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Diverse Practices of Free Grazing in the Knowledge Creation Spiral: A Case Study of Cow-Calf Farming in Oita Prefecture

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ABSTRACT

With serious issues in the agricultural sector, such as large-scale abandoned farmland and a declining farming population, the livestock industry also faces challenges in Japan. Since confinement rearing requires significant cost and labor for cattle-calf production, grazing has been gaining renewed attention in the industry. Grazing practices have traditionally been diverse, and more recently, one pioneer has emerged with an innovative approach to year-round cattle-calf grazing. This paper attempts to introduce a case of cow-calf farming in Oita prefecture and how the know-how gets distributed to other farmers in the knowledge creation spiral.

1. Introduction

In Japan, several issues have been raised across the Japanese Archipelago. Growing the area of abondoned land and decreasing the number of farmers is two primary concerns. The extent of abandoned land called as idle land, was 423,000 hectares in 2015 which increased from 131,000 hectares as subjectively reported data from farmers [2]. In contrast, objective data reported by the Ministry of Agriculture, Forestry and Fisheries [3] tends to be less area; total abandoned land has increased 94,000 hectares in total including about 41,000 hectares of intermediate agricultural regions between flatland and mountainous areas. Regardless of which dataset refering to, abandoned land exists on a large scale in Japan. From the number of farmers, core persons mainly engaged in farming as full-time farmers were accounted for 2,241,000 people in 2005, which increased to 1,363,000 people in 2020 [4]. The average age was 68.7 years old in 2023, up from 62.2 years in 2000, which let us observe rapid aging nationwide [5]. As the farming population ages, the number of farmers declines, which in turn contributes to the growing issue of abandoned areas without much of the next farming generation.

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In this context, a labor-saving and more efficient style of agriculture is urgently needed. Ministry of Agriculture, Forestry and Fisheries (2008) [7] presents a case introducing crops used on abandoned farmland, including buckwheat, rapeseed, soybeans, wild edible plants, grazing, tea, fruit trees, Manchurian wild rice, and sweet potatoes. Among these, grazing-based livestock farming especially enables savings of labor and cost. It has been gaining increasing attention as a solution to these issues. The growing focus on free grazing is reflected in recent agricultural policy developments as an example, the Livestock Industry Department of MAFF launched the Livestock Industry Cluster Program in 2013 as part of a direct payment scheme to support pasture development and grazing [8]. Until now, in 2025, the program continues to develop livestock clusters in Japan, with changes in system and name. In particular, grazing-based systems are encouraged for new entrant farmers with financial support [8], as grazing was one of the key strategies for abandoned farmland [17].

2. Beef Production in Livestock Industry in Japan

Looking at cattle farms in Japan, a particular trend is shown: a noticeable decline. Table 1 shows a declining trend in the number of beef cattle farm households engaged in both breeding and fattening from 2012 to 2020. The total number of such farms decreased from 65,500 in 2012 to 43,900 in 2020. Both breeding and fattening farm households steadily declined throughout Japan during this period.

On the other hand, the beef production by wagyu and crossbred cattle were upward trend over two decades from 2000 to 2023 based on cut meat volume; crossbred cattle production from 69,000 tons in 2000 to 95,000 tons in 202, and wagyu production from 162,000 tons in 2000, and 171,000 tons in 2023 [10]. This is because the average number of cattle per farm was 34.1 head in 2007 [14], and which count per farm increased to 52 heads in 2017 [12] and 73.2 heads in 2024 [13].

Table 1
Changes in breeding and fattening cattle numbers from FY2012 to FY2020
(Unit: 1,000 heads) [9]

Item	2012	2013	2014	2015	2016	2017	2018	2019	2020
Breeding cow	56.1	53	50	47.2	44.3	43	418	40.2	38.6
Beef cattle	14.3	13.5	13.1	11.6	11.7	11.3	10.8	10.2	10.0
Toral	65.5	61.3	57.5	54.4	51.9	50.1	48.3	46.3	43.9

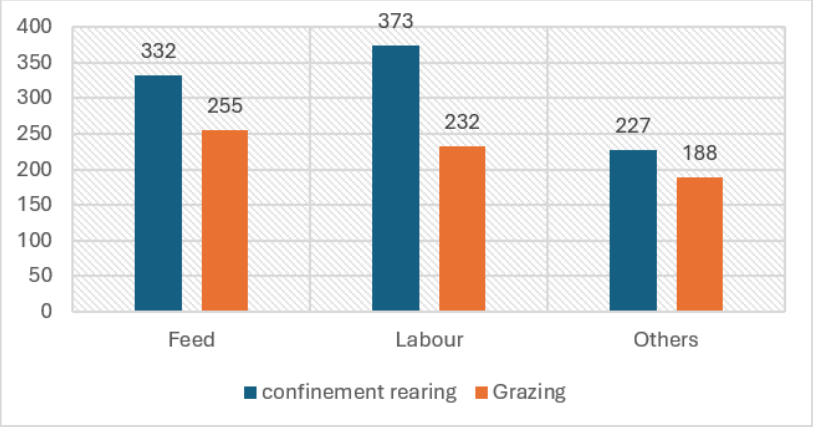

Fig. 1. Cost reduction from conventional confinement reading to free grazing by item. Note: Livestock product production costs in 2020, Unit: 1,000 yen [11]

In beef rearing industry, Figure 1 explains advantages of free grazing. There are mainly three advantages; cost reduction, labour saving, and less investment in facility. Besides, free grazing can work on weeding and keeps animal healthy with exercise etc. Firstly, in terms of annual cost, conventional confinement rearing is 933,000 yen annually which costs much higher than the annual cost for free grazing in 675,000 yen animal annually. According to the breakdown shown in Figure 1, every item shows cost reduction from feed, labour and others [11]. Especially labour costs were the highest amount at 373,000 yen reduced to 232,000 yen annually. Traditionally free grazing was one practice gaining attention because of the advantages among farmers.

In the livestock industry, currently there are conventional confinement rearing and grazing. Confinement has been relatively new in the last half century. Traditionally speaking, grazing is a method adopted by farmers. Grazing, and more specifically free grazing, has traditionally been practiced worldwide. Before 1970, most farm households typically owned no more than two head of cattle in Japan. In old times, livestock on farms used to be draft cattle for farm work and at the same time beef cattle for meat production. Because the number of cattle per farm was limited to a small number of head, people sometimes kept them jointly in satoyama communities which is flexible in the small area. After World War II, their numbers gradually increased [14] and began to shift toward more intensive and large-scale farming for meat production. Basic feature of grazing by practice and system is described in Table2 based on MAFF reference (2017) [15]. Based on the technical feature of grazing type, there are various styles of grazing by combination of features; Satoyama style and summer mountain-winter valley grazing. Satoyama style grazing is similar to fixed grazing, and summer mountain-winter valley grazing (*Natsuyama Fuyusato Hōshiki*) is mixed method with rotational and strip grazing in summer season and Confinement rearing in indoor housing in winter season. When the number of cattle were small, cattle were commonly grazed in the community's hilly or flat opened area for farmers who were cattle owners in the earlier time under loosely managed control. However once cattle become an economic animal for farmers, even they graze carrels, calves get confinement rearing for protection from disease and accidents. With the confinement rearing among calves, the method for mother cattle grazing remains as a method of gazing.

In most cases in Japan, because the number of cattle per farm has increased due to confinement rearing, the percentage of cattle involved in grazing remains limited to 14.1% [16], which is counted by heads, not by pasture area. Because Japan faces the challenge of increasing abandoned farmland alongside a decreasing number of farmers, given this situation, the government and municipalities encourage to utilize abandoned area for grazing [3].

Table 2
Feature of grazing by type [15]

Type	Feature
Rotational Grazing	This method is good for pasture management. Cattle graze in a pasture that is divided into several areas and used in rotation.
Fixed Grazing	For long term, cattle graze in the same grassland.
Strip Grazing	The area is divided into small plots and managed using electric fences.
Tethered Grazing	Cattle are tied with ropes and graze without fences, rotating to eat the surrounding pasture.

Looking at the advantages of grazing, it seems that this method can utilize a large area of pasture land with less intensive labor. It is worth considering for the country and municipalities to promote grazing practices for breeding cattle farmers. Cattle farming with less labor and lower costs through various grazing practices has become a promising option until calf prices began to decline. Concerns

remain over price stability. As shown in Figure 2, the unstable price trend of cattle and calves has gradually discouraged free grazing. Once, the price peaked at 815,000 yen per head in 2015, up from 361,000 yen in 2009, but it fell to 542,000 yen in 2024. Due to this sharp drop, many calf-rearing farmers left the industry. Such price volatility negatively impacts farm management. In recent years, rising feed costs especially for imported maize and other concentrates due to the war in Ukraine have also placed pressure on farmers. Amid these challenges, an innovative grazing practice emerged, developed by a pioneering cattle farmer in Oita Prefecture. This new method of free grazing has become controversial: it has attracted new farmers while sparking debate among those practicing conventional rearing methods.

year	2007	2008	2009	2010	2011	2012	2013	2014	2015
calf price	491	385	361	390	399	420	503	571	688
No. of breeding cow	636	667	682	684	668	642	618	595	580
year	2016	2017	2018	2019	2020	2021	2022	2023	2024
calf price	815	769	767	746	689	745	642	554	542
No. of breeding cow	589	597	610	626	622	633	637	645	640

Fig. 2. Trends in the number of breeding beef cows and calf prices [1]

3. Research Frame

The objective of this paper is to introduce a case of free grazing advancement in cattle mother-calf annual grazing and how its method has been distributed among trainees of the pioneer cattle farmer. The method may require least cost with less intensive labour among diverse practices of free grazing. Research method is based on face-to-face interview in person among eight cattle owner farmers including the pioneer farmer.

In terms of characteristics of research area, Oita Prefecture used to be a well-known agricultural area. Although there are mountainous and hilly areas, the municipality historically promoted green tea and fruits such as oranges and Japanese lime called as kabosu. However, depopulation has become a serious issue, accompanied by an increase in abandoned farmland. Looking at Figure 3, abandoned farmland is shown by color: yellow indicates less than 10% of farmland is abandoned in Japan. Light green and light blue represent abandonment rates of 10% to 15% and 15% to 20%, respectively. Dark blue indicates a rate above 20% by prefecture across Japan. Oita Prefecture falls into the 15% to 20% category, which is relatively high within the Kyushu region in the southern part of Japan.

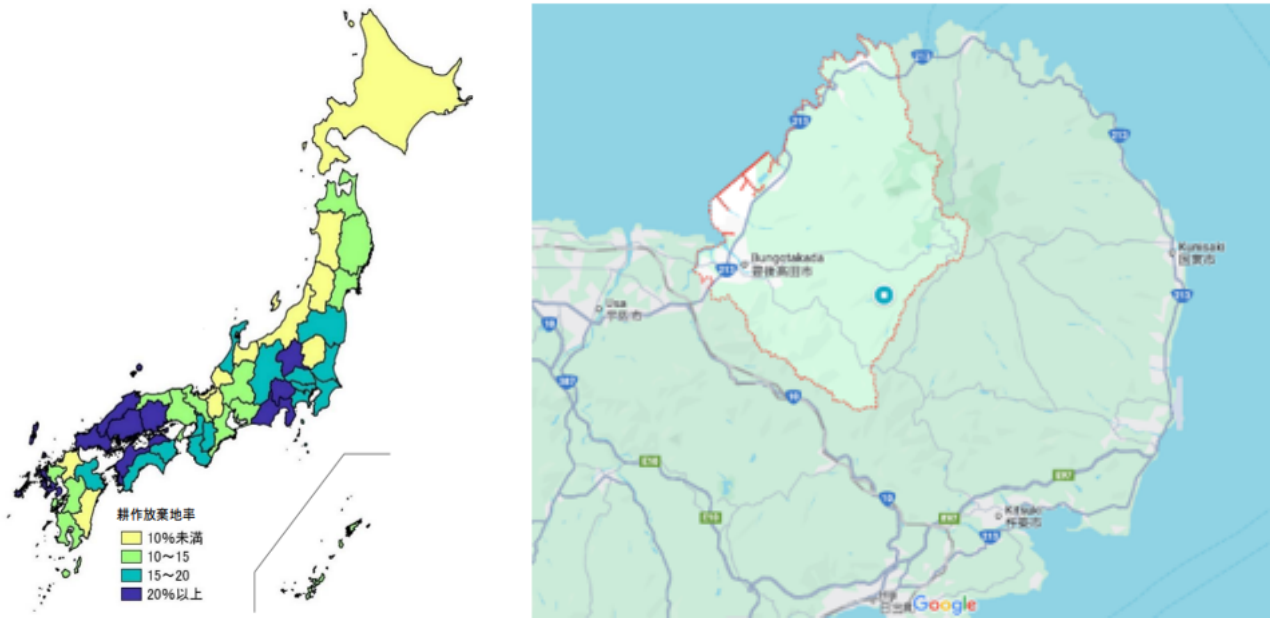

Fig. 3. Map of abandoned farmland rates by prefecture [6]

Once farmers leave the sloped mountainous or hilly farmland, it becomes very difficult to recover it for agricultural use. That land needs to be reutilized. With this in mind, "Nagamatsu-style grazing" known as year-round cow-calf grazing initiated as an approach to use abandoned land in Bungo-Takada City with minimized labour cost

3.1 Case Study: A Pioneer for Innovative Grazing

This section introduces a case of a cow-calf farmer known as a pioneer of grazing practices in Bungo-Takada City. Mr. Nagamatsu started practicing year-round cow-calf grazing. Unlike conventional farmers, he does not build a cattle barn to shelter calves from the heat in summer or the cold in winter. He prepared cattle shed simply by steel pipe frames and attach stanchions for each cow and calf for feeding. Unless there is any specific health concern like diarrhea or health problems after calving. The characteristics of year-round cow-calf grazing method in the following from (i) to (vi) based on Mr.Nagamatsu style of grazing:

i. Grazing outside cow shed is year-round regardless of seasons.
ii. Stanchions are equipped under a roof of simple shed structured by simple steel pipes.
iii. Cow-calf pairs stay together till the day calf get shipped.
iv. Feeding is limited to fed hay rolls and a small amount of concentrated feed.
v. If cow produces enough milk for calf, there is no bottle-feeding milk.
vi. If maternal rejection occurs, calf gets nursed by farmer.

This style of raising calves entirely outdoors is very rare, even among grazing farmers. Although it causes a controversial argument among conventional cattle rearing farmers, he committed to graze cow and calves in his way. Among farmers who practice conventional confined rearing, Mr.Nagamatsu way is unthinkably different practice that has drawn considerable criticism. When he started, the calves' price was relatively high, farm's management was in a good condition. After that, Bungo-Takada City became a home to those farms and cooperations who like to operate own grazing

in his way. He stated to accept approximately 10 trainees and taught how he manages the farm and raise cow-calves' pairs throughout the year.

As of February 1, 2024, there are three agricultural corporations and ten individual farmers in Bungo-Takada City which practice grazing in Mr.Nagamatsu way after spending a certain period of time, with some having trained for two years. Individual farmers were mostly new entrants to the agricultural sector. They started by looking for large land to graze cows in Bungo-Takada. Bungo-Takada City has strong support to find land and negotiate with landowners to let contracts with new farmers, sometimes, single plot of land has multiple owners which requires more than few owners, requiring municipal officers to coordinate with all owners. Often new entrants face challenges to find land and operate livestock farm in new place.

In order to understand at Mr.Matsunaga practice, it is necessary that the process of technological transfer through the knowledge creation spiral known as SECI model (Socialization-Externalization-Combination-Internalization) be discovered by Ikujiro Nonaka. In the model, the foundation of knowledge creation moves from tacit knowledge to explicit knowledge through four stages of Socialization-Externalization-Combination-Internalization. In the relation between Mr.Nagamatsu and the new farmers, he created own practice out of his experience and intuition and trained new farmers by sharing his method. They learn the practice from his explicit guidance and adopt the knowledge with their own experience and ideas. The process is intended to form continuous spiral of knowledge creation to more refined and suited to own land environment and features of cow-calves variety with health condition.

However, the circle of knowledge creation did not progress smoothly. Because the year-round cow-calf practice was not commonly used, conventional or other players attempted to mix the practice with conventional one. In the livestock industry for cattle breeding, there are a wide range of stakeholders including conventional rearing farmers, veterinarians, extension officers, and staff from the city's livestock promotion division who are highly experienced and have deep knowledge of conventional rearing. The main difference between conventional rearing and Mr.Nagamatsu style of year-round cow-calf grazing are as follows from (i) to (vii):

i. For conventional rearing, cost is not the primary concern for raising big calf with good girth, size and wright of the calf.
ii. Calving is managed with human intervention.
iii. Cows separated from calves after two months on average.
iv. For some cases, right after the birth, calves are separated and feed bottled milk by farmers.
v. Nursing is basically by farmers including milk feeding.
vi. Concentrated feed is well fed for more weight.
vii. Cow sheds are well build.

Although these were well-intentioned, there was an attempt to mix high-cost practice with cow shed and feeding concentrated feed and powdered milk disputed the original balance and causes imbalance of cost and labour input. Some farmers lost the balance of management and could no longer benefit from Mr.Nagamatsu style of cow-calf grazing. Although the study focused on an innovative year-round cow calf grazing, there are a lot to consider how new farmers adopt the grazing method in their farmland under the microenvironment conditions and mix, or not to mix the practice with other method for the development and establish own practice at farm.

4. Conclusion

A case of "Nagamatsu-style grazing" introduced in this paper offers valuable insight into how traditional grazing practices can respond to recent challenges in the livestock sector of Japan's agricultural industry. Throughout the year, cow-calf grazing is such an innovative method by holding substantial number of cows at a farm without the solid cow shed. However, the issue still remains for knowledge transformation and creation among new entrant farmers who came to practice year-round cow-calf grazing. The case shows the need of aligning support for new farmers surrounded grazing players by in terms of practical measures at national and municipal levels for new farmers. They need multiple tangible support to select method and practice for knowledge creation even after the completion of training.

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