

IRRIGATION MANAGEMENT IN JAPAN:
A CRITICAL REVIEW OF JAPANESE SOCIAL SCIENCE RESEARCH

by
William W. Kelly

China-Japan Program
140 Uris Hall
Cornell University
Ithaca, New York 14853

Rural Development Committee
170 Uris Hall
Cornell University
Ithaca, New York 14853

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PREFACE

The purpose of this monograph is to introduce to a wider audience significant Japanese social science work on issues of irrigation management. Irrigation has been central to agricultural development throughout Japanese history, and in the present century, it has become the subject of a voluminous and sophisticated body of social science research. Spanning the five decades of 1930-1980 and spread among many disciplines, irrigation research in Japan has come to embrace a wide range of topics.

One may discern five main lines of research:

- a. patterns of management of irrigation networks;
- b. characteristics of terminal-level (or field level) irrigation procedures and their relationship to village organization;
- c. the nature of customary river water rights of agriculturalists and the regulation of conflicts between agriculturalists and other river water users;
- d. measurement and evaluation of economic effects of irrigation projects; and
- e. the place of irrigation in the water resource development of river basins.

Virtually all of this research is published only in Japanese and thus is inaccessible to most irrigation scholars and development specialists. It is my aim here to analyze critically for English-language readers the work of some of the principal Japanese irrigation researchers. I will pay particular attention to those who have explored organizational issues and thus will confine myself to work that falls within the first two lines of research mentioned above. Even so, the relevant literature is extensive, and exhaustive bibliographic citations have been avoided on the assumption that the reader without Japanese language proficiency is interested more in what have been the major topical concerns and theoretical orientations than in a listing of references.

I should at the outset briefly define the analytical vocabulary of the monograph. I am using 'irrigation' as a shorthand term for the entire cycle of agricultural water use. I have elsewhere (Kelly 1982b) defined this cycle to include four phases: water source control, water delivery and distribution, in-field use, and drainage. Within each phase, there are potentially four different types of tasks: construction of facilities, their maintenance and operation, water

allocation, and conflict resolution. I use the term 'irrigation organization' to mean the configuration of roles by which these tasks are performed. 'Irrigation network,' by contrast, refers to an articulated series of facilities and environmental modifications to control, deliver, use, and drain water. I make this distinction --and avoid reference to an 'irrigation system'--because it is imperative that we differentiate between the natural patterns of water flow (hydrology), the physical networks of irrigation (technology), and the institutions and roles of irrigation (social organization). The term 'irrigation system' implies the boundaries of units on these three levels coincide, but this is, more often than not, empirically not the case.

All Japanese names in the text are written in Japanese order, with family name preceding given name.

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Chapter I

INTRODUCTION

In Japan, scholarly concern with the social, economic, and political features of irrigation may be traced to the early part of this century, when social science research itself was just beginning. Water control and the management of irrigation activities was recognized even then as a key plane of organization in the countryside. Organizational as well as technical improvements in agricultural water use were seen as fundamental to agricultural development and rural social change. Since the end of World War II, sparked by the post-war land reform and substantial government investment in agricultural development, irrigation research has expanded in all fields of Japanese social science that deal with agriculture and rural society, including history, rural sociology, economics, anthropology, and cultural geography.

This sustained interest in irrigation is hardly surprising, given the central role of irrigated rice cultivation in the agriculture of the country. For 2000 years the spread of irrigated rice cultivation through the Japanese islands has been a consistent theme of regional development. Although there is thought to have been some rudimentary channeling for drainage in the wet lowlands where rice was first grown in the second or third centuries, B.C., irrigation development did not begin in earnest until perhaps the fifth century, A.D., when an influx of persons from the Korean peninsula brought to western Japan a second wave of rice varieties and technology, together with iron-tipped tools and techniques for

irrigation pond construction. In the next several centuries, irrigation and paddy land expansion was centered in the small basins and narrow plains around the Inland Sea in western Japan. It supported first a new central state authority in Nara and Kyoto and then, by 900 or 1000 A.D., warrior chiefs in the provinces, who gradually wrested effective control over small estates they had formerly only managed for nobles at the Kyoto court. In the fourteenth and fifteenth centuries, the focus of paddy land expansion shifted to the mountain basins and river plains of central Japan with the development of new river training technology that permitted flood control and canal networks along the much larger rivers of central Japan. These new agricultural areas and irrigation networks were sponsored by and became the support bases for powerful regional warrior lords. Fighting among these lords brought several centuries of political instability that was ended in 1600 when one of them, Tokugawa Ieyasu, achieved a national hegemony that ushered in the two and a half centuries of the Tokugawa shogunate. This also marked a final shift in the political center of gravity from central Japan to the Kantō Plain and northeast Japan, and paddy land development too was now focused on the largely unexploited northeast. This was a region of high discharge rivers with extensive downstream plains, so this expansion of rice cultivation depended on further improvements in river control and irrigation technology. This new technology of the Tokugawa engineers was the basis for the tremendous expansion in paddy acreage in the 1600s and 1700s, the centuries in which, scholars agree, most of the large river-canal networks originated.

The Tokugawa shogunate ended in 1868 with the formation of the Meiji state, and increases in agricultural output constituted well-known

contributions to its early modernization. There has been, though, little acreage expansion in the last hundred years. The development has been intensive, based in large part on successive improvements in water control and management: the landowner-organized terminal ditching, drainage, and field adjustment projects of the early 1900s; and substantial government investment after World War II, first in storage dams and main canal-level projects, more recently in extensive terminal-level reorganization. Even today, despite growing rice surpluses, government irrigation investment continues at high levels, and irrigated rice remains the principal crop, occupying 3.2 million hectares, or 57%, of the total cultivated acreage of 5.6 million hectares. Virtually all of this paddy land is, and has long been, irrigated, either from river-canal networks (82%) or from pond-canal networks (15%). Irrigation in Japan is almost entirely rice paddy irrigation.

The continued importance of irrigation and irrigated rice-cultivation through Japanese history is of more than passing interest here. It must be underscored that, with only a few exceptions, Japanese social science research on irrigation is research on Japanese irrigation. There has been some recent work on irrigation organization elsewhere in Asia which will be reviewed later in the paper. However, the literature is, first and foremost, a continuing attempt to interpret the features of Japanese irrigation, to assess its place in Japanese agriculture and rural society, and to analyze government policies and programs.

It is important to note, too, that scholars have often turned to these issues of Japanese irrigation in the context of two broader and somewhat ideological concerns. The first of these has been the problem of the so-called "stagnation" of Japanese agriculture and how to overcome it.

Stagnation here refers to "structural stagnation" rather than merely depressed productivity (though that is considered to be a consequence of the former). It is the inability of Japanese agriculture to break out of the pattern of small holdings of dispersed field parcels (the shōnōsei, "small cultivator system," or the reisai bunsan kōchisei, "small, dispersed field system"). How this pattern came about and why it continues has been a fundamental issue in Japanese agricultural studies. It is widely felt that because of this small holding pattern, the individual cultivating household has had to depend on and participate in communal irrigation arrangements. Over time, these arrangements for network operation/maintenance and water allocation have become permanent, increasingly inefficient "irrigation customs" (suiri kankō), preventing individual cultivators from changing their own water use practices to adopt new cultivation methods and technologies. The nature of these irrigation customs and how they might be "rationalized" (gōrika) into "irrigation procedures" that permit efficient water allocation and maximum freedom of field intake-outlet have thus figured prominently in irrigation research.

The second broad concern, central to Japanese rural society studies, is the "feudal" (hōken-teki) exploitation of the cultivator, the submergence of the individual in a web of hierarchical dependency relations within a "village community" (kyōdōtai) as the main obstacle to more democratic forms of association. Scholars have been drawn to irrigation because it is this village community in which irrigation customs are thought to be embedded. From the medieval shōen estate-managed networks and the more autonomous sō irrigation groups of the fifteenth and sixteenth centuries to the seki and igumi inter-village

association networks of the Tokugawa period, to the Irrigation Cooperatives of the early modern period and even to the Land Improvement Districts of the present-day -- the village as a kyōdōtai corporate community is commonly considered to be the elemental organizational unit of irrigation networks. For this reason the group regulation of water by the village community and the prospects for more democratic organization of water users have been frequent research topics of investigators of rural Japan.

Organizational issues of irrigation are thus of critical significance in the rather politically aware and committed Japanese social sciences. Shōnōsei, hōkensei and kyōdōtai are key concepts in the social science literature, each with a range of special and hotly debated meanings according to the theoretical predilections of the analyst. While this certainly does not preclude the outsider from drawing upon this body of irrigation research, it does make it imperative that he/she understand the original context of research. It is hoped that this review will illuminate something of this context as well as indicate the substance of the research itself.

Chapter II

EARLY RESEARCH ON "IRRIGATION CUSTOMS," 1930-1950

Although there was some occasional research at the beginning of this century,¹ scholarly writing on the social, political, and economic aspects of irrigation did not appear with any frequency until around 1930. This was a time when several factors were drawing public attention to the procedures and organizational patterns of irrigation and were threatening agricultural water users' previously unchallenged use of the country's rivers. A shift from coal-fired electric generation to hydroelectric generation had begun to interrupt normal discharge patterns in several major rivers, and rising water demand from industrial and urban growth was creating shortages in at least some agricultural areas.

The central government was already moving to amend its earlier hands-off policy towards irrigation. The Irrigation Cooperative Law of 1890 had simply laid down a basic framework for cooperative organization and had contained no stipulations about allocation or network operation/maintenance; this had been left to "customary practice." Similarly, the River Law of 1896 countenanced existing irrigation claims and even afforded them some ambiguous legal standing. But by the 1910s, bureaucrats in both the Interior Ministry, which through its Engineering

¹ Most notably, the work of the folklorist Yanagita Kunio, who collected examples of irrigation practices as part of his "vocabularies" of rural life and wrote a short article in 1908, "On Irrigation," in which he proposed that village groups contract with private water development companies for their water supply.

Bureau had jurisdiction over rivers, and the Agricultural Affairs Bureau of the Agriculture and Commerce Ministry were pressing for greater government control over irrigation practices, which they saw as serious obstacles to improvements in crop yields and paddy acreage expansion. As an initial step, several surveys of "irrigation customs" were conducted by both bureaus in 1917 and 1918. These provided important statistical data and case studies for the scholars who turned to issues of irrigation in the late 1920s.²

Yet even more important than these factors in determining the tone of the early irrigation research were the heated factional debates (ronsō) that consumed the largely Marxist social science world in the 1920s and 1930s. These debates centered on two related issues: a general question about the stagnation of Asian societies raised by both Marx and Weber and a particular dispute over the interpretation of the Meiji Restoration of 1868 that had ended the shogunate. The first of these began in the sharp Comintern debates about the nature of the Chinese revolution of 1925-27. Marx had written ambiguously of an "Asiatic mode of production," and the controversies in the Comintern and, derivatively, in Japan, turned on whether this referred to a type of agrarian class society (in which case it was a historical stage of societal evolution) or to a distinct type of Oriental Society, static and outside history (with no intrinsic capacity for change). For a time at least in the 1930s, Wittfogel's interpretation

² A later stimulus to research was an extensive and prolonged drought in 1939 throughout western Japan and Korea. This attracted attention to the variety of traditional low-water allocation practices and renewed demands for a stronger government policy on water resource development. However, most government activity in irrigation from the late 1920s on was severely limited by the war.

that it was a distinct mode of production and thus a special form of society was influential.³ Japanese scholars debated whether China and/or Japan exhibited an Asiatic mode of production, a feudal mode of production, or a special "Asian feudal" mode of production. Given Wittfogel's emphasis on a "logic of water" (mizu no ronri) that was the environmental basis of the relations of production in the Asiatic mode, many believed the debate hinged on an analysis of irrigation.

Most scholars and intellectuals came to reject the attribution to Japan of the Asiatic mode, outside history and without potential for internally generated development, but continued to disagree about Japan's feudal or special Asian feudal character. This second controversy was sparked by a series of "theses" (or resolutions) adopted by the Comintern in 1922, 1927, 1931, and 1932 on the nature of Japanese capitalism. These were essentially policy directives to the Japan Communist Party. The 1932 resolution defined the Meiji Restoration as a feudal realignment and decreed the need for a two-stage revolution, bourgeois-democratic and then socialist, in Japan. This was adopted by the orthodox Kōza-ha scholars (the "Lectures Faction," so named for their collective seven volume Lectures on the History of the Development of Japanese Capitalism, published in 1932-33). They held that feudalism had survived the Meiji Restoration as a slightly altered han-hōkensei, or "semi-feudalism," in which a semi-feudal, exploitative landlord elite had emerged to replace the old feudal authority. A rival faction of scholars, the Rōnō-ha ("Workers and Peasants Faction"), insisted that the Meiji Restoration

³ Although never translated in English, Wittfogel's 1931 Wirtschaft und Gesellschaft Chinas (Economy and Society in China) appeared in Japanese in 1933 and was widely read.

ushered in genuine capitalist development and that there was an ongoing decomposition of the peasantry into rural wage laborers. They rejected the two-stage strategy of political action.⁴ These debates over the nature of this landlord domination led researchers again to the features of irrigation as the decisive means of production in Japanese agriculture.⁵

It was in this highly charged ideological atmosphere, then, that irrigation first came to the attention of scholars. A common form of this early research was the investigation of (or sometimes merely speculation about) "irrigation customs" (nōgyō suiri kankō). This was a term used to mean long-standing, traditional practices and procedures of physical network operation/maintenance, water allocation, and in-field use. Three of the more prominent scholars who, at least theoretically, treated this problem of irrigation customs were Kondō Yasuo, Koike Motoyuki (1942), and Iawakata Isoo (1942).

Kondō's 1934 Theory of Agricultural Economy was followed in 1942 by A Theory of Japanese Agricultural Economy and in 1947 by a revision of his earlier 1934 book. Regarding irrigation Kondō argued that the special feature of water as a "means of production" was the public nature of its supply and delivery and the private nature of its actual use. This had two consequences, the first being that it should be possible to promote increases in productivity through public investment in irrigation

⁴ For useful discussions in English of these debates see Yasuba 1975, Beckman & Okubo 1966, and Itoh 1980:22-26.

⁵ By 1910, roughly 30% of farm households owned all the land they cultivated, 40% of the households owned some land and tenanted the rest, while 30% were pure tenants. With minor fluctuations, this remained true through the early 1940s. There were about 100,000 "landlords" who tenanted out over five hectares but only about 3,000 with holdings over 50 hectares. (see Fukutake 1972:10-11)

facilities. He warned, however, that there were "contradictions" of economics and technology in the terminal-level "paddy land readjustment projects" (kochi seiri jigyo) that were at the time the major form of physical network improvement.⁶ That is, such projects created an overall rise in productivity but a differential distribution of this increase to landlords and tenants. The landlords benefitted both by higher tenant rents on the improved paddy fields and through increases in total rental acreage (that is, the rearrangement of terminal-level facilities tended to increase field acreage by reducing land used for bunds, paths, ditches, etc.). The tenants, on the other hand, often saw most of the yield increases appropriated through rent increases; they were also drawn deeper into the cash economy and pushed further toward rice monoculture.

The "public nature" of irrigation also implied that water use by individual cultivators had to be regulated, ultimately by "outside pressure" (gaibu kara no kyosei), presumably the capitalist state. Kondō studied reports from various areas during the 1939 drought to determine how irrigation customs were preventing "rational water use"; the problem of irrational customs he attributed to the "semi-feudal" land pattern of dispersed small holdings. Like most Marxists, Kondō felt the large producer was bound to replace the small cultivator as capitalism penetrated into the semi-feudal agricultural sector; this was viewed favorably by Marxists because only with full transition to capitalism was

⁶ These projects, locally initiated under national legislative guidelines, were intended to create improved water distribution and field drainage, larger and more standardized field parcels, and wider paths for field access. Typically, the project pattern was a grid of rectangular 1 tan (0.099 hectare) parcels; ditches ran along the short sides of the parcels to allow direct intake and discharge of water, and beside one of the ditches was a field path.

the stage set for socialist revolution. The persistence of irrigation customs was one measure of feudalism's tenacity and the need for more active state policy.

The concerns of much of this pre-1950 literature are of only limited interest today (indeed, more valuable than the scholarly works are the 1917 and 1918 government surveys on which they largely drew for evidence). One scholar of this period, however, is worth singling out because his life-long research on irrigation in the Tokugawa period has provided the basic historical grounding for the concept of "irrigation customs" that so pervades the literature. This is Kitamura Toshio, who from 1938 to 1951 conducted a series of twenty-four case studies of Tokugawa irrigation in various parts of the country. In 1950, he published his Historical Research on Japanese Irrigation Customs: General Volume, in which he used these cases to illustrate various generalizations about Tokugawa irrigation engineering, the structure and operation/maintenance of irrigation facilities, service area organization, allocation procedures, water rights, and dispute resolution. It was not until 1973 that eighteen of these case studies were collected together in a single companion volume, Historical Research on Japanese Irrigation Customs: Case Studies.

In the general volume, Kitamura argued that the basic organization form of twentieth century Japanese irrigation was established in the Tokugawa period. Despite improvements to the physical networks and because the pattern of agricultural production and the structure of agricultural villages had remained unchanged, one must study Tokugawa period irrigation to understand that of the present day. He enumerated three features of this Tokugawa irrigation:

- a. overall control of irrigation by feudal authorities. Because

water control was the determining factor in rice cultivation, ultimate authority was exercised by shogunate officials or domain lords, especially in matters of new construction, major repairs, and serious allocation disputes.

b. the village settlement as a corporate community in irrigation. The named and usually nucleated settlement was legitimized by Tokugawa authorities at the beginning of the period and delegated various administrative responsibilities. It was the actual management unit at the terminal level; irrigation networks usually extended over a number of villages' lands and were managed by a council of village representatives overseeing irrigation-specific roles. While villages held rights to water within the irrigation cooperative, there were no individual rights to water within the village community. Water was attached to land (that is, to paddy land), but only in the sense that individual land parcels were articulated to "village" ditching and individual households were members of the village community. There were both vertical relations of differential rights among villages of a cooperative and "class" distinctions among households of a single community.

c. rigid and irrational customs. Kitamura argued that allocation of water and of authority and obligation in irrigation tasks to canal networks along a river, to villages within a network, and to individual cultivator households within a village was "irrational" because it was based on such factors as relative geographical location, relative antiquity, and relative status and power. This initial division of water, authority, and obligation was expressed in terms of fixed and formal irrigation customs. The difficulty of subsequent adjustments to these customs blocked efforts to improve productivity. For example,

restrictions on water use periods prevented second-cropping; rigid transplanting schedules prevented adoption of new varieties and culti-methods; and water allocation by fixed dimensions and materials of intake works rather than general allocation principles created gross discrepancies between fields in water availability and consumption. Such constraining irrigation customs, Kitamura argued, were a principal reason why large holdings were tenanted and not owner-operated.

None of this was original with Kitamura, but his construction of a composite model proved quite influential with later researchers. There was other historical research during these decades -- most notably, Nishioka (1929) on the sixth through ninth centuries and Hōgetsu (1943) and Nakamura (1939) on the medieval period -- but it was accorded much less attention because of the consensus that contemporary irrigation had its origins in the "feudal" Tokugawa period.

While Kitamura amply illustrated his general discussion of Tokugawa irrigation, we realize when we turn to his volume of collected cases that it contains a wealth of data on traditional irrigation patterns that he himself barely began to use. Most importantly, the cases represent significant organizational variation, illustrating, for example, at least three patterns of network management:

- a. networks in which irrigation tasks were directly supervised by a hierarchy of officials articulated either to a regional domain or to the central shogunate.
- b. networks in which authority was exercised by a local farming elite, often households descended from pre-1600 landed gentry who remained in a local area as wealthy cultivators and were not drawn up into the warrior stratum. Alternatively, such a pattern

might develop in areas opened up in the early 1600s by cultivator groups headed by ex-warrior households.

- c. networks managed by local, autonomous associations of villages with little apparent elite intervention. Kitamura's cases suggest this pattern was more often found in networks that pre-dated the Tokugawa period.

In sum, the picture is one of variation, regionally and through time, in the relative degree of local autonomy and state and non-state elite intervention (see Kelly 1982a for a fourth variant and for further discussion). In his general volume, Kitamura did recognize some variation from his model, which he attributes vaguely to the level of domain lord concern for rice agriculture, the extent of commercialization of agriculture in an area, and the degree of autonomy of village organization. However, a much more rigorous exploration of ecological and political-economic conditions is required to construct an explanation that promises to be of much value in our understanding of the settings in which certain forms of irrigation organization are to be found. This problem of variation, though, has not received much attention in the Japanese literature, oriented as it has been towards the common features of a societal stage.

Chapter III

THE "RATIONALIZATION" OF IRRIGATION PROCEDURES

Scholarship on problems of irrigation organization expanded quickly after the end of World War II in an atmosphere of serious food shortages, a major land reform program in the late 1940s, legislation that reorganized the management of irrigation networks and the procedures for irrigation projects (the Land Improvement Law of 1949), and greatly increased government investment and policy control over irrigation improvement projects.⁷ Initially, much of the research effort in irrigation was expended in a rather theoretical debate on whether the land reform would have any effect on irrigation customs. Then, by the late 1950s and early 1960s, it was clear that the allegedly intractable irrigation customs were in fact giving way under the influence of physical network improvements, legislation, changing cultivation technology, etc. Researchers turned now to the question of how these rechristened "irrigation procedures" should be rationalized to permit maximum water

⁷ The 1890 Irrigation Cooperative Ordinance and its 1902 revision had provided the legislative basis for the formation of "regular irrigation cooperatives" (futsū suiri kumiai) with legal standing; in most areas, this amounted to reorganization of existing main canal network groups. Under the Land Improvement Law of 1949, these irrigation cooperatives were encouraged (and later required) to reorganize internally into tochi kairyō ku ("Land Improvement Districts"). Despite their name, they remained irrigation groupings. Henceforth in this monograph they will be abbreviated as LIDs. A good English language summary of this post-war legislation and policy is Ogura 1980:402-468. Dore (1959) is the standard reference on the land reform.

user freedom. Finally, in the 1970s, different problems have arisen: the new water use and drainage techniques have increased water demand at a time of rising pressure from non-agricultural users for more economical consumption and the village, divided now between full-time and part-time farmers, is no longer an effective organizational framework within most Land Improvement Districts. Researchers are now considering what alternative organizational patterns might be feasible for terminal-level operation/maintenance and water allocation.

But in the first decade after the war, such organizational changes were largely unexpected by many policy makers and academic researchers. Initial attention focused on the consequences of the land reform program for irrigation. The land reform was clearly successful in sharply reducing tenancy, but it had few direct provisions relating to irrigation, and there was considerable doubt about its effect on irrigation organization. A number of influential irrigation studies were published in the early and mid-1950s, most of which found little change. This reflected in part a broader pessimism current among scholars and intellectuals at the time; as they sought out the bases of support for pre-war fascism, they became worried that the post-war "revolution by law" would not have much effect on the traditional social attitudes and relations.

In one sense, of course, this was but a recasting of earlier debates on the persistence of Japanese "feudalism." At issue in the 1930s was the emergence of landlords as a semi-feudal elite exercising control over agricultural production through domination of the village community, which held rights to and regulated the water on which its members depended. It was agreed that in the land reform these landlords had lost their

principal material base of control-- their arable land-- and a farming population of small-scale independent cultivators was established. It was further conceded that the Land Improvement Law had replaced the earlier landowner Irrigation Cooperatives with Land Improvement Districts, cultivator organizations which were now the legal entities for projects and for operation/maintenance of major irrigation facilities. But as Furushima Toshio (1954:202-3) argued, even taken together, this legislation could not directly reform customary irrigation practices because communal regulation of terminal-level irrigation persisted. All former tenants now held title to land, but they still depended on the village community-managed irrigation network for water. Long-standing customs of allocation and operation/maintenance continued to favor the semi-feudal, former landlord elite households and attitudes of deference towards them persisted. Indeed, this argument was known as the "reorganization of semi-feudalism" (han-hōkensei saihen ron), and it was because it rested in large part on an evaluation of irrigation relations within the village community that much of the irrigation research of the period remained enmeshed in ideological concerns.

Paranetically, this argument required some delicate tinkering with the concept of the "village community" (kyōdōtai). The basic meaning of kyōdōtai in the Japanese social science literature is as a technical term for an elemental structural unit of rural society in a feudal class order, where production is largely private but is constrained by communal ownership of certain key means of production. It is a stage intermediate between the primitive communal village and the capitalist cooperative village. Of course there are arcane permutations of this -- proposals for Japanese villages as "special feudal kyōdōtai," "special Asian kyōdōtai,"

etc. In any of its denotations, though, it differs from the rather loose usage of "village" or "communal irrigation system" in the Western irrigation literature, and arguments for or against the "village community" as irrigation unit must be considered accordingly.

The agricultural economist Kanazawa Natsuki agreed with Furushima that the land legislation was producing no changes in water use, though his emphasis was less sociological (the survival of "semi-feudal" authority relations in the village) and more economic: the continuation of irrigation practices that were the principal obstacle to improving productivity. In his 1954 book, The Economic Structure of Rice Cultivation, he was especially concerned with the ways in which irrigation patterns could restrict the labor process in rice cultivation. He believed that transplanting was the decisive step in the labor process and that when and how it was done depended in turn on the timing and volume of water. But transplanting was regulated by the communal management of the irrigation network, which enforced an areal uniformity and prevented individual initiative in introducing new varieties, water use methods, and transplanting techniques. He presented several detailed cases of transplanting practices but was rather pessimistic about overcoming communal water allocation.

The legal sociologist Watanabe Yōzō was another pessimist about the potential for change in irrigation relations. In his 1954 Research On Irrigation Water Rights, he focused on the nature of these rights⁸ and on

⁸ The legal standing of agricultural water rights had long been debated by scholars as an indication of the degree to which the system of capitalist private property rights had penetrated the semi-feudal agricultural sector.

how procedures within "irrigation communities" (his term for the inter-village irrigation cooperatives) were maintained. In the first section of the book he reviewed legal decisions and government surveys to determine the status of irrigation rights. He argued that despite their general acknowledgement in national law, irrigation rights did not exist as abstract, legally sanctioned rights. They were simply fixed patterns of specific rights and duties in particular networks, generally accepted by the irrigators of the area. While he thought such irrigation rights might be classified into three types (exclusive rights; joint rights; and subordinate surplus water use rights), he emphasized that they did not develop from the application of a general legal principle (such as prior appropriation) but rather they emerged from the interplay of various local circumstances, expressing relative antiquity, geographical location, financial burden, etc.

In the second section of his book, he turned to sociopolitical relationships. At the highest level, the holder of irrigation rights was the "irrigation community" (i.e. the irrigation cooperative) organized from constituent villages in a single canal network. Irrigation rights developed, he said, from conflicts between irrigation communities; they expressed the relative power of the different irrigation communities and for this reason are irrational. For example, water allocation did not reflect actual water needs but rather an irrigation community's ability to obtain and maintain a customary share of river water. However, each community itself was not a harmonious and homogeneous group rather it existed for and was controlled by a "ruling class." Since the end of the Tokugawa period, this had been the landlords, and thus the irrigation community was but another extension of landlord control. Despite changes

in formal organization to Land Improvement Districts, the village remained a constituent unit in the "irrigation community" and the hierarchical social relations of water within it persisted. In a third section, Watanabe turned to conflicts between irrigator rights to river water and river water use rights of hydroelectric plants, the expansion of which in the early 1950s he and others attributed to a military rearmament. (In a 1963 revised edition of his book, he added material on irrigation rights in the new River Law, which had been enacted in the interim.)

Not all researchers shared this pessimistic assessment of post-land reform irrigation. Shirakawa Kiyoshi in his Land Investment and Its Organization (1954) tried to show how patterns of investment in irrigation improvements and of network management had changed in the post-war period on a rice plain in Yamagata Prefecture, and Takeyama Masujirō, in his 1958 Research on Irrigation Ponds, took issue with many points raised by Watanabe, arguing for instance that irrigation groups he surveyed were controlled rather democratically by water users and not by a few powerful ex-landlords; the groups themselves, he found, were distinct from village organization. His evidence alone constituted a valuable compendium of details of water allocation and operation/maintenance of irrigation pond networks in the Osaka area.

However, the most influential rebuttal to the pessimists who saw in irrigation organization a carry-over of "semi-feudal" authority relations was Shinzawa Kagatō's A Theory of Irrigation (1955). Shinzawa, an agricultural economist, had been working on other topics in the early 1950s but was troubled by the sway that the "irrigation feudalism theory" held over the field. He prepared three case studies, which composed almost all of his long book, to set out a different perspective on the

nature of irrigation problems.

He believed that the land reform had included irrigation; it had freed not just the land but also, in the case of paddy lands, the inalienable water intake right attached to them. In one of the cases he demonstrated the influence in irrigation affairs of shogunate and domain officials of the Tokugawa era and of large landlords in the early modern period and admitted that some of the older hierarchical patterns might still persist. But, he argued, that was not the important problem in irrigation. Rather, the basic conflict of interest in irrigation had always been areal (chiiki-teki tairitsu). Before the land reform, this resulted in opposition between landlords in different networks; now following the land reform, it was between cultivators-water users of different areas. The so-called "irrationality" of irrigation customs originated in this areal opposition of interest, and it was a mistake to label such irrationality a feudal survival. The case studies in the book were intended to detail just what were those areal conflicts of irrigation interests and how they had been or might be successfully mediated and overcome.

In the first section of the book, Shinzawa described how in two separate instances shogunate engineers on Kantō Plain in the 1720s had drained large irrigation lakes that had long been sources of rancorous disputes. In both cases, land below the lakes had been converted to paddy land to the limits of the lakes' supply, while lands above the lakes, irrigated from other sources, suffered very poor drainage. To mitigate these above-lake/below-lake antagonisms in the Minuma area, for example, the lake was drained, its bottom was developed into more paddy land, and a main canal of over 80 km was dug from the large Tone River. A canal

network and corresponding hierarchy of management posts articulated to the shogunate were established which unified the previously antagonistic areas.

In the longest section of his book, he detailed the course of events in the early part of this century along three rivers in the Hokuriku region (the Shō, Jōganji, and Kurobe Rivers). In each instance, hydroelectric project developments aggravated water temperature and intake problems for irrigators along the rivers. This outside pressure persuaded the landowners in the previously antagonistic irrigation networks to cooperate in headworks unification projects in each of the three rivers. This, he found, not only resulted in improved water delivery but also in a major reorganization and consolidation of task management, fee distribution, and allocation procedures.

In a final section, Shinzawa considered a case from the lower Kisō River area near Nagoya City, in which drainage practices of one network were greatly complicating water intake to a network just downstream. This was a problem that continued at the time of his writing and for which he suggested a solution involving, among other elements, a new intake arrangement by siphon for the downstream network.

Together, the three sections of the book were intended to demonstrate Shinzawa's contention that regardless of the class structure and landholding patterns of the period, the most contentious and intractable irrigation problems had arisen from areal conflicts of interest. The clear implication of his argument was that outside pressures (e.g., hydroelectric construction), new technology, and/or state investment could produce the improvements in the physical network and facilities of irrigation that would in turn resolve endemic conflicts and reform

irrigation procedures. This was very much the opposite policy implication from that of the "feudalism" argument, which was that to create "rational" water use, radical legislative reforms were required to insure cultivator control of irrigation organization and democratization of the villages.

Of the two, Shinzawa's position proved the more prescient; the pessimism of the irrigation feudalists was belied by developments in the mid- to late 1950s, though the direction of change did not always follow the course predicted by Shinzawa. There were a number of factors, inside and outside agriculture, that presaged organizational changes in irrigation. The era of high economic growth that began about 1955 brought sharp competition for river water from rapidly expanding industrial and municipal users; it also marked the beginning of an exodus of people from agriculture, changing the character of the farming villages. A growing and conspicuous disparity between agricultural and other sectors in both labor productivity and personal income created pressure for a basic reorientation in government agricultural policy. Within agriculture itself, government investment in multi-purpose dams and main canal-level irrigation facilities, the beginning of mechanization, new rice cultivation methods permitting earlier transplanting times, and other factors came to alter water use patterns. In response, the emphasis of the social science literature in the last twenty years has moved from the irrationality of traditional practices to analysis of on-going changes and prescriptions for new procedures and organizational patterns. While Japanese social science remains more politically committed than that, for instance, of the United States, the recent irrigation literature is notably less polemical and at the same time more empirical than earlier work.

Two volumes instrumental in this shift in research focus were Japanese Agriculture and Water Use (1960) and Research on Irrigation Procedures (1961), both products of group research. The first was a volume issued by the Ministry of Agriculture and Forestry and written by staff people in its Agricultural Land Bureau. By 1960, agricultural water users were coming under severe criticism from industrial and municipal interests (including the national Ministry of Construction, which tended to represent these interests) for their alleged wasteful use of river water. To document that agricultural water use was not in fact excessive, the Ministry issued this volume, which came to be known as the "Irrigation White Paper."⁹

But while showing the public how rational (and thus how justified) was irrigators' use of river water, the volume had the contradictory aim of indicating to irrigators the directions in which the ministry thought it necessary to further "rationalize" irrigation practices.⁹ It identified what it called "three objectives of modernization" and spelled out their policy implications for irrigation:

- a. specialization and simplification of function. Organizationally, this aspect of modernization was already reflected in the shift

⁹ This volume was also intended as the Ministry's final position on the work of the Water Institutions Committee (Mizu-seido Bukai), an influential deliberative council that met in the mid-1950s to plan future government water resource management policy. Yet a fourth aim was to report on the extensive series of surveys of irrigation conditions done by Ministry staff in 1956-1967 and eventually covering fourteen selected river basins. The individual reports began appearing in 1959 under the generic title, Agricultural Development and the Progress of Irrigation in (river basin). A major purpose of the surveys was to assess the role of past land and water improvement projects in raising rice productivity in each basin; this historical material has proven quite valuable to researchers.

from the multi-functional village as irrigation management unit to the pre-war irrigation cooperative to the post-war land improvement district. In the future, it was necessary to further strengthen the LID as an independent, legally incorporated body specializing in the initiation of irrigation projects and the management of irrigation networks.

b. increase in scale. An expansion in the scale of irrigation management and projects was thought necessary to overcome the opposition and conflict of interests between local areas; the volume called for future planning to be on a drainage basin-wide scale. To prevent such expansion in scale from simply enclosing more problems and conflicts, it was to be predicated on building specialized irrigation works and clarifying management responsibilities.

c. commercialization. The volume recommended the increased commercialization of water in several senses: a shift from unpaid water user labor in operation/maintenance to assessment of cash operation/maintenance fees and operation/maintenance labor paid at competitive wages; equalization of irrigation fee assessments within networks; clarification of costs and benefits per unit of water and a shift from measuring water demand and use indirectly in terms of acreage to measuring it directly in terms of water volume.

The volume went on to stress that the success of such a modernization of irrigation depended on a more general "structural improvement" of agriculture, and it is interesting to note that at the time it was preparing this "white paper," the ministry was preparing legislation that

was to become the 1961 Agricultural Basic Law. One might say that this law translated the above "three objectives of modernization" into general agricultural policy. While there are few who would characterize the government's overall agricultural policy in the two decades since then as consistent, its irrigation policy objectives have remained remarkably stable. More to the point here, they continue to be points of reference for irrigation researchers.

A second volume that was important in defining the course of research in the 1960s and 1970s was Research on Irrigation Procedures, which appeared in 1961. This was the final report of a four-year joint project by an ad hoc group of most of the leading irrigation scholars of the time, including Shinzawa Kagatō, Watanabe Yōzō, Satō Toshio, Kanazawa Natsuki, Baba Akira, Furushima Toshio, and others. The general editor was Kayō Nobufumi, but much of the actual editorial work was done by Shinzawa, who also contributed two of the ten chapters and collaborated on a third.

The group attempted to signal a change in research focus by forswearing use of the term "irrigation customs" and adopting instead the term "irrigation procedures." What had once seemed to be "permanent" customary practices were now showing signs of change, and the project was designed to identify those external and internal factors that were bringing about such reforms. The volume is thus a useful summary of developments up to 1960 in agricultural water law, government irrigation-related administration, irrigation improvement projects, rice cultivation methods, and so on. However, because each topic was treated by different scholars and there was no general conclusion, the report lacks any joint assessment by the group members of just how far and in what specific ways these irrigation procedures had been modernized. What

projections there were often cast in idealistic terms.

As an illustration of this, in the chapter on "irrigation procedures and farm management," Kanazawa and two collaborators had a section on the reform of irrigation practices in pond-canal networks. The optimal strategy for such a reform, they argued, would be a major land improvement project that would reorganize the existing, "complex" pond irrigation groups into "modern" organizations, but they admitted that would be difficult. They believed it more reasonable to leave the organization intact and try to "separate out" from it the irrational customary ways of allocating water and maintaining the pond network. This can be done in two ways: by increasing the volume of water stored in the pond and/or by reducing the volume of water used per unit area. The first could be accomplished, they suggested, by installing pumps to use underground water to supplement the traditional run-off and river diversion sources of ponds. The second could be accomplished through adoption of the early transplanting culti-methods that had been advocated since the mid-1950s. Either or both strategies would improve the supply-demand balance and relieve what they saw to be the common plight of pond irrigation areas -- that paddy land development had expanded to the limits of the pond's water storage volume, giving rise to complicated and rigid allocation rules and maintenance practices that enforced a common, though not necessarily equitable, cultivation regime on all pond water users.

If there was an implicit theme in this volume, it was that further "rationalization" of irrigation organization and procedures should support an "individualization" of water use. This has generally come to mean that individual water user/cultivators should have maximum independent control over water intake to and drainage from each of their field parcels; they

should be able to draw and discharge water freely in accordance with their particular cultivation schedules. This has become an important concept in the irrigation literature since the 1961 volume. The researcher who has perhaps most elaborated it, both theoretically and empirically, is Nagata Keijūrō. Nagata is an agricultural economist by training and has worked for a long time at the Ministry of Agriculture's National Experimental Station outside Tokyo. His book, The Structure of Irrigation in Japanese Agriculture (1971) brought together his research of the previous decade and was a sustained treatment of this concept of "individual water use" (kobetsu-teki suiriyō) -- why and where it had emerged, prospects for its spread, and the limits of individual water use in the Japanese form of small-scale rice cultivation. It remains today one of the most influential works in the literature.

The book begins with a general theoretical discussion of the concept. Nagata criticized previous research for its preoccupation with village community regulation of irrigation; it had ignored the fact that there existed within this web of group relations the potential for what he identified as individual water use. This potential he attributed not to the farm management pattern of small-holding independent operators but to the field pattern of small, dispersed land parcels articulated to a network of dual function delivery-drainage field ditches. The ultimate unit of water was the single small parcel (of which a cultivator would have many, dispersed over a wide area), with water use for each such parcel entrusted to its cultivator. Of course, such a field pattern also necessitated group managed and group maintained irrigation procedures, though Nagata stressed that these procedures dealt with water distribution to and drainage from each land parcel and not with the supply of water to

each individual farm operation. He made this distinction in order to argue that group irrigation customs did not constrain the individual farmer as farm operator directly, and so changes in farm operation could initiate a relaxation of group irrigation customs. In fact, he continued, this was what had been occurring at least since 1955; increasing commercialization was forcing the farmers to rationalize their farm operations and this in turn created pressure for more independent and individual irrigation practices (for example, adoption of certain rice varieties and fertilizer/pesticide application strategies that improved yield and marketability also required much more careful regulation of field water levels in each parcel)t

After this abstract and at times convoluted theoretical excursis, Nagata turned to documenting the present circumstances of individual water use with three extended case studies. He took an example from each of the three main forms of Japanese irrigation (according to most Japanese researchers): "river irrigation,t' gravity-flow branching canal networks with intakes along rivers; "pond irrigation,t' canal networks from storage ponds typically fed by hill-side run-off and/or off-season diversion from rivers; and "creek irrigation,t' networks of improved natural ditches in some of the few flat delta areas of Japan. In river irrigation, he argued, the crux of irrigation procedures was the regulation of water allocation to upstream and downstream users. In pond irrigation, the central problem was how to achieve equal allocation of a fixed volume of ponded water. And in creek irrigation, procedures centered on maintenance of ditchest In each case, Nagata found that there was a growing individualization of water use, though the reasons for this varied with the form of irrigation.

His example of river irrigation was a canal network in the downstream plain of the Yoshii River in Okayama Prefecture. It exhibited the characteristic antagonisms between upstream and downstream branch canals along the main canal, the origins of which Nagata traced to the evolution of management practices and roles in the Tokugawa period. These practices gave considerable privilege to upstream branch canals in both the timing and volume of water and supported higher soil fertility and higher, more stable yields in the upstream areas. Most disputes over procedures and infractions revolved around upstream efforts to protect their privileges and their soil fertility and downstream efforts to achieve a more equitable allocation of water and operation/maintenance fees. This conflict of interest was true not only along the main canal, but also within the various branch canals.

At the time of his investigation these upstream-downstream disputes continued unabated, but Nagata was able to find at least three areas, all in upstream branch canals, where the old procedures were giving way to more equitable ones that also permitted freer water use to cultivators. The catalyst for this was a new set of cultivation methods that the local agricultural cooperatives had promoted from the mid-1950s. This included increased frequency and quantities of a mix of fertilizers; increased applications of pesticides to 6-10 times per season; a shift in varieties, deemphasizing the number of grains per stalk and emphasizing weight per grain; an increase in planting density; and necessitated by the above, a change from continuous ponding with only one mid-season drainage to adoption of a 5-2 irrigating schedule (five days ponding and/or continuous flow, followed by two days of field drainage).

This package of methods -- in particular, the new water application

schedule -- required a reorganization of gate operations and water allocation along the branch canal. There was initially strong resistance from water users in the upstream areas of the branch canal, but they were eventually persuaded by technicians of the agricultural cooperative and of the irrigation cooperative that the new varieties would be more commercially profitable and the new methods would better preserve soil fertility. Unfortunately, Nagata reconstructed this from interviews and records and his case at this point offered few details of what precisely would be of most concern to the development specialist; how, in actual situations, irrigators come to accept new procedures and organization. (Nagata indicated that yields did in fact increase, particularly in the downstream areas.)

Nagata's pond irrigation case was from the plateau on the left bank of the Kakō River in Hyogo Prefecture. The Kakō Plateau is a diluvial upland encircled by rivers on three sides and the Inland Sea on the fourth, but with easy access to none because it is 30-60 meters above the rivers. Paddy land development depended on the construction of ponds fed by springs and run-off. On the plateau were about 600 named ponds and nearly 200 more smaller unnamed (i.e., unregistered) ponds; the pond-to-paddy areal ratio was about 1:4.

What was unusual about the Kakō Plateau was that in 1891 and in 1915 two long canals were dug from intakes along two small rivers upstream of the plateau to deliver water to Kakō ponds during the off-season. A network of twelve branch canals was constructed which brought together an unspecified number of ponds into an integrated delivery network. The construction spurred further pond and paddy land development, increasing paddy land acreage by perhaps 30%. This created a distinction between

"old ponds," those that pre-dated the canals and which had their own run-off sources in addition to the new, supplemental river water, and "new ponds," which were built after and depended entirely on the canals. There was in the post-World War II period a single Land Improvement District organization for all areas served by the canal network; Nagata found that this LID was in fact an association of member pond organizations (not of villages or individual cultivators). Each pond organization was a formal, though not legally recognized, cooperative of cultivators of lands served by one to several ponds; there were a total of 84 such pond organizations in the LID.

After briefly describing the general features of the network, Nagata contrasted the organization and procedures of an old pond cooperative with those of a new pond cooperative. He found they both had detailed rules regulating: the pond opening day; the timing and methods of field tilling, seedling beds, transplanting, and weeding; and the in-season allocation of water to each parcel. This was all done by special roles appointed from the membership. In an important respect, though, he felt the new pond cooperative was stricter: it had a written agreement in effect since its founding and all of the above matters were regulated each year. The old pond cooperative, on the other hand, dated back to the Tokugawa period but did not have a written agreement; except for the pond opening day and in-season water allocation, the members (more precisely, those with service area holdings over 0.8 ha) decided from year to year which of the other matters needed to be regulated. Nagata's explanation for this difference was that the water supply-demand balance was much tighter in the new pond service area.

In the Kakō Plateau area, too, Nagata explained the emergence of

individual water use as a consequence of farmers trying to rationalize their farm operations to take advantage of new commercial opportunities. Here, though, these were to be found not with new rice varieties and cultivation methods but in a growing commercial market for vegetables. The labor demands in the non-irrigated vegetable gardens competed with labor demands of spring rice work and in some places were forcing the abandonment of the highly labor-intensive field tilling and transplanting regulations of the pond groups.

One might suppose that the water users of the old pond service areas would have been more easily able to adopt individual, unrestricted water use procedures, but Nagata found instead more evidence of their adoption in the new pond service areas. His explanation, which a brief summary renders more improbable than it appears in full detail, was that for the very reason that the water supply of the old ponds was more plentiful and stable and enabled a more amicable and equitable allocation, their cultivator-water users felt less "motive power" than those of the new ponds to pressure for the relaxation of cooperative procedures that would permit more independent farm operations.

What in Japanese is termed "creek irrigation" (kurīku kangai) refers to special canal networks in a few, very low and flat deltaic areas of the country. The most notable example is Saga Plain, about 25,000 ha of paddy land in the most downstream section of the Chikugō River, the largest river of Kyushu. Nagata studied a section of Saga Plain as his third case of individual water use. Creek irrigation is said to have properties of both river irrigation and pond irrigation. It is a form of river irrigation in that a few main canals deliver water from the river to many small, man-made "creeks." However, there is virtually no grade and thus

little flow in these terminal "creeks." They do not fit the branching, gravity-flow channel pattern of usual Japanese river irrigation. In fact they more resemble ponds in so far as they function to store water for use in the paddy fields, all of which directly front on a creek. But unlike pond networks, the creeks are lower than the surrounding paddy land by .3 to 1.0 meters. Thus, there is very little control over intake and delivery possible, although the uniform flat grade insures a rather equitable distribution throughout the creek network. In such a situation, the central problems for irrigators are drawing up water from the creeks to their paddy fields and dredging the creeks to maintain proper depth and to obtain silt for compost and soil replacement. A special, highly labor-intensive rice cultivation developed in these areas, based on arduous foot-pedal pumping, continuous creek bottom dredging, careful tilling and bunding to reduce water seepage back into the creeks, and so forth. Nagata believed that these features of creek irrigation had themselves long fostered an individualist orientation in water use.

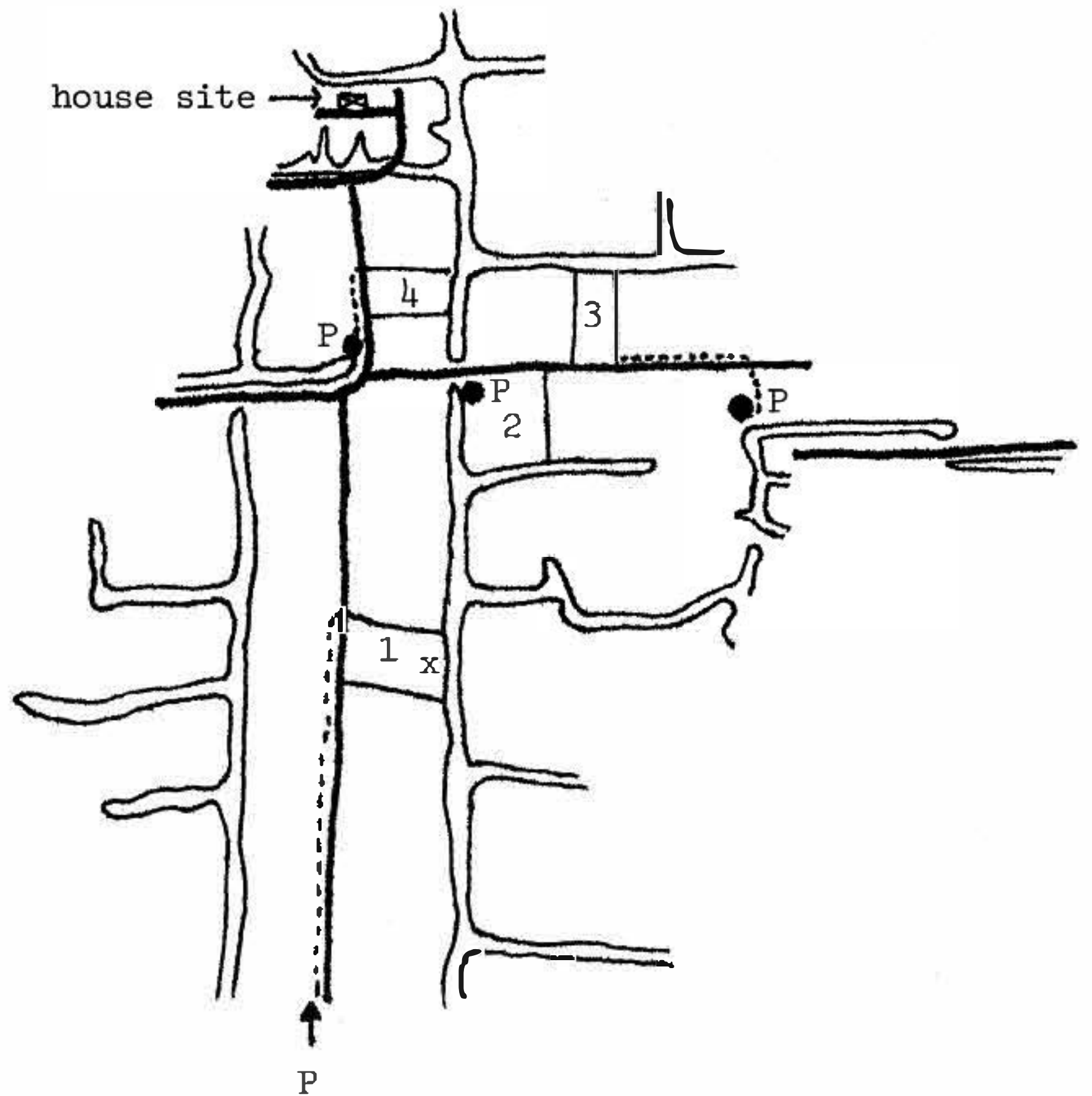
Saga Plain has figured prominently in the Japanese agriculture literature as the region thought to have the most advanced rice growing technology in the late 1920s and 1930s. The "Saga stage" was the term applied to conditions in that period, which began around 1920 with a shift from foot-pedal pumping to electric pumps. Pumping labor had always been the principal constraint on increased production in the creek area, and cultivators supplemented household labor with hired seasonal laborers from outside the region. By the 1910s and 1920s, however, alternative industrial and mining opportunities proved more attractive to the laborers, and the Saga cultivators faced sudden labor shortages. This, Nagata (and others) argued, prompted adoption of electric motor pumps. It

also led somewhat later to gradual reduction in creek bottom dredging as cultivators began to further conserve labor and rely more on chemical fertilizers for soil fertility maintenance. Nagata believed that this was a key to the high yields of the "Saga stage" period; with foot-pumping, the cultivators were so hard-pressed with the need for continuous pumping labor that there was no margin for regulation of field water levels. With electric motor pumping, careful manipulation of water intake and discharge was possible.

The pumps were generally installed under the aegis of an area irrigation cooperative and were placed along the creeks so as to supply water to a number of adjacent fields. The pumps were operated jointly by the cultivators of these fields who were often, Nagata added, residents of several villages. As Figure 1 indicates, a household would thus participate in a number of such pump groups. By the 1930s, some cultivators were supplementing this with smaller, individually-owned pumps.

The Saga Plain creek case does not really seem to illustrate Nagata's major contention that the "rationalization of farm operations" to take advantage of commercial opportunities was sufficient impetus for farmers to create new procedures for terminal-level operation/maintenance and allocation that would permit highly individual water use. Indeed, the cooperative pump groups could be interpreted as a step away from individual water use. Nagata anticipated the latter objection in the concluding comments in his book; he observed that in return for a modicum of cooperation among adjacent cultivators, each greatly improved his own capability to make the continuous water level adjustments necessary for higher and more stable yields. Maximum individual freedom of intake and

Figure 1: Paddy land parcel locations and access to pumps of one cultivator household in Saga Plain creek network. (Based on Nagata 1971:271)



field parcels:

#1 = .39 ha

#2 = .53 ha

#3 = .20 ha

#4 = .28 ha

field path

cooperative pump

individually-owned pump

pump-to-parcel delivery
channel



P

x



discharge did not imply a dissolution of all cooperative arrangements in delivery and drainage tasks.

Yet two questions remain unanswered by the three case studies of the book. The first is just what sort of organization for terminal-level operation/maintenance and water allocation is appropriate for maximizing individual water use. The general response in the literature, to which I believe Nagata would agree, is that any arrangements should represent voluntary cooperation among independent farmer households -- in contrast to the implicit compulsion of the kyōdōtai community. However, it is not clear from Nagata's book, nor from much of the other literature, just what form such cooperative arrangements should take.

A second problem concerns the relation of this objective of individual water use to other possible objectives of irrigation improvement policy, such as high productivity of water, environmental stability, etc. Individual water use has been a central objective of the "field reorganization" projects (hōjō seibi jigyō) that began in the mid-1960s and, since then, have received the major share of government agricultural project funding. These projects are a package of terminal level improvements, including enlargement of field parcels (typically to .3 hectare rectangles), complete separation of delivery and drainage ditching, widening of field access roads, and post-project holdings consolidation. They are often carried out after or in conjunction with canal network improvement projects that include canal straightening and lining, automated gating, etc. As a result, water delivered to a parcel is only used in that parcel; when drained, it is drained out of the network.

Such a water system greatly enhances in-field water level adjustment

and drainage, as required by the new varieties and new fertilizer-pesticide application techniques. However, water consumption rates have risen in many networks far above original projections, and, as the next section will suggest, mechanization, monovarietyecultivation, and increasing part-time farming have all contributed to concentrated demand peaks that have given rise once again to the need for rotation schedules. There are new demands inside and outside agriculture for more efficient and coordinated water use patterns. It is interesting to note that in his more recent articles (e.g. 1979), Nagata has written less about individual water use and more about these changing demand patterns, though he has yet to deal with their organizational implications. The problem, then, is one of having to compromise among a number of desirable but contradictory policy objectives; this problem has been insufficiently addressed in the literature.

Chapter IV

THE VILLAGE, THE IRRIGATION COOPERATIVE, AND THE LAND IMPROVEMENT DISTRICT

The Japanese agricultural village is typically a nucleated settlement surrounded by fields -- the mura of Tokugawa times when it was often designated as the lowest unit of domain administration and the buraku of modern times, after administration amalgamation has stripped it of many of its official roles. In the English-language literature on Japan, it is termed a hamlet, though 'village' is used here because it is the more frequent in irrigation research.

The village has been analyzed by Japanese researchers from a variety of theoretical perspectives, but chiefly in Marxian terms as a kyōdōtai pre-capitalist communal group (as discussed above). There have been other approaches too; for example, under the influence of American rural sociology, Suzuki Eitarō analyzed the village as a "natural village" based on Sorokin's "cumulative community" concept. Common to most analyses, though, is its description as a socially and territorially bounded corporate community; principal among its functions is said to be the management of water within its boundaries and its participation as a sub-unit in larger irrigation organizations formed to manage networks extending over several or many villages' paddy fields. These larger organizations went by various terms in the Tokugawa period, such as yōsui, igumi, and seki; following legislation at the end of the nineteenth

century, most reorganized into legally sanctioned "ordinary irrigation cooperatives" (futsū suiri kumiai) and more recently, after 1949, into "land improvement districts" (tochi kairyō ku). The nature of village control of water, the role of the village in the larger irrigation organizations, the structure of these larger organizations and the prospects of a continued irrigation role for the village have all been issues treated frequently in the irrigation literature.

One researcher who is particularly concerned with these organizational issues is Tamaki Akira. Tamaki is an agricultural economist by training, but he has written prolifically in the last two decades on historical and contemporary social patterns of Japanese irrigation. He did joint research with Nagata in the 1960s in the Saga Plain and lower Tone River "creek" areas and in the Kakō Plateau pond area. He has more recently collaborated with another economist, Hatate Isao, in several projects including an Institute for Developing Economies study on Asian irrigation and a 1974 book, Culture and Environment (Fūdo), which is a useful 'irrigation history' of Japan.

Expanding on Kitamura Toshio's work, Tamaki has stressed in a number of writings that the basic technical and social patterns of twentieth century irrigation were established in the 1500s and 1600s. These were the centuries when new flood control strategies allowed the development of the broad downstream plains that slope gently from alluvial fans formed where rivers come out of the mountains. The "alluvial fan type irrigation network" became the predominant Japanese network type, characterized by extensive, gravity-flow, branching canals from a river intake at the top of the fan down on to the plain. Due to the force of the river in the alluvial fan section, permanent intake works were seldom possible;

instead, temporary weirs were set across the river to divert water to a reinforced cut in the natural levee. Initial construction was often organized and financed by the shogunate or regional domain lords, who sought to increase their taxable land base through new paddy lands; an independent, small-holding peasantry emerged in these newly settled areas.

While major repairs and new construction was often subsidized and occasionally directed by the shogunate or domain, ordinary operation/maintenance of such a network was generally handled by an inter-village cooperative-- an alliance of villages, not individuals, with lands in the service area. Tamaki has distinguished between operation/maintenance of intake works on the one hand and of delivery-drainage canals on the other. The intake was an object of common interest throughout the service area, with expenses assessed and laborers mobilized from all service area villages as part of obligatory irrigation duties. But with delivery-drainage canals, concern (and neglect) varied with the significance of a particular canal or other works, that is, with its location and function. Upstream villagers showed little concern for downstream sections of the main canal, for example, and Tamaki argued that the scope of the facilities maintained through shared burden depended on the relative power of service area villages.

With allocation of water, the only common, service area-wide interest was in protecting the main canal's share of river water intake. Like most investigators, Tamaki identified within the network a fundamental upstream/downstream opposition; he insisted that this could never be fully resolved by the organization itself and occasionally required intervention by state officials.

Still, he claimed, intervention by state elites was seldom direct.

This was due to the multi-level, segmentary nature of the network organization, which had the effect of containing conflicts; upstream and downstream villages along a branch canal might have had serious disputes over allocation but that would not have prevented their joining together to protect allocation to the branch canal as a whole, when threatened by other branch canals. This segmentary organization made elite control easier because authorities had only to address those problems which could not be resolved by the top-level main canal organization. Moreover, given the branching canal layout, they could exert pressure on the whole service area merely by controlling the intake works, the pressure point so to speak. This was, Tamaki noted, a pattern of indirect control most appropriate to feudal authority.

Commonly, terminal-level operation/maintenance and allocation were left to the villages, which handled the tasks in a variety of ways -- through general roles such as the village headman or irrigation-specific roles, hereditary or filled by rotation or selection; maintenance labor was generally an obligation of all households, requisitioned per household and not in proportion to irrigated acreage. There were sometimes written village agreements specifying procedures and sometimes only oral understandings. Like Kitamura before him, Tamaki presented an idealized picture of the village as irrigation group. The literature still lacks studies that relate variation in terminal-level organization to ecological, political, and economic features.

Of course, the village as irrigation unit in the large alluvial fan networks was not an independent group (whereas it often was in the small pond networks). It existed only within the framework of the larger network organization, represented by village officers, and its procedures were

constrained by those of the larger organizations. To Tamaki, though, this embeddedness only intensified the solidarity and authority of the village as it sought to protect its interests in the larger inter-village arena.

In his 1974 book with Hatate Tamaki proposed that from at least the mid-eighteenth century the Japanese village had been characterized by a dual form of solidarity, a balance between "cooperation" and "communality." This was a departure from the kyōdōtai concept and implied a more positive evaluation of the traditional village. It probably owed something to Nagata Keijūrō, with whom Tamaki had collaborated and who had suggested the potential for individual water use in group irrigation relations, as discussed above. Tamaki argued that by the mid-1700s, there was an emerging commercialization of agriculture, as evidenced by the de facto recognition of private land ownership, the appearance of large accumulations by landlords, merchant-sponsored paddy land projects, etc. The village began to assume the character of a "cooperative group" of individual and independent producers. At the same time, though, in certain of its aspects such as water control, it retained its communal character. It was at once a "cooperative" group of separate farm operators, each producing for private profit and a communal group, in which individual interests were not defined and for which all residents worked in common.

Tamaki's assessment of the community was the reverse of the 'stagnation' pessimists; the community did not inhibit individual production but rather was essential for it. Land was only valuable and profitable as paddy land when it had access to water. Thus to the extent that the farm operator worked for the interests of the community he was also acting to further his own operation. Tamaki concluded that as long

as both the pursuit of private profit was possible within the village framework and the village was necessary for that pursuit, the village would remain a viable and essential unit of irrigation organization (see Kelly 1982a for a different assessment).

This indeed has been the case until quite recently, Tamaki continued. The village remained important even during the period of extensive large landlord holdings in the late nineteenth and early twentieth centuries. Because of the dispersed and fragmented field pattern, landlords could not monopolize and "privatize" water. They found it necessary to act as members and representatives of the village in the larger irrigation cooperatives -- not out of paternalistic altruism but out of self-interest. For that reason, the village remained the basic unit in the irrigation cooperatives.

Tamaki found, though, that since the late 1950s and early 1960s there has been a growing "hollowness" in the village as community and an increasing irrelevance to irrigation organization of the village unit. Large numbers of households have given up farming but remain resident in the villages; even among those who continue to farm, there are widening productivity gaps due to differential mechanization. These differences make it difficult to perceive a common welfare in irrigation as well as other matters.¹⁰ This has been compounded by the spectacular rise in land values due to industrial growth and urban residential development. The essential notion of "paddy land" -- valuable only in so far as it was articulated to a delivery-drainage network -- has been lost; paddy land is

¹⁰ See Dore 1978 and Smith 1978 for excellent English-language accounts of recent changes in two villages.

a valuable asset simply as a piece of land. One can now realize substantial private profit outside the framework of the village. Frustration with the "suffocating" restrictions of the village -- previously tempered by real benefits -- is more sharply felt.

As a result, it is difficult to attract people to positions of village leadership, formerly filled on the basis of prominence and influence. They are increasingly perceived as inconsequential and noisome tasks. Raising stipends has been tried, but more frequently villages have turned to rotation, lottery, or some other mechanical form of recruitment. This only contributes to further decline in the efficiency and prestige of village leadership.

Tamaki believed that the decline of the village community has had a significant adverse effect on terminal-level operation/maintenance. For example, villages find it increasingly difficult to requisition adult workers from all resident households for periodic cleaning and repair; those working at non-agricultural jobs are satisfied to send a child or elderly member of the household, increasing the burden on the declining numbers of full-time farmers. There have been basically two responses to this: introduction of a wage system (absentees pay a cash wage equivalent) and support for restructuring the terminal-level field ditching to reduce operation/maintenance requirements. The latter explains why the government's "field reorganization" program (kiban seibi jigyo) has been so welcomed by full-time farmers. Tamaki, though, has interpreted such measures as only further undermining the village as irrigation unit by increasing its irrelevance to the "pursuit of private profit."

In a 1976 pamphlet on "The Land Improvement District and the

Village," Tamaki considered in greater detail the effects of these and other changes on the land improvement district, the organizational form into which most of the older irrigation cooperatives were reorganized following the Land Improvement Law of 1949. He also predicted a number of difficult organizational problems emerging. LIDs in most of the major rice-growing areas have been faced in the 1970s with an increasing concentration of water demands in the field preparation/transplanting period (shitsuke-mizu or "planting water"), already the period of highest water volume demand. This has been due in part to mechanization, which shortens considerably the spring work period, and also to the spread of monovariety cultivation, a strategy promoted by the agricultural cooperatives and the prefectural extension agents for reasons of marketing and seedling culti-methods. It is compounded by the trend toward part-time farming. Spring Sundays are moments of feverish activity in most areas, and the water difficulties often experienced on those days are nicknamed "Sunday droughts" (nichiyōbi kanbatsu) by the farmers. As a consequence of these factors, LIDs face mounting shortages and strain on network facilities during this spring peak period.

For reasons outlined in other articles, Tamaki believed that the village as a unit would be increasingly ineffective in arranging and enforcing rotation schedules that might mitigate these problems. There is less consciousness of "village water" and more of "an individual LID member's water"; even the rapid spread of telephones in the rural areas has made it much easier for cultivator members to call directly to the LID office with complaints rather than going through their LID council representatives.

Tamaki in this pamphlet worried too that terminal level

operation/maintenance was fast becoming a burden for the LID office staff. In most areas, a formal or informal division of labor had been arranged whereby the LID (i.e., its paid staff) would assume responsibility for main irrigation-drainage facilities within a network (intake works, main canals, pumps, etc.) while terminal level operation/maintenance remained the responsibility of village units. Although the village has no formal standing in the LID organization (it is a membership organization of individual water user/cultivators), it has in fact remained important as an intermediate unit between member and LID office. However, villages are increasingly unable to mobilize residents for terminal level operation/maintenance, and this has become the most pressing concern of LIDs. Many LIDs, Tamaki believed, were quite anxious about having to widen the scope of their direct operation/maintenance responsibilities because that would require costly staff increases. The alternative-- projects to create simplified, labor-saving terminal facilities-- is also expensive, and Tamaki questioned whether LIDs had the political will necessary to raise member assessments. LID director and council representative positions are often of local political significance and elections are hotly contested. Raising assessments is never a popular position to support.

What Tamaki proposed was a continued separation of main level operation/maintenance and water distribution in the hands of some sort of autonomous grouping. Improvements in terminal level facilities would be made by these groups with low-interest government loans. A water contract system would be instituted in which LIDs would supply fixed volumes of water to the terminal groups of its service area.

The problem, he admitted, was how to organize such terminal groups.

The village was clearly no longer an effective unit, nor did part-time farmers show sufficient interest in careful water regulation. He concluded with some vague suggestions about "voluntaristic producer groups," but he was obviously as uncertain about future organizational patterns as Nagata and most others.

While Tamaki has long been interested in the importance of the village for irrigation, the perspective is the reverse for many rural sociologists. Yoden Hiromichi, for example, has investigated irrigation organization in several pond irrigation villages of Hyogo Prefecture and the Nara Basin in order to identify just how irrigation sustains a "village community." His use of this term is complicated because he has been trying to develop a theoretical construct that combines a version of the Marxist kyōdōtai with Suzuki's natural community concept. His emphasis has been on the social relations of irrigation rather than on the communal ownership of facilities. Common to his several articles has been the argument that the combination of a dispersal of holdings among a number of "field ditch groups" and several layers of cooperative irrigation groups creates a density of irrigation relations and an integration of water interests that in turn form the base of solidarity as a village community.

In one of the villages he studied, he found three named sets of small irrigation ponds: one set of three ponds, one of two ponds, and a third of a single pond (Yoden 1956; Yoden 1970 is a very poor translation of this). He unfortunately did not provide detailed mapping to determine why the village ponds were so divided, but it appears that a set was formed of those ponds that supplied a single main canal. From each of the main canals were a number of branch canals, which in turn supplied field

ditches. Organizationally, Yoden proposed a concept of "field ditch groups" of all cultivators with parcels irrigated directly or indirectly by a single field ditch (which he termed a mizo-gakari ta sei). Encompassing these groups were small work groups (sho-moyori) of all cultivators of parcels articulated to a single branch canal; these were the constituent groups of the larger "pond groups" (ike-moyori), formed for each of the three pond sets in the village. Each of the three pond groups handled pond repairs, operation/maintenance, and water allocation within its network and mobilized the branch canal work groups. Each pond group had an executive committee, under which was a "water distributor" and a "group accountant." Finally, the village council served as a venue for consultations among the pond groups; it also fixed the transplanting schedule for the whole village and distributed funds from the village treasury to the three pond groups (details of which he does not provide). It was not only this four-layered and "cumulating" structure of groups but also the fact that most cultivators had parcels and were thus implicated in a number of field ditch groups that together explained the solidarity of the village as a community.

In a recent short article on "Water and the Village" (1975), Yoden added that his earlier studies were not meant to imply the existence of smooth and conflict-free irrigation relations with the village. That would have been a reasonable conclusion because he rarely mentioned the potential for conflict, but in his most recent discussion, he emphasized that such conflicts as occur are effectively contained. Dispersal of holdings apparently fosters a concern for equal water distribution and the several layers of organization provide a framework for resolving lower level problems in a higher level group. These speculations, though

plausible, were not supported by evidence; as with much of the literature, Yoden's cases are rich in descriptive detail but lack primary observational data.

An exception to this is the monograph by the rural sociologist Kakizaki Kyōichi on "The Village and Irrigation Procedures" (1964). Its value is further enhanced by the fact that it deals with Niiike, the Okayama village studied by the University of Michigan team of Beardsley, Hall, Ward, and others in the early 1950s (sections of their Village Japan dealing with irrigation have been excerpted in Coward 1980). Kakizaki was a member of the Japanese research team that came to Niiike after the Michigan study to follow the introduction of small-scale agricultural machinery into the village, sponsored as a pilot program by the Asia Foundation. Their final report (Okada and Kamiya 1960) has never been translated into English, but with Village Japan, the two constitute the most detailed case study of social change and agricultural development in rural Japan for 1945-1960. Kakizaki, a fieldworker in the village for three years from 1956-1959, prepared a separate monograph on irrigation from his daily journal, and it is a valuable supplement to the Village Japan materials on irrigation.

Niiike was an especially interesting situation because paddy fields within its boundaries were irrigated from three separate networks -- the 5300 hectare Jūnikagō (12-Gō) river-canal network; a multi-village pond-canal network serving 49 hectares; and a small pond-canal network serving about 4 hectares within Niiike itself. Households had lands dispersed among two and sometimes all three of these networks. Kakizaki discussed the features of each network, adding some details to the discussion in Village Japan, and then presented notes of actual meetings

(e.g. a meeting to fix the pond opening date for Taishō Pond), details of water flow and allocation in several field blocks, and a record of water distribution in one field block during the days of June 19-21, 1957 (the start of transplanting in that block during an unusually dry, low water year).

Like Yoden and others, Kakizaki found irrigation groups to be formed from those households which cultivated parcels in a certain canal service area in order to coordinate water distribution and operation/management of the shared facilities. That is, irrigation groups were formed along canal lines, and as most households had parcels in several networks, they belonged to several irrigation groups. But where Yoden saw the village as the apex of several, progressively wider and more encompassing levels of such irrigation groups (and thus its "communal solidarity" the product of internal organization), Kakizaki traced the village's cohesion as an irrigation unit to its external relations. In most cases (Yoden's example being very much the exception), the village was not the largest of a set of nesting organizational boxes of irrigation groups; the territorial and social boundaries of the village only imperfectly fitted the land holding patterns of its residents and the canal networks that irrigated its lands. Nonetheless, because the village was a prominent social and political unit in the Japanese countryside (for various historical reasons that have little to do with irrigation) and because most irrigation networks extended over at least several villages, the village became a convenient, if only approximate, frame for defining common interest and responsibility. Kakizaki's notes of Taishō Pond committee meetings illustrated village leaders (typically the village headman) representing as a single unit those of their village lands that were within the

network.

On the terminal level, though, the village was often an irrelevant unit, and Kakizaki found rather complex patterns of cooperation and conflict. Because of exceptionally low water levels in the ditches during the three day period of water distribution in one Niiike field block for which he provided a record, most of the cultivators with parcels in the block brought out portable vertical pumps, powered by small kerosene engines, to get water into their parcels for transplanting. There were no established rotation procedures and Kakizaki tried to identify the types of ad hoc cooperative arrangements made between some of the cultivators to share pumps and the kinds of tensions that arose between others. For example, if two cultivators with parcels near one another along the same ditch both tried to set up separate pumps, one or both would have difficulty drawing in water. Kakizaki observed a tendency for adjacent cultivators in such situations to share pumping (that is, to set up one pump in the field ditch and run water through one field to another), but such arrangements were much more frequent between main and branch households and among other kinsfolk and friends, regardless of village residency, than between those without such ties. Apparently, positions in upper-level irrigation groups did not carry advantages at the terminal level; a Niiike pond committeeman trying to fill a parcel for transplanting was kept waiting for some time by someone from a nearby village who was irrigating a parcel just upstream of the first and in which transplanting had already been completed.

While one can find details of village-level irrigation throughout much of the rural sociology and agricultural history literatures, scholarly case studies at the irrigation cooperative and land improvement

district levels are much more unusual. There is, however, a genre of studies that has become a most important source of irrigation organization data. This is what one might call the 'commissioned history,' the study of a particular irrigation cooperative or land improvement district, written under contract from the organization by an outside researcher. I would estimate that such commissioned histories easily number over five hundred, from cooperatives and LIDs all over Japan. They would appear to be funded for a number of reasons: in the course of disputes over water use and rights with other users, an organization may see such a volume as documenting existing conditions or recording the negotiations; at the time of organizational changes, usually at the transition from irrigation cooperative to LID, an organization may wish to create a historical record; or at the completion of a major project, such as a headworks unification bringing together a number of previously separate networks, the new organization may commission a volume to record previous conditions and the course of the project.

These commissioned histories vary greatly in quality, of course. Some are multi-volume projects by eminent scholars or teams of knowledgeable local researchers; others are less well-funded and less ambitious. All tend to be chronological in design, offering little interpretation or analysis, and many include large numbers of primary documents. It is this last characteristic, especially, that makes them valuable as data sources.

One of the more scholarly and analytical of these studies was that done by a team of five researchers under Ishikawa Takeo of Iwate Prefectural University of Sannōkai LID in that prefecture (Ishikawa 1972). In 1971, Sannokai LID had 3327 member households and served 3888 hectares

of paddy land. It composed roughly the alluvial fans and downstream plains of two parallel rivers that run west-to-east as tributaries of the large north-south Kitakami River. It had been formed in 1951 as a consolidation of five smaller cooperatives to manage a large headwaters dam (which was completed in 1952 to provide supplementary water storage) and a set of three main canals below the dam, which brought together a number of formerly separate canal networks. The study traced irrigation practices and organization in the centuries prior to the dam project (section one); the course of events leading up to the project and the formation of the LID (sections two and three); present organization within the LID for facility operation/management and water distribution (section four); and changes in farming patterns in the two decades since the project (section five). The value of the study to the Western investigator is enhanced because it complements an English-language study dealing with the same area, done in 1968 by Shimpo Mitsuru (Shimpo 1976). The Shimpo study emphasized the leadership of the local agricultural cooperative in promoting new farm management techniques, while the Ishikawa study concentrated in much greater detail on the nature of irrigation changes and their impact on farmer organization and farm practices. Shimpo did include an opening chapter on local irrigation; however, he only dealt with one area of the LID and his account contains some inaccuracies of detail.

As with many of the large alluvial fan/plains areas of central and northeast Japan, major irrigation and paddy land development of the Sannokai area did not occur until the early 1600s following the establishment of the Tokugawa shogunate. In this case, an interesting set of circumstances led to an early written agreement about irrigation

procedures. Upon the death of the regional domain lord, the Tokugawa shogunate in 1664 ordered that the domain territories be divided between the former lord's oldest and second sons, creating a main-line domain and a branch-line domain. The branch-line territories were deliberately distributed among the main-line lands. The branch domain was given the lands between the two major rivers of the present Sannōkai area; those lands to the north of the northern Takina River and to the south of the southern Kuzumaru River became main domain territories. As a consequence, an understanding was signed between the two in 1672 that in effect codified details of main canal allocation and operation/maintenance along the rivers.¹¹ These, the Ishikawa volume argued, remained in effect, with one allocation adjustment in 1895, until the dam's opening in 1952.

Along both rivers, the earlier, upstream canal networks enjoyed advantageous intake rights. Along the Takina River, for example, there were twenty-seven intakes to main canal networks, serving altogether about 950 hectares. With specified weir structures, the nine upstream networks drew out all the surface flow of the river; the ninth set out an earth and stone weir completely across the river. The lower eighteen, with about one-third of the total service acreage, were left to rely on leakage and on an underground stream flow just below the surface of the river bottom. Within the upper nine networks, there were frequent disputes between the #2 network, the largest single network, which irrigated most of the left-bank main domain lands, and the seven networks below it, #3-#9, which

¹¹ This agreement established domain boundary markers along the rivers, registered existing main canal intakes, specified intake methods and structures, prohibited new river intakes, restricted water use in new paddy lands, etc.

served mostly the right-bank lands. Within each main canal, there was a further differential distribution of water. Along #2 Main Canal, for example, the upper twelve branch canals had continuous drawing rights; the middle branch canals rotated water intake during the daylight hours; and the lowest three branch canals rotated water intake during the nighttime hours (that is, each drew water every third night). Within each branch canal, too, there were certain field blocks with special intake rights. There were similar patterns of differential distribution within the Kuzumaru River basin.

Water rotation and network operation/maintenance within most main canals was managed by a "water chief" system. For each branch canal or sometimes for each rotational group of branch canals, there were one or several "water chiefs" (mizu-gashira), who supervised rotation and canal maintenance within that section. From among these water chiefs a "main canal chief" was selected, who apparently represented the main canal in river-level matters. The water chief posts were generally hereditary positions held by old households with large land holdings. The same households sometimes also held village officer posts, but the Ishikawa study did not indicate any direct role for the village in branch canal irrigation tasks. It is interesting to note that in this region villages were usually dispersed rather than nucleated settlements, but it is necessary to go back to the primary sources, which were unavailable for this review, to draw any conclusions about village units in the traditional, pre-dam irrigation organization.

Sections two and three of the Ishikawa study dealt with circumstances surrounding the dam construction and LID formation. Downstream cultivators had lobbied for a headwaters dam since the 1920s, but their

efforts foundered on the protests of upstream irrigators, who objected to the expense and possible rearrangement of river water allocation. This conflict was finally resolved by a complex, eighteen-grade project fee schedule that offered upstream irrigators much reduced assessments. After the project, when a single LID was formed from five pre-existing cooperatives, downstream members successfully demanded that future projects and all operation/maintenance expenses be assessed on a uniform, per acreage formula.

Section four detailed network operation/maintenance within the LIDe Network facilities were divided into three classes. Class I was the dam and the main canals, for which the central LID office staff managed both facility maintenance and operation (that is, water distribution) The LID handled water distribution to the branch canals, the class II facilities, but branch canal maintenance was handled by "water use regulation groups." Both operation and maintenance of all class III tertiary canals and terminal ditching were managed by these local water use regulation groups. The class I and II canals were divided into seven zones, each with a gate-canal watchman, hired from among that zone's memberse Technical personnel in the operation/maintenance section of the LID office oversaw a dam watchman and the seven gate-canal watchmen. During the season the latter reported on zone water conditions twice daily to the operation/maintenance section chief, from whom they received instructions for adjustments; they also had the authority to make adjustments on their own, subject to subsequent office approval.

Still, shortages remained in some downstream areas. Despite a principle of equal distribution per unit area, in-transit losses were (perhaps deliberately) underestimated. Several downstream areas joined

two other adjacent LIDs or installed pumps to draw up underground water, but these only increased their financial burden and further undermined the 'equal allocation' principle of the LID. The Ishikawa group believed that these problems might be addressed through joint projects with adjacent LIDs, but they saw no indication of an interest in such cooperation.

Because of these problems, the LID office staff and council of member representatives attempted to organize members into "water use regulation groups" to handle terminal-level operation/maintenance and to set up allocation schedules. Canal and terminal-level projects since the 1950s had greatly altered network lines, so the LID used this as an opportunity to reorganize and consolidate the old groupings into 11 large zone groups. Each had between 160 and 740 members, electing a 20-40 person council from which 5-8 executive officers were selected. The Ishikawa group observed that the village was frequently the unit of representation. The LID attempted to delegate maximum responsibility for intra-zone allocation to the group. During drought periods, there were special LID-wide allocation procedures to direct water to needy zones; the authority to declare such a period rested with a committee of the eleven water regulation group heads plus the LID director who oversaw water distribution matters.

Ishikawa and colleagues ended this section with a description of a village that was functioning as a sub-unit of one of the zone water regulation groups. It was cited as an example (and, one might hazard to speculate, an unusual example) of the benefits of terminal-level cooperation in promoting mechanization and regulating water flow. To avoid competition among households in obtaining exchange labor for transplanting and to make more efficient use of jointly-owned tractors, the village had established an order in which households did tilling and

transplanting. The sequence was regulated by means of a planting water allocation schedule. The Ishikawa group (and the LID office) felt that this represented an optimal model for terminal-level organization, and it does seem to have fit both Nagata's and Tamaki's prescription for voluntaristic cooperation among households to maximize individual water use. I have not been able to locate for this review any later reports on the Sannōkai LID (other than a 1975 article by Ishikawa himself that essentially summarized several sections of the book), and thus it is not clear if this village pattern has been adopted elsewhere in the LID or even persisted here. But because it seemed to be primarily motivated by the need to share efficiently the jointly-owned tractors and to regulate transplanting labor problems, it is doubtful that this water user pattern could have survived the widespread adoption of individually-owned tractors and transplanting machines in the mid-1970s and late 1970s.

Chapter V

IRRIGATION ORGANIZATION ELSEWHERE IN ASIA

Most Japanese social scientists working on irrigation topics have concentrated on irrigation in Japan. Compared to that extensive literature, their work outside of Japan has been quite limited. Nonetheless, there has been some significant research on irrigation organization in other parts of Asia, especially in the last two decades. This section will introduce two rather different lines of research, irrigation in historical China and in contemporary Southeast Asia.

Considerable numbers of Japanese historians specialize in China, and since the initial "Asiatic mode of production" debates of the 1930s, they have been much more sensitive to questions of water management in Chinese society than their Western colleagues. They have largely handled these questions in the context of debates on the nature of Chinese society within Japanese Marxist historiography (see Masubuchi 1966 and Grove and Esherick 1980 for English-language analyses of this literature). Thus in this literature, too, the "irrigation community" has special connotations. For example, an influential 1956 article by Toyoshima Shizuhide argued that the groups that built, maintained, and allocated water within irrigation networks in northwest China had the characteristics of "German-type irrigation communities" (with internal relations of equality) rather than "Asiatic-type irrigation communities" (with hierarchical internal relations). He implied that these irrigation communities were in fact village communities and that the historical

communality of terminal-level operation/maintenance and allocation had paved the way for recent socialism. This contradicted the prevailing view among Japanese historians, who saw the Chinese village community as the communal arrangements (including water control) by which the gentry landlords perpetuated their domination of the peasants. Toyoshima's article prompted responses in 1960 by Miyasaki Hiroshi and by Ebara Masaaki, both of whom disputed this characterization of Chinese irrigation groups. They argued that such groups were internally hierarchical and that because possession of water rights was the criterion for membership in irrigation groups but was not automatically extended to all village residents, irrigation groups were not coterminous with village units. This debate on Chinese irrigation groups continues today, and since the mid-1960s, interest in these issues has been sufficient to support a small journal, Research on the History of Chinese Water Utilization (Chūgoku suiri shi kenkyū).

Perhaps the leading scholar on organizational aspects of Chinese irrigation is Morita Akira, whose 1974 volume was a revised collection of previously published papers on water control in the Ch'ing period (1645-1912; see Elvin 1975 for an English-language review of this volume). Morita distinguished several technical arrangements for water control: river irrigation networks, pond irrigation networks, protective water works (e.g., sea walls), and drainage and reclamation works (polders and polder dikes). He offered a wealth of descriptive data on how various water control tasks were carried out (or were supposed to be carried out) in particular networks at various points in time, but unfortunately the data were not brought together in an analysis relating general patterns of management to the different types of water control networks. He did offer

the conclusion that there was a gradual decline in landlord involvement in later water control and irrigation groups during the Ch'ing centuries and that the groups tended to become more autonomous cultivator organizations. He attributed this to the increasing dispersal of landlord holdings; landlords were thus less knowledgeable about local water control conditions and arrangements in all the areas of their holdings and more able to avoid levies and assessments for repairs and operation/maintenance. In one of his extended cases, Morita showed how the villages in a fairly extensive irrigation network became, over time, its organizational units, but he declined to offer a resolution to the general question of how significant villages were in Chinese irrigation.

The work of these historians is important for its documentation of traditional patterns of irrigation organization, but probably of greater relevance to present-day concerns is the Japanese research on contemporary irrigation organization in Southeast Asia. This is fairly recent in origin and includes policy-oriented studies in agricultural development and more basic social science research on patterns of rural social organization. Much of this research is associated with three institutions: Kyoto University, especially its Center for Southeast Asian Studies, an interdisciplinary center begun in 1964; Tokyo University, especially researchers at the Oriental Culture Institute and in the Faculty of Economics; and the Institute for Developing Economies (Ajia Keizai Kenkyūjo) in Tokyo, which has supported some of the projects at the above two universities as well as organized several projects dealing with irrigation within its own active research program.

The major project at the Kyoto University Center for Southeast Asian Studies in its first ten years was an extended study of Thailand, which

brought together natural and social scientists to explore the physical environment and political economy of agriculture and agricultural development in that country. Among the scholars whose work touched on irrigation organization were Mizuno Kōichi (anthropology), Tomosugi Takashi (anthropology and cultural geography), Tanabe Shigeharu (geography), Takaya Yoshikazu (geography), and Ishii Yoneo (history). Thailand: A Rice-growing Society (original, Ishii 1975; English translation, Ishii 1978) was something of a final report on the project (though Thailand research at the center continues). It contained revised versions of a number of articles previously appearing in the center's journal, Tōnan ajia kenkyū, including an overview of Thai irrigation by the agricultural engineering scholar, Kaida Yoshihiro, chapters by Ishii Yoneo and Tanabe Shigeharu on the historical development of rice cultivation, canal construction, and land reclamation in the Chao Phraya delta, and a chapter by Takaya Yoshikazu.

Of particular interest to irrigation researchers has been the work of Takaya and Tanabe. Based on his extensive research on Thailand with the center's project, Takaya has been working for some time on an "ecological model" of Southeast Asian rice-growing regions. His model has undergone some changes (compare his 1975a and 1975b articles; three articles appear in English: 1975c, 1977, 1978), but essentially it is based on a hydrological-physiological typology of the "Southeast Asia-type river basin." In his 1975a article, he divided such a characteristic river basin as the Chao Phraya into three sections: the mountainous sections of the upstream tributaries; alluvial fan sections, including those formed in intermontane basins; and a broad delta flood plain (further divided into an upper and lower section). He then spelled out the implications of each

for irrigation. In the mountainous tributary sections, there are only very limited connections among cultivator-water users because each of the small tributaries is hydrologically distinct; there is thus little need for coordination and little cause for conflict.

In the alluvial fan section, though, opposite conditions prevail; all canal networks tend to have intakes along the river near the top of the fan so potentially all irrigators are connected in a single web of mutual interest and conflict. In both the mountainous tributary and alluvial fan sections, however, there is the opportunity for careful water regulation through water control and delivery works.

The delta is characterized by long periods of inundation, but there are crucial differences between its upper and lower sections. In the upper delta, the river has often formed natural levees, upon which human habitation is possible. Water transport and fishing are possible in the flooded areas, while rice can be grown in the swamp land behind the levees. Compared to alluvial fan conditions, of course, there is much less opportunity for water control. In such an environment there is no need for water user organization as water naturally flows to one's fields in the flood season. The flooding itself is too extensive to control with traditional technology, nor can shortages be managed. Little cooperative work in irrigation-drainage tasks is possible, nor is enforced labor effective.

In the newer lower delta sections, there are no such natural levees and for several months everything is inundated, making the area uninhabitable. On the other hand, though, without levees, there is little to contain the flood waters; they spread over a wider area to a much shallower depth -- about 0.5-1.0 meter as compared with depths up to 3

meters in the upper delta. Thus if only settlement were possible the conditions are actually more favorable for tropical rice.

Takaya argued that with major capital and labor investment, lower delta development is not difficult. What is needed is a canal network for transport and drainage, the banks of which would provide house sites. This was, he said, what happened in Southeast Asia in the late 1800s when the lower deltas of the European colonies and Thailand were transformed into "rice plantations."

Still, like the upper delta, cultivators in the lower delta can only passively adapt to the flood cycle. There is none of the rigidity of water allocation discipline and organization for operation/maintenance that is conspicuous in the alluvial fan areas, and people are more independent. Settlements are linear, without a territorial center, and boundaries are indistinct, making formal organization more difficult to sustain. But then until quite recently there has been little hope of raising yields through water control anyway; rather, efforts were directed towards improvements in rice varieties through experimentation. Delta cultivators, Takaya has noted, are agronomists in orientation, while alluvial fan cultivators are engineers! However suggestive, Takaya's model has been criticized for its implications of hydrotopographical determinism, but he claimed to find support both in the example of Japanese irrigation development and in the historical research of Tanabe (1973) and Tomosugi (1966) on Thailand. Tanabe (1973) in particular has tried to trace the developmental sequence of the canal networks in the Chao Phraya delta from about 1350 to 1900, showing how different types of canal construction (for military, commercial, and irrigation-drainage purposes) were related to topographical variation in the basin, the

shifting balance of state authority and commercial elite wealth, and the international economy.

Tanabe (who went from Kyoto University to become a researcher at the new National Ethnological Museum) also conducted in 1975 one of the few Japanese ethnographic studies of traditional Southeast Asian irrigation (Tanabe 1976). His site was a narrow valley of the Chiang Mai basin, in which there were four separate small canal networks with diversion weir intake works along the river. They provided irrigation for rainy season rice cultivation for service areas of 48 to 96 hectares. This was principally subsistence cultivation of glutinous varieties with only a small minority of fields planted in commercial non-glutinous varieties.

After discussion of the ecological zones of the Chiang Mai area, details of the rice cycle and cultivation techniques, and a sketch of the history, land holding, and tenancy patterns of one of the valley villages, Tanabe provided a well-documented description of the weir-canal network in which most of that village's lands were found. The gradient of the river at the intake point was steep enough to require a pair of diversion weirs set across the river; these were made from thousands of wood stakes, driven close together into the river bed and along the river banks. A gated intake led to an unlined main canal, from which several branch canals took off at concrete reinforced division points. There was a fairly well-developed terminal-level ditching. Most of the fields had direct intakes from the field ditches.

Tanabe argued that the topography of the valley prevented expansion of crop land beyond the available river supply and that rainy season allocation was not a serious problem; there was continuous flow in the canals, with no need for low water rotation procedures. Rather, it was

maintenance of the weirs and canals that required the close and concerted attention of all service area water users. The weirs required major repairs at the beginning of the wet season cultivation; they were constructed from a total of 780 1.5 meter stakes and 24,000 1 meter stakes plus several logs; materials for sections requiring replacement were requisitioned from all service area water users in proportion to acreage cultivated; one adult per household had to participate in the weir repair (two days) and in canal dredging (usually two days). Minor maintenance was also required before the start of dry season cultivation.

There was a named, formal "weir group" of all cultivators using network water, from which a "weir group headman" was elected. The position demanded considerable experience in the hydraulics of the network and was generally held for 10-20 years by a man who was one of the larger land holders in the service area and who frequently doubled as administrative village headman. The weir group headman directed the weir and canal maintenance and was responsible for daily operation. He made all adjustments in canal intakes, but terminal field intakes were regulated by each cultivator.

The weir group headman appointed a diversion weir guard (literally, "father of the weir"), frequently a person who lived close to the intake, who supervised weir repairs and inspected the weir and main canal daily. The diversion weir guard also conducted the Weir Spirit ritual at the end of all repair projects. Following a simple ritual at the Weir Spirit Shrine, food offerings were placed at five locations around the weirs.

The organizational pattern Tanabe described is similar in many respects to that Moerman (1968) had earlier presented, though here the posts of irrigation headman and administrative village headman were

generally filled by the same individual and Tanabe did not mention any village council working in tandem with the headman. The case would appear to illustrate, too, what Coward (1980:205-6) describes as the "accountability model" of traditional irrigation leadership. It is an exceptional case in its richness of detail, sensitivity to ecological setting, and attention to historical development.

The principal conclusion that Tanabe drew from the case was that the substantial cooperative labor necessary to maintain the weir-canal network created a high degree of communality which was symbolized by the Weir Spirit ritual and which supported a cohesive, "tightly structured" village (a la Embree). It should be clear from this review that communality is a highly charged term in the Japanese literature, especially in conjunction with village organization. In this case, though, Tanabe's own detailed material raises three points that cast doubt on an easy equation of village and weir group.

The first is the problem of what should be the ethnographic referent of 'village.' The "tightly structured" village that Tanabe wrote of was the muban, the administrative village. There were four of these in the valley, together forming an administrative village group, a tanbon. But each of the muban was composed of several nucleated hamlets or ban. The three hamlets of Muban Nōng Pāman, which Tanabe studied, were settled by captive Lü, who were forced to colonize the area between several existing Thai Yuan hamlets at the beginning of the nineteenth century. Each had a hamlet spirit shrine and shared a single temple wat. Nōng Pāman was organized as an administrative village about 1916.

Second, the degree to which weir organization communality supported ban or muban solidarity is not clear. There were in the valley four

weir-canal networks and four muban administrative villages, but Tanabe indicated that there was much overlap between village residency and weir group membership. When first settled, two of the Muban Nōng Pāman hamlets had joined to dig a new canal network, while a third opened lands irrigated by one of the existing networks. Weir group membership, landowner-tenant relations, and cultivation patterns had continually changed over the past 150 years and they would seem to have been related to residency, religion, and ethnicity in complex ways. The case seems to be more illustrative of Geertz's model of Balinese rural social organization as a set of "planes of organization" with rather subtle political, economic, and social points of intersection that, in the case here, remain to be identified.

Finally, there was some suggestion of at least potential divisiveness within the "communal" weir group itself. There were apparently ad hoc work groups formed along branch canal and field ditch lines during the canal dredging. There was also another intra-weir group distinction between the "year beginning group" of water users who cultivated rice during the wet season and a "dry season group" of cultivators who used network water in the dry season for commercial crops like non-glutinous rice, tobacco, and soybeans. There were different fee and labor assessment procedures for the two groups,¹² though the weir group headman was a year-round position. All major repairs were done before the wet season irrigation. At the time of the study, Tanabe reported there were 90 members of the wet season group and 142 members of the dry season

¹² Wet season group users paid a fee in rice at harvest time in proportion to acreage, while dry season group users paid a fee in cash according to both acreage and type of crop.

group reflecting a tendency of land owners to tenant out small parcels of land to agricultural laborers for dry season cultivation. He did not say how many persons belonged to both groups, but he did note that dry season cultivation of irrigated crops had only recently become popular. Within the wet season group there was also a recent enthusiasm for replacing glutinous rice cultivation with commercial non-glutinous rice cultivation. Tanabe did not report any conflicts arising from different water use patterns of the wet season rice varieties or of the several dry season crops nor did he relate any local demands for physical network improvements or procedural reform. However one might anticipate growing differences in support for such improvements between and among wet and dry season groups that would threaten the cohesion of the overall weir group.

In addition to its Thailand research projects, the Kyoto University Southeast Asian Center has also sponsored projects in Malaysia, including a comparative study of three villages by two anthropologists (Kuchiba Masao on a Kedah rice-growing village and Maeda Narifumi on a Melaka rice and rubber village with high levels of seasonal out-migration) and a sociologist (Tsubouchi Yoshihiro on a Kelantan village). The original Japanese report (1976) has recently been issued in English translation (1979). The project was particularly concerned with the relationship of Malay bilateral kinship organization and historical land use patterns, religion, and value systems. Following the three village cases in the report was a section on "technology and the social environment." This included a chapter by the Kyoto University hydrologist Kaida Yoshihiro on technical details of the Muda, Kemubu, and Besut Projects, but there was little integration of the irrigation material into the village studies themselves.

In a separate article, however, Kuchiba offered a more general commentary on "Water and the Village in Southeast Asia: Irrigation and Communal Organization" (1975). In this article he proposed a revision of Embree's "impressionistic" notion of loosely and tightly structured social systems (well-known in Japan) by means of Takaya's ecological model of rice-growing zones. Is not, he asked, the "looseness" of Southeast Asian societies related to ecological characteristics? He observed that support for Embree's notion came from delta areas and from areas where cultivation was not restricted by seasonality of precipitation or cold winter temperatures. From Takaya's point of view, these were areas where organizational cooperation for irrigation was ineffective and largely absent. It was rather in the alluvial fan plains and basins where a high degree of cooperation was necessary for irrigation and where one might thus expect tightly structured organization.

Kuchiba then turned to a rather cursory recitation of various Southeast Asian village studies representative of Takaya's several zones. He concluded that indeed there was a tendency for intermontane basin and alluvial fan areas to exhibit a tightly structured social order. On the other hand, deltaic areas of Thailand, central Luzon, and Kedah supported Embree's description of loosely structured systems in which there were no strong social pressures for associational affiliation and few coextensively bounded and mutually reinforcing organizations. He argued, though, in a final section that even the high degree of organization in the former areas did not equal that characteristic of Japanese alluvial fan type networks. This was because in Japan the corporate character of the village was much stronger, reinforcing in turn the solidarity of the irrigation group.

Interestingly, there has been another comparative village study of three Malaysian villages, this one by a group from the Faculty of Economics at Tokyo University that included Ōuchi Tsutomu, Takahashi Akira, Horii Kenzō, Saeki Naomi, and Tanaka Manabu. The final report was issued in Japanese and in English translation (Ōuchi et al. 1977). Three villages (kampong) with varying intensities of irrigated rice cultivation were selected for a study of the impact of government-sponsored technical innovation (principally in the form of physical irrigation improvements). One of the villages, in Perlis, was within the Muda scheme, while a second, along the eastern coast in Pahang, was part of a smaller government irrigation project; a third village, also in Perlis but to the north of the first village and outside the Muda scheme, was served by a largely unimproved small-scale network. They found in the government project areas an overinvolvement of administrative personnel and a lack of farmer participation and recommended autonomous associations of farmers on the Japanese model of land improvement districts. They recommended too that attention be shifted to drainage improvements to allow more careful regulation of field water levels. They proposed projects for "adjustment of agricultural foundation" (kiban seibi), that is to say, the adoption of the Japanese project package of terminal ditching, field parcel consolidation, soil conditioning, etc. Their suggestions were in essence for policy changes and administrative reorganization within the context of large-scale government projects. However, the apparent success of locally initiated measures to build canals and expand double-cropping in Takahashi's Beseri Dalam, the one village yet outside of government projects, suggests that more decentralized, small-scale programs might prove effective.

In addition to the Faculty of Economics, the Oriental Culture Institute at the University of Tokyo has also sponsored work on Asian irrigation organization. Takahashi was attached to the Institute when he did his central Luzon study, and Ōno Morio, an expert on Asian village society, has led a number of field trips to study irrigation and agriculture, especially in southwestern Asia. A recent monograph from one such trip by Gotō Akira dealt with "Water and Agriculture in Iran: Patterns of Irrigation Agriculture in the Marvdast Region" (Gotō 1976). Gotō examined in great detail the socioeconomic effects of several technical irrigation changes on the Marvdast Plain. In one area, following one of the land reform programs, there was a switch from traditional river and qanat sources to private electric pump wells, significantly raising land productivity for those "modern agriculture practitioners" (middle to upper level cultivators) who moved quickly to adopt them. Elsewhere on the plain, Gotō described changes in traditional allocation procedures in river-canal networks following government construction of a large-scale dam and introduction by the government of a water purchase plan.

The Institute for Developing Economies, through its own research staff and with outside investigators, maintains an active research program, although organizational aspects of irrigation do not appear to be one of its principal interests. It did sponsor a one-year project followed by a three-year group research in 1971-1975 on "Asian Irrigation and Village Society," the final report of which was published as Asian Irrigation Agriculture (Fukuda 1976). The report consisted of two engineering articles, by Fukuda Hitoshi on characteristics of Asian irrigation systems and by Kimura Takashige on problems of irrigation

development policy in Asia. This was followed by two rather theoretical articles by the economists Tamaki and Hatate. Both have been published separately in English-language translations by the Institute (Tamaki 1977 and Hatate 1978).

Hatate's article was a sketch of various forms of state elite and landlord involvement in Tokugawa period irrigation; as it treats only Japanese irrigation, it is not clear what lessons were meant to be drawn for Asian irrigation. He attempted to show how, after the early contributions of state authorities in flood control and paddy land development, several types of landlords emerged. He argued that landlords in the early and middle Tokugawa period were village elite who tended to promote village interests and protect them against demands of the state elite. However, by the 1800s, landlords were commercial elite increasingly absent from the villages and pursuing their private interests to the detriment of the village. This progression of landlord types is at odds with most of the literature; Ronald Dore and Thomas Smith among Western scholars and Baba Akira and Tamaki Akira among Japanese scholars have demonstrated that a range of landlord types emerged and persisted into this century, playing prominent innovative roles in adoption of new methods and sponsorship of irrigation and paddy field improvement projects.

Tamaki's contribution to the volume was a brief speculation on the causes of stagnation in Asian agriculture outside Japan (Japan, he believed, had experienced continuous development), and a plea for "decentralized irrigation systems" in future policy planning to "revitalize Asian community structures. He was vague on the details of such systems, though he cited with approval the Chinese 'melons on a vine'

pattern of independently managed pond-canal networks joined to a central source by main supply canals. He did not mention but perhaps had in mind, too, the Kakō Plateau pond networks in Japan that he had studied fifteen years before with Nagata Keijūrō.

The report concluded with six chapters summarizing historical and contemporary irrigation developments in Thailand, Burma, India, Sri Lanka, Pakistan, and Iran. These were only brief overviews with little new material to those already familiar with Asian irrigation.

Chapter VI

CONCLUSIONS

Coward (1980:24) has recently observed that irrigation development usually takes place in one of two modes: either as development in "community irrigation systems" or as the development of (state) "agency-operated systems." Japan offers an extended example of the former, if by that we mean irrigation networks managed by some form of association of local water users with no more than occasional intervention by state authorities or other outside elite.

By the seventeenth and eighteenth centuries, Japan had expanded irrigated rice acreage to cover most of the available, arable flat lands of the country (except for the northern island of Hokkaido, which remained undeveloped until the end of the nineteenth century). Through much of the twentieth century, there has been a thorough organization reform and extensive technological renovation of these physical networks. This has been based largely on government investment and design inputs and supported by legislation regarding water rights, land reform, irrigation cooperative organizations, land/water improvement project procedures, etc. Yet essentially, this has all been in the service of reform and reorganization of existing, locally-managed networks ("community irrigation systems," in Coward's terms) rather than their replacement by direct state agency-operated networks. Generally there has been strong central direction of project planning and design, but once constructed or rehabilitated, network facilities have been turned back to local (albeit

often restructured) organizations.¹³

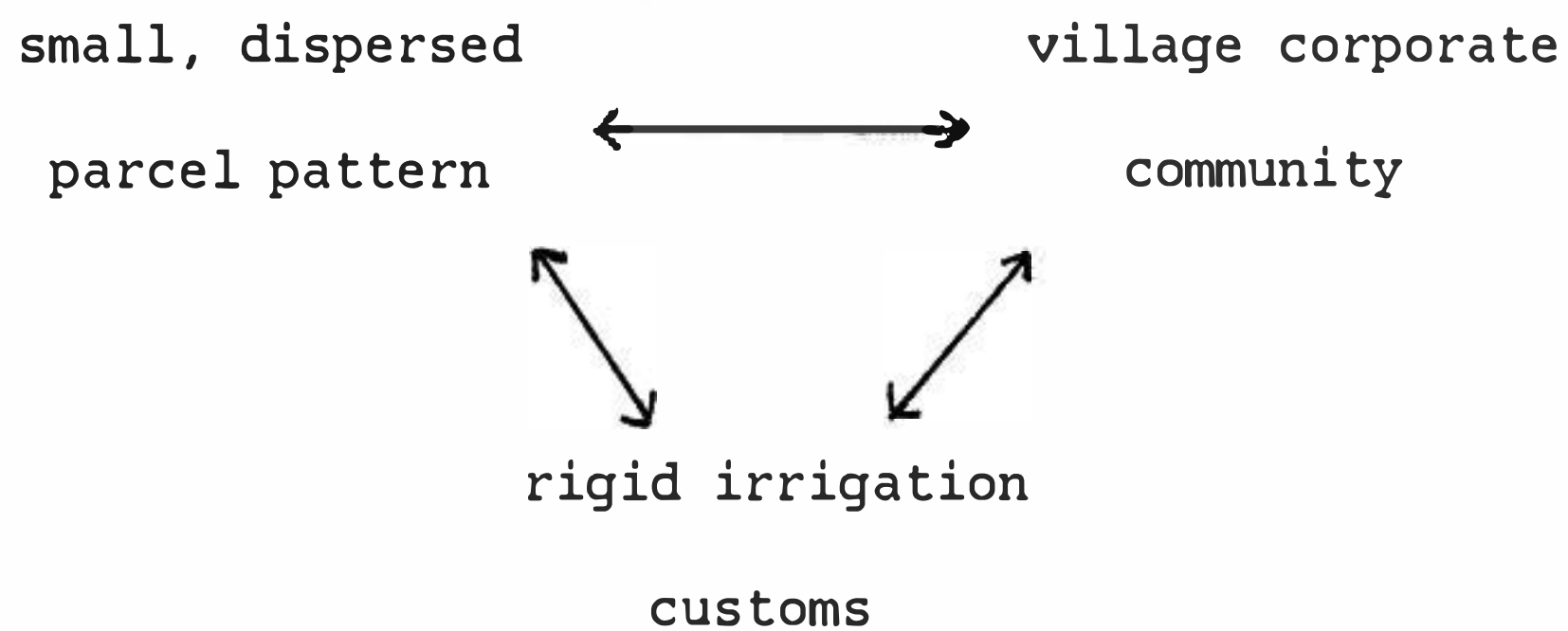
If Japan is an unusual example of long-term directed change in locally-managed irrigation networks, then the prolific research and writings on irrigation by Japanese social scientists represent a sustained commentary on this process. It is this commentary, with its only recent extensions outside Japan, that has been the subject of this review. It bears reiteration that the purpose of this monograph has been to introduce this social science literature to Western researchers. It is neither a survey of government irrigation policy and programs nor an analysis of the Japanese irrigation experience itself; this experience has been only partially shaped by government policies and it can yield interpretations quite different from those of the Japanese social science literature (see Kelly 1982a for one such interpretation).

Most Japanese analysts, regardless of academic discipline and ideological persuasion, have reached strongly negative evaluations about the traditional organization and procedures of these locally-managed irrigation networks. They have found them to be significant causes of a structural stagnation in Japanese agriculture -- that is, an inability to break out of the pattern of small-scale, household holdings of tiny, scattered parcels -- and of a suppression of the initiative of the individual farm operator. Conversely, reform of irrigation organization and procedures has been viewed as a principal element in the modernization of agriculture and the democratization of rural society.

¹³ Abel (1977) has observed the combination of centralized planning and decentralized management in Taiwan also. Given Japanese programs during its colonial period in Taiwan and its continued influence in the postwar period, the pattern similarity is not coincidental.

Traditional procedures for maintaining networks, operating facilities, and allocating water have been characterized by early and recent researchers alike as rigid "irrigation customs" that expressed and supported old status and authority differentials between households, between villages, and between canal networks; these customs bore only incidental resemblance to rational operation/maintenance and efficient allocation. Irrigation organization is believed to have been centered on the village, conceived of as a hierarchically-structured corporate community; this village community regulated irrigation tasks within its boundaries and functioned as a solidary unit, through its representatives, in the inter-village association that managed the larger networks to which it was articulated.

Thus, in effect, it has been frequently proposed that the field pattern of dispersed holdings of small parcels, the village corporate community, and the customary procedures for managing irrigation formed a mutually supporting chain that was difficult to break.



Because a household's holdings were dispersed through one or several ditching networks, its individual farm operations were constrained by the

villagers' communal management of these networks. Its customary management procedures enforced an areal uniformity that prevented the adoption of new methods and varieties.

Well into the 1950s, the prevailing Marxist social science orientation interpreted this chain in the theoretical context of a "feudal" type of agrarian class society surviving in attenuated form as the semi-feudal, landlord-dominated rural sector of an increasingly capitalist nation. Because the exact nature of that "semi-feudalism" was a matter of heated debate, much irrigation research was caught up in strong ideological currents.

Shinzawa Kagatō's work in the 1950s was instrumental in setting a new tone in irrigation research. He was especially interested in river-canal irrigation, the overwhelming network type in Japan -- the so-called alluvial fan networks of branching, gravity-flow canals from river intakes along its fan section. He insisted that their irrigation problems could be traced not to a particular form of political economy but to a fundamental upstream-downstream opposition that expressed itself at all levels of such networks. He argued that such conflicts should be resolved -- and the irrigation customs they gave rise to, reformed -- by investment in physical network improvements. He did a number of studies, for example, of headworks unification projects, which since the mid-1950s have been a major government investment objective. In these projects, the separate intakes of several main canal networks along a river were replaced with a single, permanent headworks, and Shinzawa emphasized the opportunities such technical changes presented for organizational reform. Existing main canal cooperatives were consolidated into a single land improvement district in which the former survived as intermediate units in

a basin-wide organization. Storage dams and more efficient delivery systems enabled the establishment of new and more equitable distribution procedures.

Shinzawa's optimism proved infectious, as evidenced by the 1961 volume Research on Irrigation Procedures, in which several of the former 'irrigation feudalists' joined with Shinzawa and others to trace the rationalization of what were now termed irrigation procedures. By the mid-1960s, scholarly (as well as government) attention had shifted to terminal-level conditions; if main-level projects have led to more dependable delivery of greater water volumes, then terminal-level improvements in field structure and field drainage now promised to insure the equalization of benefits (a basic principle of LID organization) and to facilitate mechanization. Nagata's "individual water use" objective was a representative proposal of the period. Terminal-level organization was no longer seen to be as problematical as before; Nagata believed that commercial opportunities requiring a rationalization of farm operations would be sufficient impetus to the formation of more democratic associational patterns.

But since the early 1970s, a pessimism has set in once again in many quarters, as a number of organizational difficulties have surfaced. Tamaki and the Ishikawa group exemplify those who have documented such problems, especially at the terminal level. Partly as a consequence of technical irrigation improvements and partly as a result of much broader trends in Japanese agriculture, demand for terminal-level organization has been renewed just as the capacity for water user coordination is being seriously weakened. Monoculture cultivation, mechanization, and rising proportions of part-time farmers have combined to create sharper, higher

demand peaks, requiring reinstitutionalization of allocation schedules in many areas. And, the complete separation of delivery and drainage ditching, finer tuning of field water levels, and other changes have increased water demand per unit area, raising the need for intra-network water re-circulation and re-use. But at the same time, differential mechanization, rising land values, and a widening split between full-time and part-time farmers has undermined the village unit and, consequently, its ability to organize terminal-level operation/maintenance and allocation.

Researchers are discovering that, faced with such difficulties, some LIDs support automated, labor-saving terminal facilities, while others try to revitalize terminal and intermediate-level organization, such as the water use regulation groups of Sannōkai LID. Both approaches reflect a reluctance of main-level organization to intervene and become directly involved in terminal-level tasks. At the moment, most researchers' proposals for organizational solutions to these challenges are vague, such as Tamaki's idea of a contract system between the LID and constituent user groups within its service area (an idea that in some ways takes the literature full circle back to Yanagita's 1908 article).

Further complicating this situation are such features as continued industrial and residential growth within agricultural areas and accelerated government efforts to reduce rice acreage. Much current work deals with simply trying to identify and project these emerging supply-demand patterns; the implications for irrigation organization are seldom addressed in detail. These might include the possibility of more direct intervention by national or prefectural ministries in LID organization to implement more efficient water use and to enforce a shift

from rice through water control; this could greatly alter the character of those locally-managed networks.

It is ironic that, having reached an advanced stage of highly mechanized and heavily capitalized rice agriculture, Japan should now be faced with problems of local-level irrigation organization. It is doubly ironic that it should share this problem with other Asian countries, some of whom, with vastly less developed agricultural sectors, are only now embarking on concerted irrigation development. Both have much to learn, though, from Japan's own, extensive past experience in modernizing and developing its largely locally managed irrigation.

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