RESEARCH ARTICLE

Farm Mechanisation and its Impact on Women's Labour: The Case of Shiga Prefecture, Japan

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Abstract: This paper examines changes in women's labour in rice cultivation after the onset of mechanisation. It is based on detailed field work conducted in Shiga Prefecture, Japan. Based on interviews with 12 elderly people, the paper traces the changes in women's labour in rice farming at different stages of mechanisation. It shows that technological change led to a defeminisation of agriculture. Although mechanisation in its final form reduced women's physical hardship, in the process, women lost all opportunities to participate in family farming. This change had profound economic and social implications.

Keywords: Farm mechanisation, rice, Japan, Shiga Prefecture, women, labour, female labour, agricultural labour, transplanting, family farming, agriculture, defeminisation.

This study examines the transformation of women's labour following agricultural mechanisation in rural Japan. It examines the specific types of labour replaced by machinery, the reasons why women dropped out from rice cultivation, and the effects of defeminisation on the prospects for Japanese agriculture.

After World War II, the Japanese Government implemented land reform. The initiative, which was implemented thoroughly throughout the country, converted almost all tenant farmers into owner-cultivators. The tenant farmers who finally became land owners started land improvement projects not only to raise the productivity of their own land, but also to introduce agricultural machinery to increase the efficiency of their agricultural operations. The construction work, heavily supported by the government, provided the basis for the mechanisation of rice cultivation, including the introduction of walking-type tillers, riding-type tractors, combine harvesters, and paddy seedling planters. Rice cultivation was completely mechanised by the middle of the 1970s.

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It took only a decade for about 2.6 million cattle that were used for ploughing and other agricultural work to disappear and be replaced by tractors. A survey conducted by the Ministry of Agriculture and Forestry of the Japanese Government described the swift disappearance of animals as unparalleled in world history. Rapid farm mechanisation drastically changed women's work and ultimately separated them from rice cultivation. In Japan, agricultural mechanisation was accompanied by the continuous flow of population from rural to urban areas. Mechanisation of agriculture made significant changes both to farm families and to rural society.

Araki (1989) conducted intensive inquiries in order to examine changes in labour productivity and the process of farm mechanisation. Araki (1989) observed that, after the introduction of transplanting machines, small family farmers stopped hiring labourers to transplant paddy and began to grow rice with the labour of family members alone and with their own machinery. Meanwhile, the farmers quit keeping animals such as cow and poultry and ceased to cultivate a variety of crops for sale. Teruoka (2008) analysed the agricultural economy after the establishment of capitalism in Japan, and examined the shrinkage of the agricultural sector after World War II, which was in contrast to the rapid development of manufacturing and service sectors, supported by favourable economic policies to expedite industrial expansion. Hosoya (1998) studied changes to villages and farm families in the 1980s after the mechanisation of agriculture, focusing on women's role in cultivation. He pointed out that retired women now had spare time while young brides remained busy on account of the diversification of farm management.

Changes in rural women's labour in the process of mechanisation are, however, yet to be studied. The effects of mechanisation are complex: some women who were alienated from rice cultivation because of farm mechanisation were employed in the non-agricultural sector, affecting rural labour markets, while other women played important roles in the diversification of agriculture, including the spread of vegetable and flower production and growth of farmers' markets.

Japanese Village Women in the 1950s and 1960s

The village surveyed by the author is Kurimidezaike in Shiga Prefecture, Japan, an agriculturally developed region where rice cultivation accounts for more than 92 per cent of the total agricultural land. The village is located on the shore of Lake Biwa, the largest lake in Japan, with 70 hectares of cultivated land that was developed about 200 years ago by reclamation of the lake (see Figure 1). The land is flat and the major crop is rice, which is grown on almost all the cultivated land in the village with water taken from the lake. There were 65 farming households out of 88 households in the village in 2018, although previously all of the households in the village were engaged in farming.

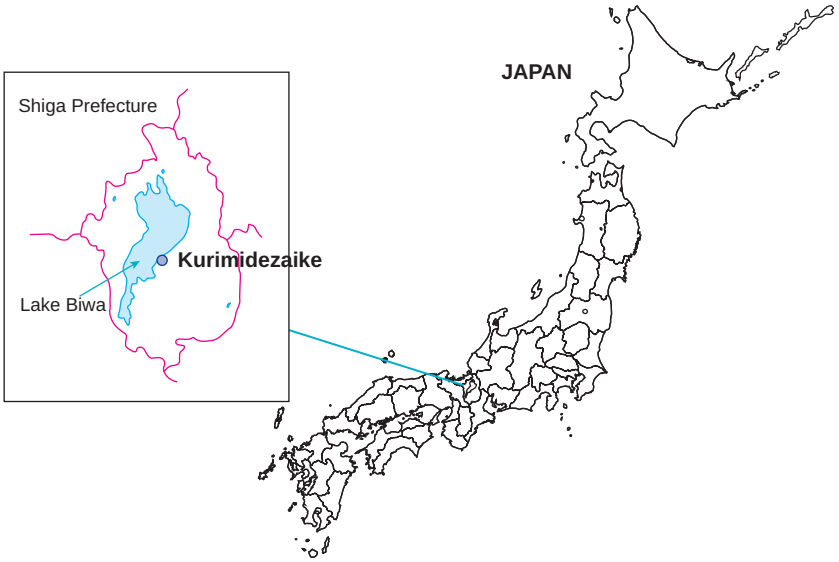

Figure 1 *Map of Japan showing location of Kurimidezaike village*
Source: Inset drawn by the author.

Historically, in a Japanese village, a farmer's wife lived with her husband's family and was engaged in the family farm business. The bride came alone to the bridegroom's homestead, where his family already lived, and joined the labour force of his family farm. Brides were strongly expected to deliver a son as a successor to the family's business.[1] The same custom can be found in today's villages, albeit in a weaker fashion. Indeed, one of the Japanese words for marriage is *temamorai*, which translates as "gaining additional labour." The head of household took all decisions on farm management, including the crop varieties to grow, operation plans, and selection of agricultural implements.

Women fulfilled supplementary roles in farming under the direction of the head of household, while also juggling a variety of household chores such as preparing meals, washing clothes, and taking care of the children and elderly in-laws. In patriarchal rural societies, until the 1970s, farmers' wives were called hornless cows, meaning that they obeyed family members and never talked back to them. A bride

[1] If the bride could not deliver a child, she was sometimes divorced by her husband, who got a new bride or adopted a son from one of his relatives. That was common knowledge and the norm until recently and there was an old Japanese saying: ''begone, a woman who does not deliver a successor.'' One of the most important issues before a Japanese farming household was to have a successor in order to inherit the assets such as lands and house. In other words, a major purpose of marriage was to acquire a male successor. The old saying mentioned above is found in *Onna Daigaku*, a Japanese book of the eighteenth century written to illustrate the norms that women of the time were expected to follow. Sexual discrimination the traditional literature was thoroughly criticised in the nineteenth century by Yukichi Fukuzawa, the famous Japanese educationist and the founder of Keio University. Fukuzawa's criticism in itself demonstrates the deep influence of *Onna Daigaku* and the pervasiveness of sexual discrimination among common people in Japan (see Fukuzawa 1899).

entering her husband's family was placed in a very vulnerable position. Brides could visit their parents' home only twice or thrice a year after getting permission from their fathers-in-law. Women could not participate in the decision-making process about farm management, which was mostly controlled by the head of household.[2]

The members of a farming household completed various jobs related to crop production and livestock-keeping throughout the year. They were engaged in cropping from spring to autumn and even worked after the cropping season. One important task in winter was making a variety of straw products for home use. In the 1950s and 1960s, the men of small farming households moved to urban areas in the winter for the construction work that was readily available during the period of historic economic growth, the period sometimes termed the years of the "Japanese miracle." Rural women also earned considerable pay from locally available construction work, including the land improvement projects mentioned above (Tokuno and Kashio 2014). Interestingly, they received pay equal to the pay men received for those jobs. They also laboured with men in unpaid construction work that was undertaken by the community, including restoring pubic ponds, building rural paths, and treading down the land to strengthen the field banks. Although rural women were in a vulnerable position, they felt a sense of importance and had some say as long as they played a critical role in transplanting work for rice cultivation and raised income from non-agricultural work.

From the 1960s, Japanese agriculture transformed drastically against the background of economic growth and mechanisation. Economic growth led to the continuous flow of population from rural to urban areas, and mechanisation reduced the workforce for agriculture and changed the role of female workers. The profound change in Japanese agriculture is reflected in the variation in the number of agricultural workers.

According to the agricultural census conducted by the Japanese government, the population of women self-employed in agriculture in Shiga Prefecture fell from 50,213 in 1970 to 11,783 in 2015. The number of women engaged in agricultural work for more than 150 days per year fell much more sharply, from 15,421 to 2,561, during the same period.[3] As a result of mechanisation, which will be explained below, women's labour was no longer necessary for rice cultivation. What is seen in current Japanese paddy fields are older men driving agricultural machinery such as tractors, paddy planters, and combine harvesters. Having been detached from rice

[2] A typical Japanese farming household is composed of members of three generations and controlled by an eldest male member. Women had to obey men who controlled the farm management.

[3] The decline of workers engaged in agriculture was not confined to women; men's employment in agriculture fell at the same pace. The number of men employed in farming declined from 24,727 to 13,077. The number of men employed in agriculture for more than 150 days in a year decreased from 12,987 to 5,331 during the same period. In Japanese agricultural statistics, women engaged in family farming even if primarily housewives were counted among those employed in agriculture. Many men who were heads of farming households but had non-agricultural gainful work were not counted as employed in agriculture, Hence, the fact of higher number of women employed in farming than men.

cultivation, some rural women remained housewives while others were employed in non-agricultural sectors. However, according to a recent agricultural census, women accounted for 47 per cent of the total workers engaged in agriculture in 2015. Many female farmers grow vegetables that are sold in nearby farmer's markets. Unlike rural women of the previous generation, current female farmers can more or less manage their farm operations independently. In the next section, we will examine women's labour in the 1960s and 1970s, when Japanese farms were undergoing mechanisation of rice cultivation in the context of a patriarchal rural society.

Mechanisation and Transformation of Women's Labour in the Village

The author interviewed elderly people from Kurimidezaike and asked them about changes in women's labour before and after the introduction of machinery. Interviews were conducted with 12 people: five women in their eighties, three women in their seventies, one man in his eighties, and one man in his seventies, and a woman and a man in their sixties. All of the interviewees encountered the process of mechanisation when they were young.

Table 1 shows the details of women's labour before and after mechanisation. In a farm family, a father-in-law typically ploughed the field with cattle, and then the mother-in-law and bride crushed the soil using hand tools. This work was repeated several times in each paddy field until the soil was smooth and fine. In the 1950s, power-driven tillers were introduced for the first time in the village.[4] According to the agricultural census conducted in 1960, there were a tractor, 10 power-driven tillers, and 19 cattle in the village. In just five years, agricultural machinery increased dramatically. The number of power-driven tillers was 48 in 1965 and increased to 90 in 1970. The 90 power-driven tillers included four tractors with more than 10 horsepower. After the introduction of walking-type tillers, women were not required to assist with work as much as before. As machinery was upgraded, women's roles were further reduced and eventually disappeared. They were no longer needed for ploughing, and they did not learn how to drive the machines or to plough land with a tiller or tractor. Women in the village recalled the change in ploughing duties:

> When the first tractor came to my farm, it was impressive that my husband looked as happy as a child. When the tractor ploughing started, I was not required to crush soil anymore but ordered to do other fatiguing duties not related to farming. There were sundry chores including clearing up of an agricultural storehouse, seeing my husband off, closing the storehouse door, and sweeping the muddy floor before the tractor came back and so on. I didn't feel mechanisation eased my burden. I had no time to rest.

The change in labour involved in transplanting is another interesting example of mechanisation. Historically, transplanting paddy seedlings was an operation

[4] Editorial Commission of the History of Kurimidezaike (2006).

Table 1 *Women's labour in rice cultivation by stage of farm mechanisation, Kurimidezaike village*

Women's labour in rice cultivation	Stages of farm mechanisation			
	Before mechanisation	Power-driven tiller or tractor, walking-type transplanter, small harvester (reaper), manual sprayer for weedicide	Power-driven tiller or tractor, walking-type transplanter, combine harvester without grain-loading device, automatic sprayer for weedicide	Tractor, riding-type transplanter, combine harvester with grain-loading device, automatic sprayer for weedicide or pest control by helicopter (for a short period)
Ploughing	Crushing soil and following cattle (several times for each field)	—	—	—
Growing paddy seedling	Watering	Watering	—	—
Irrigation	Walking in muddy fields with bare feet several times to make field flat	—	—	—
Transplantation	Taking paddy seedlings from nursery bed, bundling them with straw, carrying them to the field, transplanting them, and cleaning and bringing back tools, etc	Carrying paddy seedling boxed to the field and sometimes replanting them by hand	Carrying the seedling boxes, delivering them to the machine for replenishment, and replanting seedlings where the machinery failed to do so	—

Weeding	Removing weeds by hand and embedding them into ground with their body bent low (several times for each field)	—	—	—
Harvesting	Reaping rice plants, bundling them with straw, and carrying them to hanging poles	Following a reaper, picking up bundles of rice plants from the machine, and carrying them to hanging poles	Following the machine, changing heavy bags filled with paddy, and carrying the bags out of the field	—

Source: Field survey

conducted by women. Women were required to complete many peripheral tasks before transplanting work even began. When a paddy field was being watered before transplanting, women had to walk in the uneven field with bare feet to flatten the earth and then water the nursery bed of paddy seedlings. During this period, farmers grew a paddy nursery on part of their land, although they now purchase seedlings from an agricultural cooperative. On the day of transplantation, women – even those with babies – removed the seedlings from the nursery bed, bundled them with paddy straw, placed them in carrying boxes, and took the boxes to the field alone, after preparing a meal for the family. Transplanting usually started at dawn, and women were expected to arrive at the field first. If a woman arrived late, she was teased by other women in the village.[5] The women transplanted seedlings continuously and quickly. An elderly woman who belonged to a middle-class farming family retraced her past:

> On the day before transplanting, I prepared clothes and tools for my family members until late at night, and then made breakfast for them. I woke up alone at about 3 a.m. after having slept a few hours, and then went to the nursery bed to take them up and carry them to the field. I had to be the first to arrive at the rice field in the dark. Family members joined after daybreak. Transplanting work lasted for almost a month because we transplanted several kinds of varieties on dispersed fields.

A walking-type paddy transplanter was introduced in the 1970s, when tillers, tractors, and combine harvesters were already being widely used. Farmers purchased a paddy transplanter as soon as it was available to them. It was the last piece in the process, and completed a consistent system of mechanised rice cultivation covering cultivation, transplantation, and harvesting. When walking-type planters were introduced, women really enjoyed the mechanised operation. They placed seedlings on a plate specially prepared for the machine and manually planted paddy seedlings in places where the machine could not reach. However, a riding-type paddy transplanter introduced soon after the walking-type transplanter dramatically changed women's labour. Women had to run in the field beside the moving machine, with a heavy box full of paddy seedlings for replenishment. The riding-type planter reduced the labour for men who monopolised the skills to drive machines, while it created more labour-intensive work for women.

The hard work for women lasted until the farmers replaced the machines with more advanced ones that had larger storage space for nursery seedlings as well as greater speed. The women no longer had to run with a heavy box, and thus their labour became unnecessary for transplantation. Women's work declined substantially because of the mechanisation of transplantation, which had traditionally been performed mainly by women. In respect of weeding, although all family members bore a part of the burden of work, it was undertaken mainly by women. They removed weeds and embedded them deeply into the mud to turn them into manure.

[5] In a Japanese village, plots are small and close to each other.

This work, which continued until just before the harvesting season, required them to bend down all day. Men, however, cut the weeds on ridges and paths around the rice fields. When a weedicide sprayer was introduced, women were released from this burden. Harvesting was also completed by family members before mechanisation. They reaped paddy with a sickle and bound it with straw. Women carried heavy bundles of paddy to hanging poles and passed them to men who were waiting there.

A combine harvester initially introduced in the 1970s discharged the grains into bags placed beside the machine. However, the introduction of this machine was a hardship for rural women; women were required to move with the same speed as the harvester to remove a bag filled with harvested rice and to place a new bag on the moving machine. This labour continued all day during the harvesting season. This type of harvesting labour was required until a new combine harvester was introduced, which was equipped with a grain loader that placed grain directly on a trailer drawn by a tractor. When the new combine harvester was introduced, women had no more duties related to harvesting. An elderly woman recollected her harvesting experience:

> Harvesting by a reaper was basically manual labour.[6] It mitigated our labour a little but was not so different from sickles. But the combine harvester we bought for the first time brought a bitter experience for me. We, women, played subordinate parts in harvesting work, following the machine. The bags filled up with paddy were extremely heavy, with the weight of almost 20 kg each. I carried those bags as quickly as possible so as not to delay my husband who was operating the combine harvester. This labour continued from early morning till sunset. My husband tried angrily to rush me when I was behind in my task. I was so envious of him because all he was doing was driving the machine and complaining. This type of harvesting labour lasted more or less 10 years. It was a very long time, and I lost my health. Then my husband bought a new harvester with a loading device. Afterwards I have had nothing to do in the family paddy cultivation operations.

During its initial stages, mechanisation reduced men's work but amplified women's work. Needless to say, women did not participate in any decision-making about farm mechanisation. After mechanisation had been completed, some women became housewives while others were employed as regular or casual workers. As a result, almost all women were alienated from family farming. Technological innovation in agriculture deprived rural women of the pride they achieved from skilled work, especially in the case of transplantation. Agricultural mechanisation gradually expedited the defeminisation of agriculture. The next section will investigate the meaning of transplanting labour for women and clarify the process of defeminisation of rice cultivation.

[6] A reaper is a machine for harvesting which does not have a mechanism for threshing. It was used for a short period before the combine harvester was introduced.

Women possessed remarkable skills for transplanting. They could transplant paddy seedlings straighter and faster than men. They could plan and arrange transplanting on their own. In a sense, women were evaluated by people of the village based on their transplanting skills. A girl with excellent transplanting skills was acknowledged as a full-fledged woman not only in her family, but also in the village. During the transplanting season, the labour of women with good skills was exchanged between families in the same village, without remuneration. However, some women were hired with pay by big farmers in other villages who faced a shortage of workers for transplanting, although the cash women earned were kept by the heads of household. Nevertheless, being hired by a big farmer outside their own village was a notable honour for women, as it became known to everyone in the village.

For an unmarried girl, good performance in transplantation sometimes led to a "good marriage." A married woman with excellent transplanting skills was highly valued by her family and village. Women tried to display the perfect performance on the day of transplantation by wearing the clothes they had mended in advance. The women competed with each other to improve their skills because these skills enabled women in subordinate positions to elevate themselves and participate in the decision-making process in their patriarchal family. In other words, transplanting work had significant meaning for women: (1) they were proud of their skills; (2) they could earn cash for their skills; (3) they could participate in the family decision-making process as far as transplanting was concerned; and (4) good performance sometimes attracted a good marriage.

Mechanisation, however, made the women's exchange labour within the village and employment outside of the village obsolete. Before mechanisation, women were experts in transplanting operations in rice cultivation and they could arrange it on their own initiative, even if to a limited extent. After a riding-type transplanter was introduced, women were demoted to unskilled labourers and lost the chance to participate in decision-making. Introduction of the transplanter deprived women of their status and degraded them to subordinate labourers. They were not only alienated from the new skills required by the machine, but also required to perform labour-intensive, non-skilled work daily. An elderly woman described the situation after mechanisation:

> I was happy when a walking-type planter came to my home. It was the happiest time for me, because I didn't have to bend down for a long time to transplant the nursery and I could unhurriedly work together with my husband. But a riding-type planter and a combine harvester made my work very hard. It was only I who worked hard, while my husband enjoyed machine operations. I didn't have a chance to learn the machine operations. I felt solitude because I felt that I was separated from my husband and agriculture.

Women were forced to endure such burdens for more than ten years. Every machine-related skill was monopolised by men. Naturally, women lost interest in rice cultivation and farming in general. After years of arduous work in mechanised rice cultivation, many women began to complain about their physical condition. Men also thought that they should relieve their wives from the hardship. A 77-year-old man discussed the situation:

> I wanted to buy a new machine earlier than anyone in my village because I wanted to ease my work and brag about the new machine. It was a big pleasure to buy a new machine when it was newly marketed. People envied me, and I explained its advantageous specifications to them. Actually, the new machine made my work easy. I bought new machines with the money I earned as a regular worker outside my farm. At that time, I didn't think about my wife's body condition and her labour at all. I felt remorse when she lost her health.

Most of the men in farming households were engaged in regular work outside of their farm, and thus they could use the money earned from those jobs to purchase new machines when they came onto the market, one after another. From Monday to Friday, a man worked outside the farm, while his wife and father worked on the farm. It may be possible that a man was unaware of his wife's drudgery because he was in a factory or office while she was working on the farm. The wife of the respondent just cited explained that her husband instructed his father, and not her, on how to operate the machinery:

> My husband used to say to me to "never touch the new machine so as not to break it." He decided to buy new machines only by himself. Even his father didn't have a say in his decision. We acquiesced in the direction of our household economy by our head of household. I thought that my husband also considered that purchasing new big machines would make me free from drudgery. But when a big machine came to my home, we couldn't keep it in our homestead, so he made a new shed for it near the field. I didn't go there and never touched it. When we started to entrust rice cultivation to the cooperative, which conducted all operations with their machinery, women's labour was made all the more redundant.

Such accounts explain how women were phased out of family farming, and how men perhaps failed to see it happening. As the interviewees suggest, women's exit from family farming had physical as well as emotional repercussions. In addition, when rice production was almost mechanised, mothers-in-law retired from family farming and became housewives. They were only engaged in the production of vegetables and flowers for their family use. Young brides became non-agricultural workers and less concerned with family farming. A household's income is thought to have increased because women released from farming started to work in non-agricultural sectors.[7]

[7] Many women report that in the 1960s and 1970s they were forced to give their salaries earned from non-farm employment to their fathers-in-law and that they could not retain their own earnings.

Conclusions

This paper investigated the process of farm mechanisation and its impact on women's labour, focusing on skills for rice cultivation. This paper also examined the perspectives of women who were alienated from machine-related skills. At the early stage of mechanisation, women's labour transformed dramatically. They were forced to undertake enormous and burdensome non-skilled chores that were peripheral to machine labour. Transplanting work – in which women were experts and which they arranged on their own initiative, even if to a limited extent – disappeared. Women's confidence in their transplanting skills proved their value to men. However, after a riding-type transplanter was introduced, women were demoted to unskilled labourers and were not provided opportunities to learn new skills to operate the machines. Men became machine operators, while women were made to engage in more physically demanding labour.

With the introduction of combine harvesters, women were forced to perform physically exhausting tasks, while also losing their interest in family rice cultivation. Although the introduction of a combine harvester that was equipped with a device to load grain finally released women from physical hardship, women lost all opportunities to participate in family farming after its introduction. The gains of farm mechanisation in terms of farm management, such as the reduction of working hours and enlargement of farm size, came at the cost of women's involvement in agriculture. Mechanisation alienated women from family farming and defeminised rice cultivation, while providing men with a monopoly of the skills necessary for machine operations. Family farming, in which all members shared different roles and contributed to crop production, was dismantled. Some women began growing vegetables and flowers to sell at local markets in the 1980s, partly because farmers were forced to grow crops other than rice in paddy fields under the Japanese government's policy to reduce rice production. The lives of rural women who launched small horticulture enterprises will be the subject of future investigation.

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