Factors Determining New Rural Dwellers’ Participation in the Maintenance of Local Water Facilities in Japan

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Key Words: Irrigation Management, Local Organization, Village community, Rurbanization, Japan

Abstract

This paper is aimed at clarification of how village communities arrange the maintenance of local water facilities under the influx of new residents in Japan. The study examined 26 communities in Fukusaki town, Hyogo prefecture. The main findings are as follows. (1) The community size and the irrigation type are factors determining the organization of maintenance. (2) The location of newcomers’ residences strongly influences the formation of neighborhood groups of residents’ associations. (3) Whether new residents are included in existing neighborhood groups or not is an important factor affecting the residents’ participation in maintenance. These results suggest the necessity of establishing appropriate planning of rural development for maintaining communities and their activities.

1. Introduction

Development of irrigated agriculture depends to a great degree on organized and coordinated activities. Constructing irrigation facilities (e.g., reservoirs, sluice gates, canals, and ditches), conveying and distributing water to desired fields, and draining water from them frequently requires assistance and approval of other users, and sometimes necessitates permission from government (Coward, 1980a: 15). Today, farmers can individually purchase seeds, pesticides, fertilizers, and various agricultural materials on the market. Nevertheless, few farmers can freely buy water necessary to grow crops. Collective action of farmers for irrigation management is especially important for wet rice cultivation, which requires large amount of water. Figure 1 portrays a typical system of traditional irrigation and drainage in Japan. Arrows in the figure indicate water flow. As this figure shows, water reaches serried paddy fields from one watercourse and continues flowing downstream through a ditch. It can be inferred that paddy fields share a series of canals. This arrangement makes it difficult for farmers to use water independently.
One problem with irrigation management is the “free rider” problem derived from water delivery structures' characteristic as a collective good (Freeman, 1989). Farmers who do not pay sufficient costs for repairing canals, even if they later receive benefits from improved canals, cannot be kept from using them. Local farmer irrigation organizations in Japan have succeeded in controlling their members and in managing water effectively (Freeman, 1989). In many cases, these organizations have jurisdictions that are coterminous with village community boundaries. A traditional village community therefore has its own territory, is highly organized, and has a strong capability and precedent in managing irrigation and drainage systems. All territory residents are automatically members of the community, and are involved in community work as a matter of course.

Irrigation management includes various actions: storage, intake, distribution, and drainage of water, in addition to construction and rehabilitation of facilities, design of rules, and management of conflicts among farmers. Among these actions, maintaining local water facilities\(^1\) in communities, for example, repairing and cleaning up canals and mowing their banks, has had important implications in Japan. Historically, routine maintenance has been the most functional of community work, not only because it is

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1) Local irrigation facilities indicate secondary or tertiary facilities in the territory of the communities, such as smaller sluice gates, and secondly, tertiary and drainage canals. These facilities have been operated and managed by village communities which have remained the elemental organizational unit of irrigation networks from the medieval private estate system and the Tokugawa period to the irrigation cooperatives of the early modern period and even to the Land Improvement Districts of the present day (Kelly, 1982).
necessary for continuing wet rice cultivation, but also because it defines the ownership of the facilities and water (Noguchi et al., 2002). By conducting annual maintenance of canals, the community has gained wide acknowledgement as having a right and responsibility for them. Accordingly, all residents, mostly farmers, have participated in periodic maintenance without payment. Being a member of the community means taking part in maintenance arranged by the community, which can be quite natural for residents who have many years' experience of community residence in Japan.

However, concomitantly with high economic growth from the second half of the 1950s, village communities have changed greatly, particularly since the 1970s. Important phenomena related to that change include the increase in part-time farmers, the retirement of residents from farming, and increased settlement of suburban and rural areas by non-farmers. These changes, which can be collectively called rurbanization\(^2\), have sparked public concern and have attracted scholars' attention to problems with rurbanization-affected communities (e.g. Ninomiya et al., 1985). What issues have community changes raised among irrigation management? Rurbanization has increased the heterogeneity of residents in affected communities. Greater heterogeneity of inhabitants has in turn weakened the sense of community and has created some difficulties in maintaining community activities as before. Formerly, wet rice farming and irrigation management concerned most residents in communities where most residents were farmers. Non-farmers, new inhabitants from cities have increased particularly. Moreover, residents have become less concerned about irrigation management. Furthermore, it does not seem reasonable to newcomers that all residents should participate in maintenance with no payment. It is therefore becoming difficult for communities to maintain local water facilities properly because of the decline of their function in mobilizing residents adequately to undertake maintenance work.

This trend has continued in recent years. Figure 2 shows the average number of total households and the average component ratio of farm households per village community. In 1970, the average number was less than one hundred households; the average ratio was higher than 40 percent. However, in 2000, the average number was more than 200

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\(^2\) The notion of the "rurban community" first appears in Galpin (1915), as an abbreviation of "rural-urban community" located at the interface of rural and urban areas in America. "Rurbanization" has long been regarded in fields of geography and sociology as creating a rural and urban mixed society are, or as a process of change from rural to urban society. In Japan, results suggest that "rurban community" should be regarded as a new society that was neither rural nor urban, but a mix of both culture (e.g. Mitsuda, 1987), which has become the generally accepted definition (e.g. Ninomiya et al., 1985). See Sakamoto et al. (2003).
households; the average ratio was about 10 percent.

Since about 2000, awareness has been growing that, to address this problem, it is necessary to seek more positive participation in maintenance work by non-farmers, and especially by new residents because they are regarded as “free riders” in Japan (see Nagahama, 2003). Irrigation and drainage facilities are not only agricultural infrastructure for paddy fields; they contribute to society in other ways. For example, canal networks that are kept in good condition serve to drain water and guide it downstream smoothly, consequently reducing damage caused by typhoons and cloudbursts. Moreover, maintaining water facilities imappropriately or inadequately can cause harmful effects to rural environments, thereby affecting the lives of farmers and non-farmers. Increasingly, people have begun to regard non-farmers as new “free riders” who have not shared sufficient maintenance costs but who have benefitted from maintained water facilities. “Survey to measure farmers’ feelings about maintenance and management of regional resources (agricultural land and water) in rural communities,” published in February 2005 by the Ministry of Agriculture, Forestry and Fisheries, reported that 87.1% of farmers who answered questions hoped non-farmers who lived in the same community would participate in the maintenance of local water facilities. “Measures to conserve and improvement land, water, and environment” have been executed since 2007 for the main purpose of arousing non-farmers’ interest in and assistance with routine canal maintenance.

Farmers are generally regarded as “free riders” of irrigation facilities (Freeman, 1989; Bardhan and Dayton-Johnson, 2002). However, in Japan, it is widely acknowledged that non-farmers, new inhabitants are regarded as “free riders” on irrigation facilities. Kato (2005) made a theoretical examination of the situation in Japan using the basic framework...
of the prisoner's dilemma game. To simplify the situation, Kato considered two players: one farmer and one non-farmer\(^3\). He assumed that their choices are as follows: farmer's choice—conservation (F1) or not (F2); Non-farmer's choice—cooperation (N1) or free-riding (N2). A farmer gains 3 and a non-farmer gains 5 if rural environment is conserved. Each gains nothing if the environment is not conserved. The cost of a farmer for conservation is 4. However, if a non-farmer cooperates, a farmer pays only 2. The remaining cost 2 is shifted to a non-farmer. A farmer cannot receive any gains if a non-farmer cooperates and a farmer does not. The situation is summarized in the payoff matrix, as in Table 1. Pair of strategies (F2, N2) is the Nash equilibrium in this game; a farmer does not conserve a non-farmer takes a free ride. With the payoff (1, 3), both gain more than with the payoff (0, 0). Nonetheless, (F1, N1) is not realized in a one-shot game; provided that the same shall not apply if this game is repeated\(^4\). However, even presuming a one-shot game, when non-farmer leads the game as in Fig. 3 (B), the cooperative outcome (F1, N1) is a subgame-perfect equilibrium. Kato concluded that environmental conservation in rural areas results from the promise of cooperation made by non-farmers despite their ability to be free-riders.

This paper presents an examination of how communities actually manage the maintenance of local water facilities under ruralization conditions. This study is

\(^3\) This “non-farmer” was expressed as city dweller in Kato (2005).

\(^4\) See Baland and Platteau (1996).
important for two reasons. The first is that few works in the literature specifically examine communities that actually organize the maintenance work. Previous studies have addressed either of two aspects: non-farmers' (or new residents') motivations for positive participation in maintenance work (e.g. Aizaki et al., 2006) or Land Improvement Districts, the organizations established by the Land Improvement Law to facilitate projects to improve agricultural infrastructure (e.g. Kato and Kurashima, 2000). Although communities have played a leading role in maintenance, few researchers have examined them. The second reason is the contribution to overcoming possible difficulties in eastern and Southeast Asian countries. In recent years, similar problems are becoming apparent in countries that have numerous paddy fields and a growing economy. The results of this study are expected to provide keys to solving their problems in the near future.

2. Methodology

2.1. Research Method

Semi-structured interviews were conducted with leaders of 26 village communities (i.e., the head and/or board members of residents' associations) in Fukusaki town during August 2008. The main questions were the following: What have been the effects of the increase in the number of new inhabitants on the community? How has periodic canal maintenance (mizobushin) arranged? How were newcomers' duties during maintenance set? By comparing results among these communities, the following points were considered inductively in Chapter 3: (1) What factors determine the arrangement of maintenance by the communities? (2) What factors influence the participation of new residents in maintenance? Moreover, a supplemental survey was administered to identify characteristics of the town, sample communities (e.g., residents' associations, water distribution, and periodic maintenance of local water facilities) and new inhabitants (e.g., their attributes reasons for and motivations behind their house-moving, and their attitude toward village community and farming).

2.2. Site Description

Fukusaki town

Fukusaki town, Hyogo Prefecture, in western Japan is located about 20 km from the coast of the Seto Inland Sea, lying in a small basin surrounded by low mountains and hills. This town has long been a transportation crossroads in the area. It is situated between the
Ikuno Silver Mine, which functioned from the 1500s until 1973 on the upper Ichikawa River running north-south in the town and the port near the downriver area. Now, stretching to the north and south, east, and west, two national expressways have intersected at the central part of the town.

This town has a population of about 20,000, with approximately 6,600 households (Fig. 4). It is about 25 min by train to Himeji city, with a population of about half a million, and is about an hour by train to Kobe city, with a population of about one and a half million. Under these favorable conditions of location, the population and the number of households in the town have increased gradually. Some urbanites bought or built homes in suburban areas to enjoy larger living space, land, and improved lifestyles for themselves or their children compared to those of city residents. For that reason, new housing construction increased, especially in the town center. Although some of them have known what the members of the communities should do through their experience of living in the communities, many have not recognized rural conventions such as the community work in which all community members had been expected to participate with no compensation. Figure 4 shows that, different from the case of households, the population has shown sluggish growth lately: The increase in nuclear or aging families has led to fewer people per household.

The total land is about 4,500 ha, about half of which is forested. The town comprises 800 ha of farmland: mostly paddy fields. Of the total households, fewer than one in five

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5) These data were obtained from the national census and the World Census of Agriculture and Forestry in 2010.
are farm households. Farming is the primary occupation of only one percent of farm households. Most farmers are 65 or older. They carry on with farming activities even after retirement.

The main crop of this area is rice. In the past, many farmers grew not only rice but also wheat or various crops. Part-time farmers and the mechanization of rice-farming increased drastically after the period of high economic growth. Therefore, farmers became increasingly concentrated in annual rice production. In recent years, land that has been left uncultivated has been expanding because of lower prices of rice.

The region around the Inland Sea including Fukusaki town has a dry and moderate climate except during the rainy season, when droughts often occurred. However, since Ikuno Dam was constructed on the upper Ichikawa River in 1972 and rice-planted areas became fewer, few farmers have suffered from droughts recently.

**Features of Village Communities: Residents’ Association, Water Distribution and Periodic Maintenance of Local Water Facilitations**

Fukusaki town has 26 village communities with farming lands designated by the Act on Establishment of Agricultural Promotion Regions and irrigation and drainage canals, which can be regarded as communities keeping their tradition alive.

The residents’ associations (or neighborhood associations) in the town have the following characteristics of typical and traditional ones in Japan indicated by Torigoe (1994) and Yamasaki (1999): a unit of territory, household-based membership, the local representativeness, a full apparatus of government, and the smallest administrative branch. These communities have their clear territorial limits. In each community, a residents’ association has been organized. Most households in the territory of the associations are members, except for a few residents who are single and/or who live in apartments and/or who have plans to move. Non-farmers, including new residents, participating in the association account for more than 90 percent in every community. The associations have served their members their whole lives: promoting mutual friendship, allowing for managing of community facilities and life environments necessary for their lives, and providing a means for the solution of local issues. Additionally, the associations have assisted the town administration or conducted work requested by the office, for example passing information from the town office to residents and building consensus among the residents on local issues, policies, and measures. Therefore, probably the communities that coincide with the residents’ associations are self-reliant entities in the town.

Every association has several subgroups, called rinpo, in the town (Fig. 5). A rinpo is
a neighborhood group and a branch of the association, with members of 10-20 households living in mutually adjacent lots and having constant and face-to-face interaction. The neighborhood group (rinpo) members generally work together as a unit when communities conduct community work or perform other activities.

Irrigation services are of two types: reservoirs (19 communities) and rivers (seven communities). In communities where irrigation water is mainly taken from reservoirs, each community generally has one or more reservoirs for itself. In only one case do several communities share a reservoir. Reservoirs are treated as local assets to respective communities. Reservoir-using communities have provided each reservoir with one or more people in charge of water allocation. They are called mizuban (water keeper) in the town, operating sluice gates and checking the conditions of local irrigation facilities. However, in communities with river basin irrigation, several irrigation associations have been established by three or four communities. These communities have seized the initiative in irrigation management. The directors of the irrigation associations consist of these community representatives and control only the main sluice gates or/and primary canals. In most of them, local ones in the territory of the communities have been managed individually by respective communities. In earlier times, special full-time water keepers (mizuban) worked in some communities served by the river. Recently however, rotating water keepers can be found in many of these communities because full-time tasks have become unnecessary: Ikuno Dam can ensure a sufficient water supply. Therefore, water allocation can be quite different. Although reservoir-using communities conducted more controlled and careful water distribution, river basin irrigation communities operated freely and somewhat inefficiently.

Routine maintenance of local water facilities has been conducted periodically by the communities, not by the water associations or by the town office. The periodic maintenance work of canals in Fukusaki presents five common characteristics. First, the
communities have generally performed maintenance work twice a year: in May, before rice-planting, and in September, before rice-harvesting. The first type of work, called *mizobushin* (canal maintenance), mainly entails dredging and cleaning of canals (and ponds if any) and mowing the banks of canals (and ponds if any). The second type of work is called *michibushin* (road maintenance), mainly entailing mowing the side of farm roads and repairing roads. Consequently, the maintenance work on canals is generally performed once a year. Second, only one member of each household participates in the work in all communities. Third, some communities assign work locations to each neighborhood group (*rinpo*), not to each household. Fourth, many communities set a price of the penalty for non-participation of between 2,000 and 5,000 yen per task. Fifth, working locations allocated to new dwellers differ from those allocated to existing inhabitants or sometimes differ from those allocated to other newcomers as discussed below.

**Characteristics of New Inhabitants**

In the town, there has been an influx of new inhabitants\(^6\) since 1980s. Irrespective of newcomers’ residences, details of which are presented below, they share many characteristics.

All new interviewed residents bought or built their homes because they are seeking a larger and lower-priced living space or land than that available in urban areas. They were looking for greenery and a peaceful environment. Each lives in a house, not in an apartment block\(^7\). They moved into the town in their 30s and 40s after marriage, their child entered a school, or they started caring for their parents. Many are from rural areas that are further away from the cities than the town. Their hometowns are so far away from cities that they do not commute. Therefore, they would probably choose the town located midway between cities and their hometown. They all answered that they had no plan to move out and wished to settle in the town. Almost none is the least bit interested in trying agriculture. They regard the activities as unrelated to their housing location, as discussed hereinafter.

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\(^6\) As described in this paper, “new inhabitants” are people who have entered the community with no relatives in, or experience of, the community during and after 1980s. The reason for this definition is that most existing residents treated people whose husband or wife is from the community (This type of family are called “Shintaku” in the town.) and who had entered the community before the 1980s just as they treat each other.

\(^7\) Some inhabitants live in apartment buildings in the town (especially the center of town), but not in the sample communities.
3. Results and Discussion

3.1. Factors Determining Arrangements for Periodic Canal Maintenance:

Community Size and Irrigation Type

After investigation, two factors were identified that determined the organization of the periodic canal maintenance (mizobushin): community size and irrigation type.

Community Size

The smaller the community, the more flexible are the arrangements made for maintenance. Communities with fewer households are likely to adjust maintenance arrangements flexibly from year to year. By contrast, residents' associations with more numerous households tend to set a rule to arrange maintenance. Furthermore, the threshold of the change in the maintenance arrangement is apparently one hundred households. Half of the 16 communities in which the total households are fewer than one hundred assign each neighborhood group (rinpo) or resident different work locations on the condition of irrigation facilities or the attributes of participants (e.g., assigning more participants to a part of canals at the bottom of which much sediment had accumulated or a part of a canal bank that had become overgrown with weeds and allotting farmers who are good at using mowing machines or a neighborhood group of which such farmers were the majority to a longer length of a canal than others). However, nine of ten communities of more than one hundred households set a certain location for each neighborhood group (rinpo).

Irrigation Type

The second factor is the irrigation type: reservoir or river. As described above, the communities in which the reservoirs supplied irrigation water hire some residents out as full-time water keepers (mizuban), whereas the water keeper job rotates among farmers in many river basin communities. The same can be said of canal maintenance. Communities irrigated by reservoirs manage the maintenance actively. However, the maintenance is less active in river basin irrigation communities. For example, the average time for the maintenance work per time and person is 3.8 hr at the former. and 2.7 hr at the latter. This difference can result from the certainty expected by inhabitants that sufficient irrigation water is supplied. Ikuno Dam built upriver, induced farmers who were taking water from the river to relax, and not require maintenance of water facilities as diligently as before. Nevertheless, the risk of drought in the reservoir remains for communities.
Accordingly, control and careful maintenance in these communities are still important.

3.2. Factors Determining Newcomers’ Participation in Periodic Canal Maintenance

Housing Locations of New inhabitants and Neighborhood Group Formation

New dwellers are divisible into two groups from the perspective of where they live and the organizational structure of their residents’ associations (Fig. 6). For (A) in this figure, new residents bought building land from existing residents who moved away from the community. Because they belonged to existing neighborhood groups (rinpo), newcomers lived near existing residents, and had more opportunities to meet them. Because of the inclusion of new inhabitants in existing neighborhood groups and the social relations among existing ones, this type represents inclusive neighborhood group formation. In contrast, for (B), when newcomers’ residences are in a housing estate or in an area under sprawl development, they were so numerous that new neighborhood groups (rinpo) were established in which all the members were new dwellers. Therefore they lived independently from the existing community, having little chance of knowing existing ones. This second type represents exclusive neighborhood group formation because new residents have left the existing neighborhood relationship.

Figure 7 presents illustrations of the relations among all households in the community, the percentage of new households at the community, and neighborhood formation of these two types. It seems clear that the higher the percentage of newcomers, the greater the number of total households. However, a few communities have organized exclusive neighborhood groups in which the total households are few and the percentages of new households are small. In these communities, the residences of new inhabitants are located long distances from existing ones. Consequently, it is explainable that, rather than the community size, the location of newcomers’ homes has had a great influence on organizing neighborhood groups. Moreover, Figure 7 shows that one hundred households is the threshold for founding new neighborhood groups (rinpo). That might engender a difference of the maintenance arrangement between communities of more than one hundred households and those of fewer households. It is more difficult for the head or board of a residents’ association to control residents for community work as the number of new households increases and new neighborhood groups are founded.

Types and Characteristics of Working Locations of Maintenance by New Residents

Before explaining the factors determining the participation of new inhabitants in periodic canal maintenance (mizobushin), we describe the types of work they have
performed for maintenance. The participation rate (including that of new residents) in the maintenance of 26 communities per occasion was about 90 percent on average and invariably higher than about 70 percent. Consequently, at first glance, most residents, including new dwellers seem to participate in maintenance. However, the involvement of some new dwellers in maintenance differed greatly from existing or other new ones.

Table 2 presents the number of total households, the component ratio of new households, the irrigation type, the presence or absence of a new neighborhood group (*rinpo*), the working location of the maintenance by newcomers belonging to existing neighborhood groups, and the location by new ones belonging to the new groups in each community. Five communities with no new residents were excluded from the list. The upper half of the table shows 12 communities with only existing groups, whereas nine communities at the bottom have new groups. As shown in this figure, maintenance work by new residents is divisible into three types according to the place they are performed:
irrigation canals, side ditches of new residences, and a park or shrine. "Irrigation canals" are those necessary facilities for maintaining the function of agricultural use. Almost all existing residents have done this. "Side ditches of new housing" are those narrow canals set at the sides of homes of new residents. When new residents have cleaned the side ditches of their houses, it suggests that they have maintained their own immediate environment, not for general irrigation. If they stop maintaining the ditches, then it would have only a slight impact on wet-rice farming, but it might have a harmful effect on the home itself (e.g. flood-related damage on their houses). The importance of cleaning these areas for agricultural use is low. "Park or shrine" means that new dwellers have cleaned up only a communal facility that is independent of canals or ditches, which indicates that they have worked only for the beautification of the general environment and communal areas. Therefore, in this case, the newcomers' performance has contributed nothing to canals and farming.

Factors Determining Newcomers' Participation in Maintenance

Comparison of the results shown in Table 2 reveals the following two trends of newcomers' participation in the maintenance. The first is that new residents in the communities with existing groups tend to perform more important work for agricultural use, although new ones in those with the new groups tend to do work that is of little or no importance for agricultural use. New inhabitants have maintained irrigation canals in all the communities (upper half of the table), but newcomers have constructed side ditches, parks or shrines in eight of nine communities (bottom half). The second is that newcomers belonging to existing groups even in communities with new groups show a greater tendency to perform more important work for agriculture, whereas new ones belonging to the new groups in the communities with the new groups do not. New inhabitants belonging to the existing group have maintained irrigation canals in all of four communities with new groups (lower left of the table). By contrast, new ones belonging to the new group have done so in only two of the communities with the new groups (lower right).

As described above, in theory, new inhabitants would choose a free-riding strategy (nonparticipation in the maintenance) in a rural environment conservation game (Kato, 2005). However, results show that such cases are actually rare. This difference resulted mainly from neighborhood group formation. Many new inhabitants from urban areas are unaware of the village community conventions. When they belong to new groups that are independent from existing groups and relationships, they lack the experience of knowing the conventions and would still be likely to think it unnatural that all members of the
community, including themselves, are responsible for maintaining irrigation canals. Surrounded by similar newcomers, they rarely found communication with existing residents necessary. This situation fits the one-shot game by Kato; newcomers do not maintain irrigation facilities or limit their participation to the place where it is directly linked to their lives\(^8\). However belonging to existing groups, new residents can make social connections with existing residents and can have a chance at knowing them. Then, these newcomers found that the interaction with existing inhabitants continued for a long time. Therefore, a repeated PD game was realized. For that reason, a co-operative equilibrium can be generated in which both existing and new residents maintain the water facilities. For that

8) Furthermore, from the farmers’ viewpoint, they would hope to maintain these areas solely through the efforts of compatible members and to make an exception for new neighborhood groups because irrigation canals are crucial for rice farming and farmers.

<table>
<thead>
<tr>
<th>NTH (hh)</th>
<th>RNH (%)</th>
<th>Irrigation</th>
<th>New NG</th>
<th>WL by newcomers belonging to existing NG</th>
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Note: THH, number of total households; RNH, component ratio of new households; NG, neighborhood group; WL, working location at the canal maintenance.
reason, the way new dwellers belonging to the existing groups are treated is expected to differ from the treatment given those belonging to the new groups.

These findings suggest that not only large numbers of new residents, but also the organizational structure of residents’ associations is an important factor determining newcomers’ participation in maintenance work: village communities, even if there is a mass influx of urbanites, achieve cooperation between existing and new inhabitants on local water facilities by developing their organizational structures. Given that the housing location of new inhabitants strongly affects the organization of neighborhood groups in residents’ associations, it implies the necessity of appropriate planning for the development of building land in rural area for maintaining village communities and their activities.

4. Conclusion

This paper presented an examination of how village communities arrange the maintenance of local water facilities under rurbanization: the influx of new inhabitants in Japan. The investigation revealed three factors affecting the arrangement strategy of the periodic maintenance by the communities: community size, irrigation type, and neighborhood group formation. First, smaller communities of fewer than one hundred households tend to have more adaptable arrangements of maintenance depending on the conditions of the facilities and participants than communities with more than one hundred households. Secondly, careful maintenance is conducted actively in communities that are irrigated by reservoirs, although the maintenance is less active in river basin irrigation communities. Third, inclusive neighborhood group formation enables new residents to engage in the same work as that of existing residents, although the exclusive structure leaves them out of water facility maintenance. New residents belonging to existing neighborhood groups of residents’ associations show a stronger tendency to perform more important work for agriculture use (and also for their lives), whereas new ones belonging to the new groups are likely to do work that is directly linked to their lives (e.g., side ditches of new homes, a park, a shrine). This result suggests that the organizational structure of residents’ associations can control new inhabitants’ free-riding and stimulate them to contribute to the maintenance of local water facilities. Furthermore, based on these results, it will become increasingly important for suburbanizing areas in eastern and Southeast Asian countries to establish rural planning for the development of rural areas to keep village communities and their activities alive.
References


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