei 1983, 8:14b–15a) Assistant Surveillance Commissioner Wu Bin 吳珮 (fl. 1450s–1470s) was assigned to tackle the problem in 1471. He pointed out that the Wusong River “had been shallow and silted for a long while and needed to be dredged” (Zhang Guowei 1983, 15:15a). He thereupon launched a grand dredging effort focusing exclusively on the Wusong (15:17a–20a).

Before Xu Guan arrived, floods in Jiangnan took lives and destroyed property every year from 1491 to 1494 (Shen Qi 1996, 2:17b–18a; Zhang Guowei 1983, 8:16a). Under Xu's administration, the Wusong and several other major channels were dredged for flood abatement (Zhang Guowei 1983, 14:8a–9b). All of these projects were implemented as a consequence of severe flooding; thereby they were not designed as sustainable, regular undertakings, but as one-time actions. In addition, their focus was, in general, major waterways. It can thus be concluded that before Yao Wenhao took charge, governmental water projects embraced a crisis response approach and developed a practice in which ad hoc actions became a well-established convention.

In 1496, Yao submitted a memorial proposing a very different approach: “In previous dynasties, there were squads of civilian or military dredgers. They were exclusively responsible for regularly dredging waterways. Nowadays, people are episodically mobilized from communities and tithings, but the mobilization have no fixed guidelines [...]. I propose that all prefectures create a corps of dredger men modeled on the canal men of the north side of the Yangzi River and on the sea embankment men of western Zhejiang. *Every year* a number [of people] will be mobilized in orderly fashion, as part of the equal corvée, to get the work done” (Li Dongyang et al. 1966, 115:3a; emphasis mine).¹¹ This passage reveals that Yao blamed the irregular nature of the previous repair work for the precarious situation. To fix the problem, the state would have to ensure that dredging took place annually.

This approach resembled Jin Zao's, whose suggestions were quoted by Yao in his book: “The solution is to mobilize one worker per tithing [i.e., group of ten households].” This worker came from one of the ten households and would be

¹¹ For a brief description of how the “squad of dredgers” worked, see Zheng Zhaojing 1987, 84–6.

organized with workers from other tithings to “dredge waterways in spring, summer, and fall; they will rest in the winter. The other nine households of the same tithing will be divided into nine units. Each household will pay the worker [drawn from its tithing] 360 *wen* 文 of copper coins per month over the year” (Yao Wenhao 1984, 112). Asked if this maintenance had to be regular, Jin responded that building polder dikes and dredging ditches should be as regular as “the rotation of four seasons,” because these actions were like “drinking and eating, [things] that people cannot live without” (117). By incorporating Jin’s emphasis on regularity into his own memorial, Yao once again supported local hydrological specialists and rejected his official predecessors. This also demonstrated that the “diking” strategy was used in Yao’s time to imply regular maintenance as opposed to “dredging” strategy which entailed responsive management. Given that Yao was assigned simply to finish what Xu Guan had started, Yao’s stance was noteworthy for its significant implication that he not only deviated from the official convention, but also redefined proper hydrological management in terms of regular practice.

4 Getting the State in an Active Role: Rearrangements of Practice for Regular Management

At the heart of the local hydrological advice on regular management was a push for a more active state role. The local specialists held that the existing mechanisms had failed and that local self-regulating systems could not solve the problem. In addition, local specialists recommended improving three aspects of existing practice: institutional coordination, funding, and mobilization of labor. By offering suggestions for necessary adjustments, they gave the state path to follow in order to engage in hydrological matters more easily.

Considering Jiangnan’s lamentable hydrological condition, Jin Zao noted that when people were mobilized to repair dikes “the influential never did the work, and the weak never got a chance to rest” (Gu Yanwu 1997, 4:27a). He was convinced that if the government did not alter the way people were conscripted, the situation would become worse. Shi Jian identified three causes of regular flooding: the poor could not afford pedal pumps, the wealthy were not willing to bear the cost, and agricultural officials were unable to manage their jurisdiction. His advice was to have the top officials at the prefectural and county levels direct flood abatement (Shi Jian 1983, 6:13a–14b).¹² These observations suggest that the local specialists believed that the wealthy and influential people would refuse to shoulder their duty without a stronger government presence. In other words, active government involvement was indispensable to the long-term management of hydrological matters.

4.1 Institutional Coordination: A Dedicated or Concurrent Appointment

The redefinition of proper hydrological management as a regular practice inevitably led to a rethinking of how hydrology officials were appointed. In his memorial of

¹² Another example can be seen in Zhang Kan’s 張衍 comment. See Anon. 1996, 9b–12a.

1496, Yao pointed out that the concurrent nature of hydrological appointments was problematic. He maintained that concurrent appointment, which required agricultural officials to serve in many capacities made them too busy to regularly review hydrological conditions as often as was needed.¹³ So he proposed that agricultural officials be responsible exclusively for hydrological matters (Zhang Guowei 1983, 14:13a–13b; Li Dongyang et al. 1966, 115:4a–4b).

Beyond the prefectural level, his book reiterated a point reflected in several precedents and essays in the Song, Yuan, and Ming dynasties: the importance of appointing high-ranking officials as the regional authority dedicated to hydrological matters. Ren Renfa's argument on the advantage of specially appointing high-ranking hydrological officials, for example, was included in Yao's book. Ren attributed the success of Song dynasty water management to such appointments, saying that specially delegated high-ranking officials were hard to deceive and bribe (Yao Wenhao 1984, 61).¹⁴ Hence, Yao's concern was to ensure that the appointments from county to regional levels were all exclusively dedicated to hydrological management.

Yao Wenhao's emphasis on the significance of special, exclusive, and focused appointment echoed the thinking of local hydrological specialists. Both Shi Jian and Jin Zao had discussed the necessity of appointing *zhuan guan* 專官, meaning "officials with special, exclusive, and focused duties." Shi reckoned unsatisfactory the entrusting of the hydrological management of Jiangnan to a Zhejiang 浙江 assistant surveillance commissioner. In a letter to Supervising Secretary Chen Qiong 陳璠 (1440–1506), Shi criticized Wu Xing 伍性 (no dates), who had recently held the post. Since Wu was stationed in Hangzhou, far away from Huzhou, Suzhou, and Songjiang—the lowest and most vulnerable prefectures in Jiangnan—he hardly went on regular fact-finding trip to the areas afflicted by the worst flooding. Such officials would never fully comprehend how much people were suffering. There was a fundamental institutional problem: the concurrent appointment of the Zhejiang assistant surveillance commissioner. Shi recommended selecting an official with a certain amount of experience—a director of a ministry bureau, for instance—and having him bring his family to live in Suzhou. The director could thus easily inquire into current conditions and take action when necessary (Shi Jian 1983, 5:21a–23b).

Shi Jian also noted a similar problem at lower institutional levels. At the community level, the purpose of "making special appointment" was to simplify the supervision system, concentrating power and responsibility in the hands of tax captains and dike administrators.¹⁵ The potential improvements were clear: tax captains would concentrate on agricultural matters, including hydrological management; and officials could demand that tax captains and polder captains focus exclusively on water management. At the county and prefectural levels, agricultural officials would "regularly patrol their designated areas," and magistrates and prefects would review their work on a regular basis (Shi Jian 1983, 6:13b–14b).

Putting all of Shi's ideas about *zhuan guan* together, the picture would be as follows: at the regional and community levels, there would be officials and local

¹³ For detailed discussion of agricultural officials in the Ming, see Morita Akira 1971.

¹⁴ For other examples, see Yao Wenhao 1984, 29, 61, 63, 74, 77, 111.

¹⁵ For detailed discussion of issues related to dike administrators, see Elvin 1977, 449–57; Hoshi Ayao 1963, 496–7; Lin Jinshu 1986; Morita Akira 1974, 452–3.

supervisors whose duties had limited scope; and the changes at the top and bottom of the supervision system would provide agricultural officials with support from both above and below. In Shi's view, these institutional reforms would finally bring about regular management.

Another local specialist, Jin Zao, agreed with most of Shi Jian's argument. The purpose of his advice on institutional reform was similar to that of Shi's: to build a multi-layered, clearly defined, and well-connected executive and supervisory institution in order to carry out regular management (Gu Yanwu 1997, 4:25b–26b).¹⁶

On institutional coordination and the appointment of officials, Yao agreed broadly with Shi and Jin. There was, however, one subtle yet critical difference: while Jin proposed a system in which civil and censorial authorities would work in tandem, Yao inclined to prefer a purely civil administrative system. The difference in their views can be seen by comparing Jin's original essay and the version that appears in Yao's book:

[Jin's original text:] The specially appointed high-ranking official will be responsible for controlling seven prefectures and evaluating [officials'] hydrological projects to determine promotions and demotions. The assistant surveillance commissioner will assist his superiors, oversee his subordinates, and coordinate his colleagues to bring about good results. The regional inspector will target those who are negligent. The high-ranking censor-in-chief will play the role of mediator so as to smooth out the process. (Gu Yanwu 1997, 4:26b)

[Yao's edited version:] The specially appointed high-ranking official will be responsible for controlling seven prefectures and evaluating [officials'] hydrological projects to determine promotions and demotions. The high-ranking official's aides will assist their superiors and oversee their subordinates. The grand coordinator will play the role of mediator so as to smooth over the process. The regional inspector will bring those who are negligent to punishment. (Yao Wenhao 1984, 112)

The comparison shows how Yao drastically weakened the role of censorial authorities. The only censorial official who remained in Yao's version was the regional inspector, a figure whose rank (7a) was significantly lower than that of a censor-in-chief (2a).

By editing Jin's text, Yao suggested an institutional reform that would have increased the power of the specially appointed high-ranking official. This idea had a recent precedent: in an edict issued in 1494, the emperor granted Xu Guan sole authority, the power to do as he saw fit, recruit whoever he wanted, and punish anyone "at his discretion" (Zhang Guowei 1983, 12:4a–5a). The resemblances between Yao's view of the place of the specially appointed high-ranking official and the privileged status Xu Guan enjoyed indicated that in Yao's judgment institutional simplification and full authorization of the special official were crucial to the

¹⁶ Jin Zao and Shi Jian shared dissatisfaction with disorderly local hydrological institutions. Both used the metaphor "ten sheep with nine shepherds" to describe the confusing situation of the community supervision system in their time. See Shi Jian 1983, 6:14a, and Yao Wenhao 1984, 118. For more discussions of this chaotic system, see Oyama Masaaki 1992; Li 2007, 67–76, 105–115.

efficient and effective fulfillment of the goal to which he and local hydrological specialists aspired.

Even though Yao disagreed with Shi Jian and Jin Zao on the details of institutional coordination, none believed that the existing system, where Zhejiang assistant surveillance commissioner was in charge, could work. They were also united in their conviction that the hydrological officials had to be specially appointed. Concurrent appointments, which had become established convention by their time, were not an option. In short, all of their proposals were designed to remove institutional obstacles impeding the implementation of regular management.

4.2 Stabilization of Funds for Regular Management

Another area where Yao and local specialists opposed conventional practice concerned finance. They agreed with Yao's predecessors that those who dredged and diked should be paid (rather than enrolled via *corvée*), but they insisted on separating funds for famine relief from funds for water projects, on transferring responsibility to local people, and on having a regular income stream.

The first document that appears in *A Collection of Documents about Zhexi Hydrology* is a memorial written by Fan Zhongyan 范仲淹 (989–1052) in the mid-1030s: “In bountiful years, ten thousand people will be mobilized in the spring. They will be paid three *sheng* 升 (1 *sheng* ≈ 585 milliliters) of grain per day, will work for a month, and will get the work done. It will cost the government nine thousand *shi* 石 (1 *shi* = 100 *sheng*) of grain. In times of famine, people will be mobilized to work for relief and paid five *sheng* of grain per day. They will work for a month and then the work will be done. The cost will be only fifteen thousand *shi* of grain” (Yao Wenhao 1984, 2). Fan thus envisioned regular management regardless of whether the harvest was good or bad. The difference lay only in the amount of grain that people would receive from the government. The proposal was adopted; however, later projects during the Song dynasty departed from Fan's guidelines. Although the government still provided financial support, most projects were funded as “work for relief” (Yao Wenhao 1984, 27, 42). In other words, “work for relief” became a means to fund irregular, episodic projects. Fan's original idea of uninterrupted, regular maintenance was lost. Neither of Yao's two predecessors, Cui Gong and Xu Guan, revived it (Zhang Guowei 1983, 25:6a; Li Dongyang et al. 1966, 92:7a).

Even though this combination of famine relief and hydrological management in the use of governmental resources was periodically challenged by officials, these officials were still convinced that the state was responsible for drawing up the budget to pay the workers (Li Dongyang et al. 1966, 99:1a–2b, esp. 2a; Zhang Guowei 1983, 15:16a–16b). This practice, in which the crisis response approach was usually adopted, generated a problem: the funding was unstable. This problem had been identified as early as 1116. As Zhao Lin (fl. late twelfth century) pointed out, when funds were needed to pay the laborers for dredging a number of major waterways, grain was set aside from the treasury of Yue Prefecture and cash was collected from several other nearby prefectures. If these sources could not provide enough, other sources would be requisitioned (Yao Wenhao 1984, 28). By the time of Wu Bin and Xu Guan, things had not changed much (Zhang guowei 1983, 15:15b–16b, 27a–27b; Xu Xueju 1997, 191:9b). Given that officials took an irregular approach to

water management, there were no set rules regarding funding, and it was inevitable that they would be forced to move money and grain around within the government on an ad hoc basis.

Obviously, both Jin Zao and Yao Wenhao thought the situation intolerable. Arguing from the perspective of regular management, Yao implored the emperor to “allow the grain stored in the Assisting Agriculture Granary” to be used to pay dredger men (Zhang Guowei 1983, 14:12a–12b). The proposal had two significant points. First, while the Assisting Agriculture Granary was established by Zhou Chen 周忱 (1381–1453) mainly for famine relief, Yao made no effort to connect his request to famine.¹⁷ On the contrary, Yao maintained that the stored grain should be used for famine relief only when “the grain had not been used up [for other purposes]” (Zhang Guowei 1983, 14:12a). In making this argument, he was inching towards the separation of hydrological maintenance from famine relief. Second, by suggesting that the grain be used for dredger men’s wages, he was hoping to ensure that the financial resources for regular, not responsive, management become reliable. In this sense, Yao was closer to Fan Zhongyan than to his Ming predecessors.

However, the Ministry of Works declined to accept Yao’s proposal (Shao Bao 1983, *bie ji* 7:15a; Li Dongyang et al. 1966, 115:4b). He soon submitted another memorial—by changing the category of the dredging labor service from the “miscellaneous corvée” to “equal corvée” (Li Dongyang et al. 1966, 115:3a). Through this proposal, Yao was trying to take advantage of a new development in the corvée system, which had started in 1443 in Jiangxi under the name of “equal corvée,” and was put into practice in other areas in the second half of the fifteenth century. The category of “equal corvée” was gradually expanded, as more and more types of “miscellaneous corvée” were incorporated within it. One of the major differences between these two categories lay in the fact that “equal corvée” demanded people’s labor service by set rules and on a regular basis, whereas “miscellaneous corvée” decided who and how one had to contribute prior to the launching of episodic projects.

Another reform to the state-mandated labor contribution appealed to Yao. Beginning in the late 1430s, more and more types of corvée had been waived in exchange for a payment in silver.¹⁸ His placement of the dredging of major waterways into “equal corvée” category thus made it legitimate for the state to regularly collect annual dues from the people. Yao stipulated the categorical change after his proposal had been approved in 1497. Yang Xunji 楊循吉 (1456–1544) offered an account of how the process worked: “Under equal corvée, each and every community of Suzhou, Songjiang, Changzhou, and Zhejiang Prefectures has to provide one worker every year. [...] Each worker is converted into six taels of silver [collected from the community]. [The collected silver] is to be used by the water authority at its discretion. [The authority] will hire people from nearby localities to

¹⁷ On Zhou’s granary system, see Shimizu Taiji 1922; Hoshi Ayao 1959; Hoshi Ayao 1985; Hong Pu 1997; Wu Tao 1998.

¹⁸ For detailed research on this topic, see Liang Fangzhong 1989; Yamane Yukio 1966; Iwami Hiroshi 1986; Tang Wenji 1991. Liang and Tang offered a succinct comparison between the old “miscellaneous corvée” and the new “equal corvée,” looking carefully at the state’s role and the significance of rotation. See Liang Fangzhong 1989, 594–5, and Tang Wenji 1991, 254–6. Iwami pointed out that in the initial period, the allocation of equal corvée had not been firmly tied to household levels. See Iwami Hiroshi 1986, 236–7; Huang 1974, 109–118.

dredge waterways” (Zhang Guowei 1983, 18:48b–49a).¹⁹ With this change, Yao’s idea of a regular flow of funds to finance annual maintenance work became a reality.

Two documents in Yao’s book indicate how he may have shaped his approach to using corvée funds for water projects. The first is Yang Xunji’s account of Xu Guan’s achievements; Yang described Xu’s method for collecting laborers, calling on each tithing to provide three workers or a cash payment; the government paid each worker one *shi* of rice daily (Yao Wenhao 1984, 107). The second document was Jin Zao’s recommendation: “Every year each tithing will have to provide one worker. The nine households [in each tithing that did not give up a worker] had to pay the worker 360 *wen* as compensation each year. [...The work was to be done] from the second to the tenth lunar month, for a total of nine months. Month by month, [the worker] would receive the money from one of the nine households with a certificate [which is issued by the government to assure his right to the compensation]. In this manner, the wealthy and the poor would be fairly treated, and there would be no infringement and encroachment” (Gu Yanwu 1997, 4:27a).²⁰

For both Jin and Xu, labor service could not be forgiven. One had to either pay a fee to avoid service or fulfill the service in person. The difference between Xu’s method and Jin’s idea lay in their purpose. Xu’s method was designed for his one-time project; therefore, he did not try to regularize the process. Jin’s idea was to promote regular management, and so he formed a constantly applicable measure.

Xu’s and Jin’s approaches pointed in a direction where the state shifted its financial burden in hydrological management to the people even as it continued to recruit the people to dredge major waterways. In an increasingly monetized realm, Yao made three decisions on the use of “dredger man funds.” The first was to reduce fees. According to Jin, a worker was normally to receive 5 taels of silver annually (Gu Yanwu 1997, 4:27b). Since the money came from a tithing, a community of ten tithings would have provided 50 taels. In Yao’s plan, a community would have to pay only 6 taels a year—in terms of copper coins, the amount would be 3,888 *wen*, or 388.8 *wen* per tithing. If he had followed Jin’s advice and evenly divided the fees among the nine households who did not contribute labor, each household would have paid the worker 43.2 *wen* in any given year. As Jin, a native of Songjiang prefecture, had emphasized, demanding 360 *wen* per year was comparable to demanding as little as “one *wen* a day.” Now the fees were reduced to about one-eighth of that amount. This reduction would make collecting fees much easier.

¹⁹ It should be noted that, according to the *Changshu Gazetteer*, the dredging was “conducted annually.” See Sang Yu 1996, 3:105a. The word “community” in this passage is *li* 里. A *li* was composed of 110 households that shared a collective responsibility for the labor service assigned by the state. For the *li*, ten wealthy households of a community were chosen to serve as the heads. Each year, one of the ten wealthy households would lead ten ordinary households to fulfill the assigned responsibility. Every ten ordinary households constituted a tithing, *jia* 甲. In this community-tithing system, each household would be called upon for labor service once every 10 years.

²⁰ The conversion rate between copper coins and silver in Jin’s time can be computed based on the information in this passage and others that follow. Jin said that each worker would receive 5 taels of silver a year. See Gu Yanwu 1997, 4:27b. Because each of the nine households, which did not provide labor service, in a tithing had to pay the worker from their tithing 360 *wen* of copper coin, the worker would obtain 3240 *wen* a year. Thus, 3240 *wen* equaled 5 taels; that is, a tael of silver equaled 648 *wen* of copper coin.

Yao's second decision was to establish a daily wage for workers. This was an innovation for dredgers and dikers—even Xu Guan's method, which clearly regulated people's financial and labor responsibilities, did not address it. Yao fixed the wage at 14 *wen* per day (Sang Yu 1996, 3:105a). An important consequence was that, given fixed available funds and an established daily wage, the amount of the annual budget was predetermined. These calculations set limits on the number of dredging projects that the hydrological authority could launch and required it to adjust construction times and the number of workers to meet its goals.

Yao's third decision concerned the distribution of funds. Again we can look to his treatment of others' texts to glean insights. For example, he omitted one crucial sentence in an essay by Jin Zao: "Month by month, [the worker] would receive the money from one of the nine households with a certificate."²¹ Jin proposed a direct payment to the worker from each tithing. There was no collecting–distributing mechanism operated by the government between the payers and the payees. He recommended that the state issue a token to workers that would guarantee them payment when presented to the responsible household (Gu Yanwu. 1997, 4:27a–27b). By contrast, Yao stipulated that the money be collected, stored, and dispensed by the government; officials with direct control over the money could manage it "at their discretion" (Zhang Guowei 1983, 18:49a).

The foregoing discussion reveals that Yao Wenhao and Jin Zao both untangled the financial knots linking water projects to famine relief. By transferring the financial burden to the people and creating mechanisms that extracted it in a regular manner, they assured themselves a predictable budget for routine maintenance. Furthermore, by reducing fees and rationalizing the labor costs for construction projects, Yao was able to increase the state's role even beyond the local specialists' expectations without overburdening the people.

4.3 Mobilization of Labor: One Old Method and Two New Methods

Despite the obvious differences in institutional coordination and fundraising between the regular maintenance and crisis–response approaches, both relied on the same, old mechanism—the community-tithing system—to mobilize workers. However, as the wealthy and influential had managed to dodge their local community responsibilities, which caused the decline of the community-tithing system in the fifteenth century, some local specialists and local officials proposed two new methods to restore effectiveness and fairness into the system of mobilizing labor. Landholding would play a more important role in these two methods.

For some time, though sporadically, land ownership had been used as a gauge for assessing corvée labor duty. For instance, Shen Qi (b. 1491) noted that by the late 1480s, when pedal pumps were used to drain flood water, the number of workers that a household needed to provide was determined by the area of its land (Shen Qi 1996, 2:26a). Several local officials experimented with this mechanism in the latter part of the fifteenth century. Lan Yu 蘭玉, the magistrate for Changshu 常熟, supervised the construction of an embankment in 1474 and "apportioned corvée

²¹ The omitted sentence is 逐月對戶以票支領. For the omission, see Yao 1984, 112.

responsibility according to the area of the land one owned” (Zhang Guowei 1983, 25:10a). In 1489, Suzhou Assistant Prefect Zhang Min 張旻 (no dates) needed to dredge the Yantie Channel 鹽鐵塘, so he ordered that “the area [of people’s fields] and [the length of] the channel be calculated” to decide the amount of one’s responsibility (10:34a). In a similar manner, another Suzhou assistant prefect, Ying Neng 應能 (no dates), took Lan’s and Zhang’s methods a bit further in the early 1490s: “The needed workers were to be mobilized from the households of landowners during the slack time. For every one hundred *mou* 畝 of land that they owned, they had to repair three *zhang* of dikes and embankments. The same rule applied to dredging waterways” (14:4a). This was the first appearance of a specific conversion rate for the quantity of one’s land in relation to one’s labor responsibility in hydrological discourse. Never put into practice, Ying’s view was still an alternative available for Jin’s consideration, especially because Ying’s advice was aimed at regular management.

Jin was well aware of the notion of “apportionment of responsibility according to landholding,” though he did not think it would work. He had a different idea, which has been termed “the head-land institution” by modern scholars.²² Those whose land lay adjacent to channels would have to maintain the dikes, the volume of labor commensurate with the length of the dike that ran along one’s property. In other words, each section would be the sole responsibility of the landowner whose lands were immediately adjacent to it. Someone asked why not simply allot responsibility according to the area of the land one owned in a polder. Jin provided two reasons. First, he adopted a different perspective on the issue of fairness. In his description, the location of one’s lands in a polder indicated one’s social status. The lands directly adjacent to the dike, which had the most convenient access to water and to the material resources conveyed on the watercourse, usually belonged to the wealthy. The lands of the poor were usually located in the center of the polder, which made the procurement of water and other resources more difficult. If officials demanded that people contribute according to landholdings, the wealthy would benefit disproportionately, whereas his method would circumvent this problem. Second, he emphasized the effectiveness of his method. Whenever responsibility was allocated according to the quantity of one’s lands, officials encountered great trouble when they tried to hold individuals responsible for decrepit polder dikes. Combining the best mechanisms for fairness and effectiveness, he insisted that the “head-land institution” was better than “apportionment of responsibility according to landholding” (Yao Wenhao 1984, 118–19).

²² For a detailed discussion of this “head-land institution,” see Hamashima Atsutoshi 1982, esp. 57–106. Hamashima later argued that the head land institution was especially suitable to the time when this area was not yet fully developed. See Hamashima Atsutoshi 1989, esp. 117–121. I thank Hamashima for his generosity in showing me the paper. Even though Kawakatsu Mamoru (1980, 125–153) disagreed with Hamashima on several important points, they agreed that hydrological management functioned very well in community in the early Ming. Xia Weizhong has expressed reservations regarding Hamashima’s explanation. See Fan Jinmin and Xia Weizhong 1993, 139–142. I tend to consider that the head-land institution was an institution proposed by several Songjiang natives in the 1490s rather than an institution existing since the early Ming. No matter what the case may have been, for the purpose of this paper, what is crucial is that Jin brought it up in the hope of eliminating all the inherent problems with existing practices.

Yao Wenhao's reactions to Jin Zao's "head-land institution" were complicated. On the one hand, he readily acknowledged the advantages it offered. On the other hand, he was not convinced that it could completely solve the labor problem. After an investigation, he found that the lands adjacent to the polder dikes were not always owned by wealthy families. Some belonged to poor families, and some belonged to the families that "had fled or had died out." Since such polder dikes could not be maintained solely by the owners of "head lands," Yao stipulated that all landowners in a polder had to contribute to their maintenance. And, as if hoping to cover some situations to which even his revised "head-land institution" might not apply, he was open to "apportionment of responsibility according to landholding" (Zhang Guowei 1983, 15:23a–23b).

As for dredging, the accounts of two of the projects launched by Yao Wenhao in 1497, the first year in which dredging fees were institutionalized, offer a glimpse into how Yao's ideas were put into practice. Wu Rui 吳瑞 (fl. late fifteenth century) wrote an account of the dredging of the Zhihe Channel 至和塘, and Yao himself described the dredging of the Qipu Channel 七浦塘. Yao said workers were hired after the fees had been collected, and Wu noted that workers' wages came from the funds left over from the Qipu project—clearly, both projects were financed by the dredging funds. The Table 1 below shows the essentials of the two projects.

It may be helpful to use the case of Kunshan to evaluate the people's physical burden in these projects. To dredge the Zhihe Channel, 11 workers were recruited from each community, while for the Qipu the number was 17. The total number of mobilized workers, 28, is close to the maximal number of workers that each community provided per year for previous hydrological projects.²³ It is fewer than what Xu's method required (30 workers per community) but more than what Jin recommended (ten workers per community).

Apparently, Yao's institutional reforms did not aim at reducing people's labor service. However, the true difference between Yao and Jin involved choice. While Jin proposed that the workers dredge channels for 9 months/year, Yao only hired them for 39 days. In Yao's plan, the workers would be able to carry out their usual farming work, but in Jin's plan they would be forced to dedicate far more labor—or at least time—to the dredging work.²⁴ In other words, the larger number of workers was a result of the shortened period of work, which would enable them to lead their normal lives. Furthermore, because Yao's plan required people to work for a much shorter period, he was able to significantly reduce the fees collected from the people. Since Yao's plan collected fewer fees and required less labor service from the people, his reform was one in which the state would play a more active role without financially or physically overburdening the people.

²³ Jin wrote, "In the past, twenty-five workers would be mobilized from each community." See Gu Yanwu 1997, 4:27a. The version in Yao's book gave a range of numbers: "Twenty to thirty workers would be mobilized from each community." See Yao Wenhao 1984, 112.

²⁴ In Jin's plan, the workers would be dredging channels from the second to tenth lunar month. See Gu Yanwu 1997, 4:27a. But the dredging of the Zhihe Channel was conducted in the twelfth lunar month, a slack month for famers.

Table 1 Yao Wenhao's two dredging projects in 1497

Project		Zhihe	Qipu
Duration (days)	A	24	15
Number of labor units (1 labor unit = 1 day of work by 1 person)	B	96,500	(244,680)
Responsible counties/ Number of communities	C	Kunshan ^a /351	Changshu and Kunshan ^b /939
Total cost (<i>wen</i>)		1,350,000	3,425,500 ^c
Avg. number of workers per day	D = B/A	4,021 ^d	16,312 ^e
Number of workers from each community	E = D/C	11	17

Based on information provided in Zhang Guowei 1983, 4:47b, 10:36a, 25:20a–22a, 22b–23b. Note that workers were paid 14 *wen* daily

^a Extant Kunshan gazetteers do not provide the exact number of communities, but it can be inferred from the following information. In 1497 the Ming state separated some communities from Kunshan, Changshu, and Jiading counties to establish Taicang subprefecture. See Qian Gu 1983, 10:1a–17a and Zhang Yin 1990, 1:3b–4b. Regarding the number of the communities in Kunshan County, Liu Shilong 劉士龍 and Lu Rong provided conflicting accounts—600 and 493, respectively. See Qian Gu 1983, 10:4a and Lu Rong 1501, 37:12a. I have decided to rely on Lu's figure, because his report was written right before 1497 and given credence by Grand Coordinator Zhu Xuan 朱瑄. According to Sang Yue's account, 142 communities were taken from Kunshan (Sang Yue 2003, 2:3b), meaning that Kunshan had 351 communities after the establishment of Taicang. Finally, since the dredging of the Zhihe Channel took place at the very end of 1497, the number of the Kunshan communities from which people were mobilized should have been 351.

^b The number of the Changshu communities is added up based on the information in Sang Yu 1996, 1:27b–34a. The total number of communities in the two counties was 939 (588+351=939).

^c The cost was 5,270 taels of silver. Zhang Guowei 1983, 25:23a. As discussed before, one tael of silver equaled 648 *wen*. I rounded it up to 650 *wen*.

^d 14 *wen* times 96,500 equals 1,351,000 *wen*, which was only 1,000 more than the recorded cost, the equivalent of 0.074%.

^e This number is computed in the following way: 3,425,500 *wen* ÷ (14 *wen*/worker-day × 15 days) ≈ 16,311.90 workers.

5 Conclusion

The new hydrological strategy crafted in the late fifteenth century emerged from the collaborative efforts of Yao Wenhao and local specialists. It would not have materialized if the local specialists had withheld their knowledge of the local situation, particularly regarding the burdens the people could bear. And it would not have materialized if Yao had not conducted his own research on historical precedents and local conditions before making his decisions. It was the intellectual and institutional aspects of the collaboration that strengthened Yao's critique of conventional practice and lent credence to the alternative he presented.

Although extant evidence does not shed light on how these local specialists obtained their knowledge, it is important to reiterate that their knowledge was highly respected by their fellow literati, including those with higher social status. This is important, because it shows that where hydrological management was concerned, it was knowledge rather than social status that decided whose ideas were worth

listening to. Furthermore, taking Jin Zao's "head-land institution" as an example, its acceptance by a number of local elites was also crucial. Even though the "head-land institution" might have increased their own fiscal liabilities, they still supported Jin and endorsed it. This demonstrates that, even though most local elites tended to avoid their responsibilities, not all of them were concerned only about their private interest. The common good, which was reflected in the local specialists' efforts to distribute the burden of water projects more equitably, was a goal shared by many local elites.

Finally, it should also be emphasized that local specialists invested most of their energy in statecraft-oriented solutions: they paid less attention to the development of hydrological technologies. In their eyes, technology was not the key to solving their problems, management was. So they focused on statecraft issues and worked with officials to improve institutional coordination, fundraising, and mobilization of labor. As a result, in this late-fifteenth century reform, local society benefited from a more active state.

Acknowledgements I would like to thank the participants of "Traditions, Knowledges, Technologies: The Third *EASTS Journal* Conference" for their insightful comments. I am also grateful for the constructive advice offered by the anonymous reviewers. All errors are my own responsibility. This research is funded by a grant from National Tsinghua University (98N291E1).

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