

ERIA Discussion Paper Series**Assessing the Competitive Advantage of Public Policy Support for Supply Chain Resilience**

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Abstract: *This paper deals with the supply chain resilience of agricultural products in Japan. First, the food flow of Japan is explained. Japanese farmers and fishers produce and sell their products, receiving 9.4 trillion Japanese yen (¥). At the same time, Japan imports raw products and processed food. The fresh products move through the market to the eating out sector, the processing sector, and consumers. During this process, the value of agricultural products increases and consumers pay ¥73.5 trillion. Food flow sometimes suffers disasters, such as heavy rains, flooding, low temperatures, strong winds, volcanic eruptions, earthquakes, and tsunamis. In April 2016, a strong earthquake hit the Kumamoto area, severely affecting the production and supply of watermelons. To increase the resilience of the agricultural supply chain, the sixth industrialisation is effective and well established. Japan's sixth industry contains 60,000 businesses. Most of them are food processing and direct shop businesses. Direct shops are operated by farmers, farmers' groups, farmers' companies, municipalities, cooperatives, and producers' groups. They sell mostly vegetables, fruits, and processed food. Direct shop K is located on the urban fringe of Chiba prefecture. Since it was established in 2004, the shop has become very popular in the region. However, it has had to overcome two crises: the effect of the radioactive fallout from the Fukushima nuclear power plant accident and contamination by residual agricultural chemicals. The manager had a large role in the recovery, but Japan's agricultural policy also provided direct and indirect support at the national and local levels. Public policy supports the resilience of the agricultural supply chain through measures such as agricultural land use planning, agricultural improvement projects, rapid reconstruction following damage, and improvement of agricultural resources.*

Keywords: Public Policy Support, Resilience, Supply Chain, Agricultural Product, the Sixth Industry.

JEL Classification: Q12; Q13; Q18

1. Introduction

Japan's food self-sufficiency ratio has decreased to about 40% of the calorie base in recent years. The Ministry of Agriculture, Forestry, and Fisheries of Japan is tasked with increasing this ratio in the long term and maintaining constant supplies from domestic producers. However, agricultural production is vulnerable to, and often suffers from, natural disasters. Therefore, public policy should support local agriculture and, in case of damage, local government should help rehabilitate and restore agricultural production.

This paper deals with supply chain resilience of agricultural products, or the supply chain's ability to withstand disaster. The supply chain includes the production process of agricultural products and distribution channel issues.

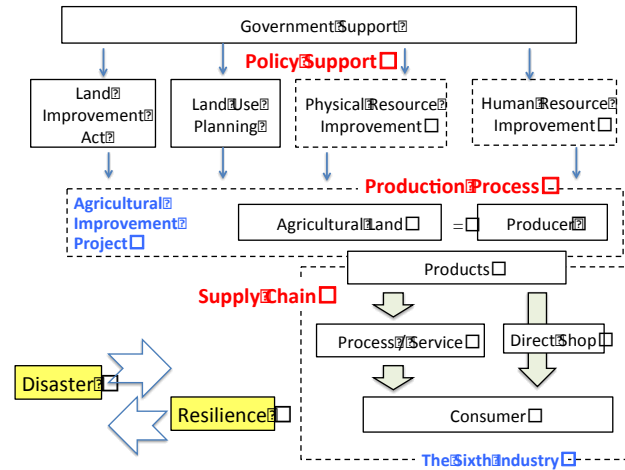
Agricultural land is the most important resource for production. It should be appropriately located and of sufficient area and quality. All other resources needed for agricultural production, such as water, labour, seeds, fertiliser, chemicals, and organic materials, are brought to where the land is located.

When a disaster strikes some part of Japan, production infrastructure at that location suffers damage and procurement of materials becomes more challenging, so production suffers. Even if the products are mature, farmers cannot prepare shipments, and usually the transport system has sustained damage. If the recovery takes time, the area becomes handicapped.

To maintain stable production levels, farmers should introduce new techniques to increase productivity and environmental friendly practices that are welcomed by consumers. Farmers can also expand their activities to include processing and services. This paper will discuss the "sixth industrialisation" for enhancing production conditions and public policy support. The term refers to the combination of the primary (agriculture), secondary (industry), and tertiary (services) industries for greater value addition.

The area of agricultural land should be maintained and its quality improved. Land use policy is essential to safeguard the area of agricultural land, while land improvement projects are necessary and have been executed to maintain or increase the productivity of the land (Figure 1).

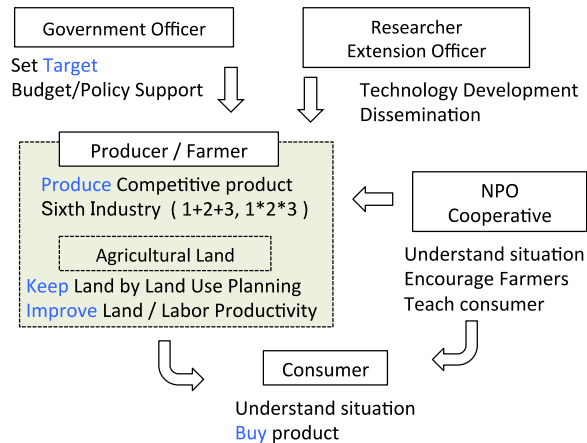
Figure 1: Process of Supply Chain of Agricultural Products



Source: Author.

Figure 2 shows a simplified diagram of the stakeholders involved in agricultural production. This paper aims to clarify each stakeholder's role in maintaining or increasing the resilience of the agricultural product supply chain.

Figure 2: Stakeholders Relating Agricultural Production



NPO = Non-Profit Organization

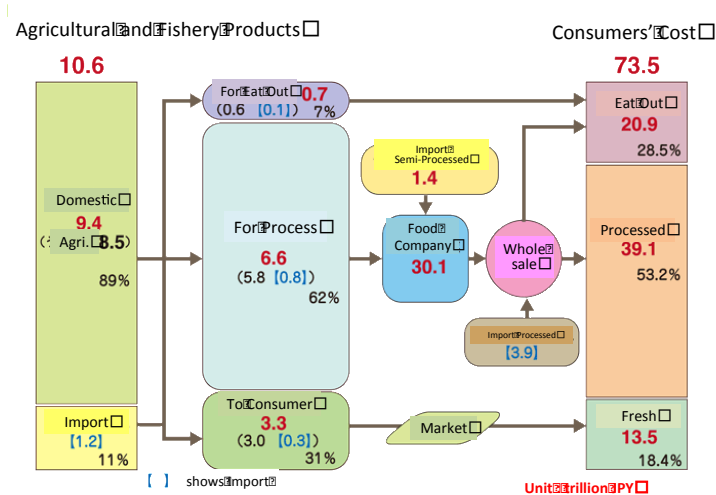
Source: Author.

2. Food Flow

Figure 3 shows Japan's food flow in monetary terms. Japanese farmers and fishers produce and sell agricultural and fishery products amounting to ¥9.4 trillion. At the same time, Japan imports raw products worth ¥1.2 trillion, semi-processed products worth ¥1.4 trillion, and processed products worth ¥3.9 trillion. About 7% of the raw product is sent to eating out sectors, 62% goes to processing sectors, and 31% is supplied fresh to consumers. The value of the raw product increases by a factor of four, from ¥3.3 trillion to ¥13.5 trillion, as it moves through the market. Figure 3 illustrates the complexity of the food processing system. Overall, ¥10.6 trillion of agricultural and fishery products, plus ¥5.3 trillion of additional imported processed materials, become ¥73.5 trillion in consumers' costs.

The agriculture sector's role is to maintain production and stable import volumes. Maintaining domestic production volumes requires efforts by farmers and a level of guidance, support, and encouragement by the government.

Figure 3: Food Flow in Japan



Source: National Federation of Agricultural Cooperative Association, 2013.

3. In the Event of a Disaster

3.1 General

Agricultural disasters caused by natural, social, ageing-related, and other phenomena cause both immediate damage and long-term effects. An earthquake, for example, directly damages agricultural infrastructure and products, and causes indirect effects, such as crushing farmers' enthusiasm.

3.2 Watermelons

Kumamoto prefecture is the largest producer of watermelons in the country, supplying 15.3% of the total crop. Table 1 shows the planted area and production of watermelons in 2015. Kumamoto prefecture produced 340,000 tonnes of watermelons to the Japanese market for consumption within Japan. The largest market in terms of volume and quality is Tokyo metropolitan wholesale central market.

Table 2 shows the volume of watermelons sold at Tokyo central market in 2015. Kumamoto prefecture's share was 21.6% of the volume and 27.1% of the value. The high share in terms of the value shows that Kumamoto prefecture's watermelons are of high quality and are welcomed by the market. The average price of watermelons at Tokyo central market is ¥178/kilogram (kg), while Kumamoto prefecture's watermelons fetch ¥266/kg.

Table 1: Production of Watermelon in Top Five Prefectures, 2015

□	Planted Area	Production	Share
Prefecture	(hectares)	(tonnes)	(%)
Kumamoto	1,490	52,000	15.3
Chiba	1,070	39,700	11.7
Yamagata	845	33,500	9.9
Niigata	588	21,100	6.2
Torroti	387	19,900	5.9
Japan	10,600	339,800	100.0
□	□	□ □	

Source: Government of Japan, Ministry of Agriculture, Forestry, and Fisheries.

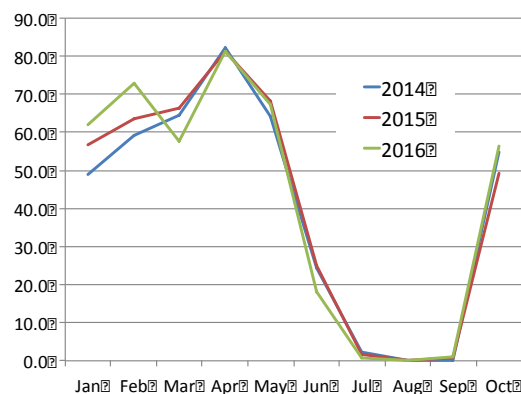
Table 2: Volume and Share of Shipment to Tokyo Market

□ Prefecture	Shipment (tonnes)	Share (%)	Production Rank
Kumamoto	9,385	21.6	1
Chiba	7,765	17.9	2
Yamagata	8,543	19.6	3
Niigata	2,308	5.3	4
Torroti	1,711	3.9	5
Ibaraki	3,987	9.2	6
Nagano	2,979	6.8	7
Japan	43,496	100.0	□

Source: Tokyo metropolitan wholesale central market.

Figure 4 shows Kumamoto prefecture's monthly share of watermelons at the Tokyo central market. Located in southwest Japan, Kumamoto prefecture benefits from a relatively warm climate, with a high daily range of temperatures. With the help of heated greenhouses, watermelons can also be grown, harvested, and sent to Tokyo market in winter. The share in winter (December to May) is much higher and ranges between 50% and 80% of the total value.

Figure 4: Share of Kumamoto Prefecture's Watermelons at Tokyo Market (Price Base)



Source: Tokyo metropolitan wholesale central market.

3.3. Earthquake Damage to the Watermelon Value Chains

The Kumamoto earthquake refers to a series of quakes that occurred starting on 14 April 2016. First quake struck at 21:26 that day. It was followed by a series of small quakes, a large tremor that struck at 1:25 on 16 April, and more aftershocks. The local residents' priority was to save lives, but although they did not have time for production, they still tried to harvest, select, pack, and ship the watermelon crop.

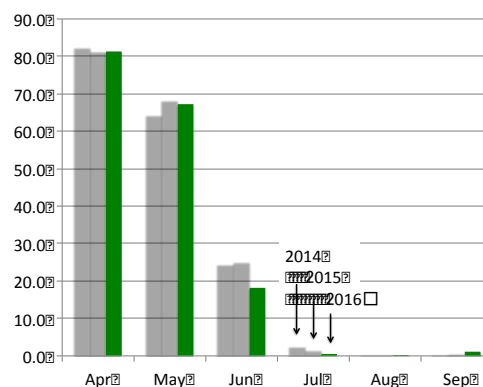
Some greenhouses were crushed. Automatic selection machines were damaged at Mashiki town, so farmers had to select and weigh watermelons by hand. Many watermelons in greenhouses were shaken and some stems were twisted and broken (Mainichi News). Part of the Kyushu expressway was closed, and detours resulted in longer transport times.

On 18 April, no watermelons from Mashiki town were brought to Ohta branch market of the metropolitan market. However, watermelons from another towns and cities continued to arrive (Nikkei news, 18 April), indicating that the severity of the damage differed from place to place. Farmers' groups and agricultural cooperatives shipped watermelons directly to the market, by the same way before the earthquake.

Kumamoto prefecture's share of the value of watermelons sold at Tokyo central market in April and May was similar to previous years. However, in June and July it decreased slightly (Figure 4).

Figure 5 shows the market data for April to September as a bar chart. The decreases in June and July were caused by the earthquake. They were minimised by the efforts of farmers (interviewed to J.A. Kamimasiki, 2016).

Figure 5: Share of Kumamoto's Watermelon at Tokyo Market after the 2016 Earthquake (Price Base)



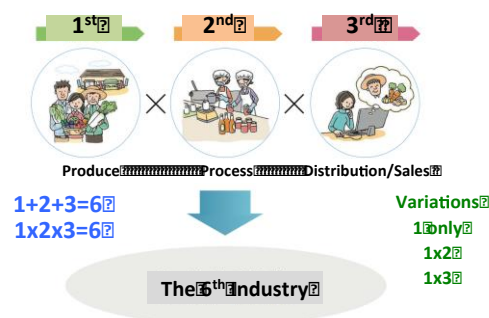
Source: Tokyo metropolitan wholesale central market.

4. Enhancement of Production and Supply by the Sixth Industrialisation

4.1. Concept

Figure 6 illustrates the concept of the sixth industrialisation, which was invented by Professor Imamura in around 1980. The sixth industrialisation refers to the opportunities created when secondary (2) and tertiary (3) industries are combined with primary (1) industry to provide greater value. This can be expressed as $1+2+3$ or $1 \times 2 \times 3$. Even part of the sixth industry, e.g. 1×2 or 1×3 , is referred to as the sixth industry.

Figure 6: The Sixth Industrialisation



Source: Kodaira, (2016) 'On the Sixth Industrialisation'.

4.2. Present Conditions of the Sixth Industrialisation in Japan

As shown in Table 3, there are 60,000 businesses involved in the sixth industrialisation in Japan. Most of them are food processing and direct shop enterprises. Fishery processing businesses dominate the fisheries subsector.

Table 3: The Sixth Industrialisation in Japan

□ Business type□	Number□	Total sales□ ¥ million□	sales / body□ ¥ '000□	workers□ '000□
Food processing□	26,660□	857,678□	32,171□	167.5□
Direct shop□	23,710□	935,630□	39,461□	207.5□
Leisure farm□	6,690□	36,430□	5,445□	45.7□
Farm inn□	1,890□	5,406□	2,860□	7.4□
Farmer's restaurant□	1,440□	32,089□	22,284□	13.4□
Fishery processing□	1,490□	172,388□	115,697□	18.4□
Direct shop□	640□	33,204□	51,881□	5.6□

Source: Government of Japan, Ministry of Agriculture, Forestry, and Fisheries

Tables 4 and 5 provide details of direct shops in Japan. About half of them are run by individual farmers. The sales of farmer-run direct shops are small compared to the sales of the cooperatives. About half of the sales are of vegetables and fruits, followed by processed food, flowers and nursery trees, rice, and meat.

Table 4: Direct Shops

Operator	Number of business	Total sales	sales / body	open days
		¥million	¥million	days/year
Farmer	11,070	63,332	5.72	145
Farmer's Group	550	15,041	27.40	234
Farmer's Company	1,370	53,077	38.77	231
Municipality	620	69,241	111.86	316
Cooperative	2,060	326,602	158.24	312
Producers' Group	5,130	148,841	28.99	206
Others	2,910	259,495	89.17	293
Total	23,710	935,630	39.46	203

Source: Government of Japan, Ministry of Agriculture, Forestry, and Fisheries.

Table 5: Sales of Direct Shops

Item	Total Sales million ¥PY
Rice	53,822
Vegetables	307,350
Fruits	158,413
Mushrooms	23,992
Meat & Fish	52,189
Other Fresh Food	25,965
Processed	131,050
Flowers & Trees	73,294
Others	109,553
Total	935,630

Source: Government of Japan, Ministry of Agriculture, Forestry, and Fisheries

Table 6 shows the number of leisure farms in Japan. Leisure farms operated by individual farmers are the most numerous. All types of leisure farm are open for about 100 days in the year, mainly at weekends and on holidays. Farm inns are similar to leisure farms, and are open two or three days per week (Table 7).

Table 6: Leisure Farms

Operator	Number of business	Total sales million ¥PY	body million ¥PY	open days/year
Farmer	5,820	19,296	3.32	72
Farmer's Group	140	1,490	10.49	112
Company	730	15,645	21.31	123
Total	6,690	36,430	5.44	79

Source: Government of Japan, Ministry of Agriculture, Forestry, and Fisheries.

Table 7: Farm Inns

Operator	Number of business	Total sales	sales / body	open days
		million JPY	million JPY	days/year
Farmer	1,730	4,482	2.59	88
Farmer's Group	40	272	6.48	161
Company	120	652	5.67	156
Total	1,890	5,406	2.86	94

Source: Government of Japan, Ministry of Agriculture, Forestry, and Fisheries.

There are many types of farmers' restaurants, organised and operated by individual farmers, farmers' groups, farmers' companies, agricultural cooperatives, and companies. They are usually open all the year round.

Table 8: Farmers' Restaurants in Japan

Operator	Number of business	Total sales	sales / body	open days
		million JPY	million JPY	days/year
Farmer	780	5,958	7.66	196
Farmer's Group	90	2,069	23.51	248
Farmer's Company	440	15,062	34.39	251
Cooperative	70	5,829	87.00	323
Company	70	3,171	43.44	298
Total	1,440	935,630	22.22	227

Source: Government of Japan, Ministry of Agriculture, Forestry, and Fisheries

5. Sixth Industrialisation in Local Level

5.1. Strategy and Support at Prefectural Level

Public policy support at the local level by Chiba prefecture, one of the local governments in Japan, is promoting the sixth industry, as are other prefectures. Chiba prefecture, located next to Tokyo metropolitan area, is the top producer of agricultural products after Hokkaido, which has the largest area and production.

Chiba prefecture has the largest number of direct shops in Japan. The Strategy of Sixth Industrialisation in Chiba Prefecture was issued in March 2016 (Chiba prefecture 2016a).

The strategy aims to (i) expand the number of workers interested in the first industry, (ii) give them appropriate advice and technical support, (iii) prepare a fund to introduce new machines and facilities, (iv) maintain or expand the market of new products, and (v) make a network for promoting the sixth industrialisation. It targets increasing the number of certified organisations to 100 in 2019 from 34 in 2014, and increasing sales to ¥100 billion in 2019 from ¥35.7 in 2012.

Adding to the support available at the national level, Chiba prefecture plans a support programme that includes (i) making the promotion structure, (ii) providing information about national-level subsidies and loans, (iii) giving support from prefecture-assisted projects, (iv) offering consultation and support from local administrations, (v) compiling a list of pioneer projects, (vi) providing information on local funds, and (vii) making a support base for new products.

In August 2016, the list of pioneer projects was issued on Chiba prefecture's website. A total of 33 projects were listed, covering wide variety of fields. All projects established processing units for agricultural or fishery products, some opened restaurants or coffee shops, or started participation programmes with urban residents. The agricultural or fishery products include organic rice, rice cake, local sushi, sweet potato cake, local vegetable pickles, carrot juice, pear sherbet, mandarin orange jam, milk gelato, ice cream, dried fish, organic pork, organic beef, and organic eggs. Participation programmes include picking blueberries and mandarin oranges, and making pizza and sushi rolls.

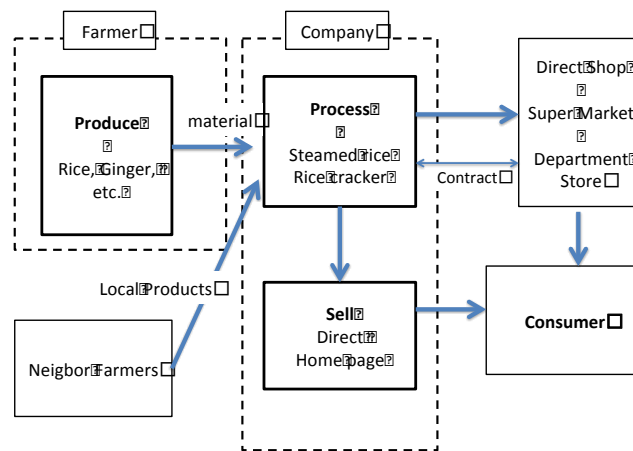
5.2. Case Study

This section discusses three sixth industry examples in Chiba prefecture. Although Chiba prefecture is the second-largest producer of watermelons, there are no cases of sixth industries dealing with this crop.

i. Case A

When a large direct shop opened in 2001, the organiser of case A established a company that mainly processed local rice to steamed rice, rice balls, sushi rolls, rice cakes, rice crackers, and packed lunch. The products were sold at the direct shop and in supermarkets and department stores. The unique aspect of this company is its frequent deliveries to the shop, providing warm, fresh food to consumers. The company employs 17 people including seasonal workers. Figure 7 illustrates the structure of this industry example.

Figure 7: Structure of Case A

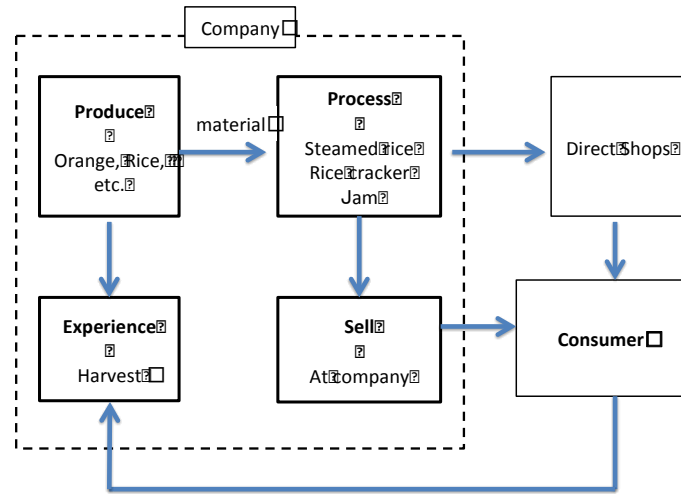


Source: Author

ii. Case B

Case B is a family-managed farm that mainly grows rice and mandarin oranges. Rice is processed into steamed rice and rice crackers, and brought to a direct shop nearby. The unique point about this farm is the experience of harvesting mandarin oranges, which has become popular with visitors. Figure 8 illustrates the structure of Case B.

Figure 8: Structure of Case B

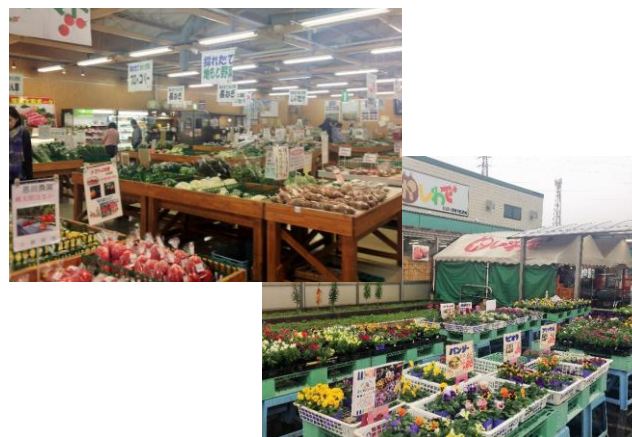


Source: Author

iii. Case C

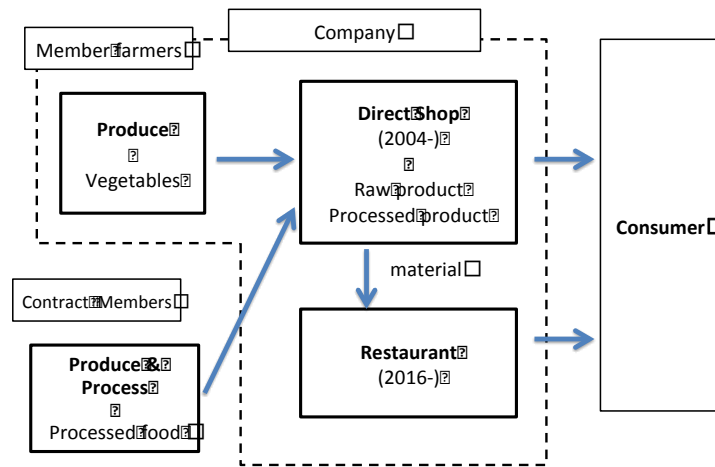
Case C is a large direct shop located in the urban fringe. It was established in 2004 by 10 farmers' groups. It deals fresh vegetables, processed dishes, and processed food. The concept of the shop is to "Make Farming Sustainable and Activate the Region." It has become very popular in the region, selling ¥1 billion (about \$8 million) per year. Figures 9 and 10 provide more details.

Figure 9: View of the Direct Shop



Source: Direct Shop C.

Figure 10: Structure of Case C



Source: Author

The direct shop has grown steadily and has weathered two recent crises. The first of these was the effect of radioactive fallout from the Fukushima nuclear power plant accident, which damaged the farming area of the direct shop. Although the volume of fallout materials was very small, it varied from place by place and from field to field. Most of the products were safe. However, consumers believed every product to be dangerous to human health and stopped buying from the shop. When the manager introduced a residue measuring instrument that showed the real status of the food, the consumers came back gradually.

The second crisis concerned residual agricultural chemicals. One of the 120 member farmers used a pesticide that member farmers had been instructed to refrain from using. When the pesticide was detected, the manager closed the shop. It took months to regain customers' confidence in the shop.

Recently, the direct shop opened a restaurant, serving a newly developed dish made with fresh vegetables.

6. Agricultural Policy in the Post-War Period

6.1. Rural Development Policies in Japan

The purpose of the agricultural policies Japan established after the war (until 1960) was to increase the food production. Technologies to increase yields were introduced through the enforcement of the Land Improvement Act, established in 1949. During that time, quantity was emphasised over quality.

In 1960s, the income gap between agriculture and industry became apparent, and the agriculture structure had to be improved to correct it. This was achieved by expanding the scale of agricultural production and increasing the range of agricultural products grown. During the years of rapid economic growth, the income gap between urban and rural areas widened, people migrated from the rural areas to urban centres, and the number of part-time farming households increased. There was therefore a need to improve the productivity of agricultural labour and modernise farm management. The Agriculture Basic Law was established in 1961, and an agricultural structure improvement programme, combining improvement of agricultural infrastructure with the development of facilities for modernising farm management, was implemented.

In 1970s, urban areas expanded due to the high economic growth, creating competition between urban and agricultural land uses. Large areas of agricultural land were converted to urban use. A law was established to safeguard agricultural land required for modern agriculture and to promote public investment in rural areas in a planned manner. A project was also carried out to improve the living environment in rural areas that lagged behind urban areas. Thus, the integrated rural improvement era began, improving agricultural production infrastructure and upgrading living environments in rural areas in a comprehensive manner. The Land Improvement Act was amended in 1972 to promote the creation of land for non-agricultural use required to improve living environments through adjusting land use.

At this time, excess production of rice and mandarin oranges became a problem. There was a surplus of rice because the procurement price and the amount produced had increased but per-capita rice consumption was falling. Therefore, a policy to

encourage crop rotation was implemented.

In 1980s, import liberalisation of agricultural products was promoted and this required changes in price policies governing agricultural products. The price of domestic agricultural products slumped and the appreciation of the yen against the dollar increased the pressure to import agricultural products. As a result, the country's food self-sufficiency ratio decreased to less than 50% in the late 1980s.

In 1990s, the World Trade Organization was established. This created a new sense of the value of agriculture and rural areas. Legislation was reviewed and the Basic Law on Food, Agriculture and Rural Areas was established in 1999.

In the 2000s, projects for improving natural environments in rural areas and emphasising amenities in rural areas have been carried out. Rural development policies have been developed to create rural areas that are comfortable for farmers and community residents, and to develop agricultural production infrastructure and maintain living environments in rural areas.

6.2. Changes in Agricultural and Rural Development Policies

6.2.1. Rural Development by Developing Agricultural Production Infrastructure

Projects to develop agricultural production infrastructure play a large part in accomplishing tasks relevant to agricultural administration, such as increasing the total production of agriculture, and improving food self-sufficiency and agricultural productivity. This section describes the development of the Agricultural Land Development Project, Agricultural Land Consolidation Project, Project, and Irrigation and Drainage Project in national level.

The Agricultural Land Development Project has played a large part in improving the structure of local agriculture by expanding the area of agricultural land. In recent years, agricultural environments have been changing rapidly due to depopulation and ageing of rural areas, and the price slump of agricultural products. The project intended to rejuvenate local areas with the creation of non-agricultural land by the planned restructuring of land use while carrying out integrated development of agricultural and unploughed land.

The Agricultural Land Consolidation Project has played a large part in increasing the production per area and the total production of agriculture and labour productivity by facilitating the introduction of large and medium-sized machines through measures such as adjusting and levelling fields, and adding pipe drains to improve drainage in paddy fields. Improving conditions in agricultural fields develops momentum for borrowing and lending and contributes to the liquidity of agricultural land and the promotion of farm work contract. The project has been expanded greatly to support the enhancement of the liquidity of agricultural lands.

The Irrigation and Drainage project has been performed in collaboration with the Agricultural Field Development Project to reduce the labour required for water management, and to enhance the liquidity of agricultural land while improving its productivity.

6.2.2. Rural Development by Improving Living Environments in Rural Areas

Japan's rural areas have faced problems, such as depopulation, ageing, and urbanisation, as young people have moved from rural areas to large cities during the period of high economic growth, and non-farm households have moved to suburban rural areas. At the same time, living environments improved more slowly in rural areas than in urban areas, and rural residents request the raise of living standard. It is important to meet the needs and aspirations of rural residents by developing conditions that encourage people to settle in these areas, and are conducive to maintaining and developing rural areas as stable and attractive places to live and work.

In view of the close association between agricultural production and agricultural life in rural areas, the Integrated Rural Improvement Project has been implemented to improve agricultural production infrastructure and maintain living environments in rural areas in a comprehensive manner.

Recently, the importance of rural areas as a place for non-farm households, including newcomers, to live has been reviewed. Rural areas have also received a lot of attention as places of recreation and relaxation surrounded by nature.

6.2.3. *Rapid Urbanisation*

Rapid economic growth during the 1960s and 1970s was accompanied by high rates of urbanisation. Although urbanisation itself can be beneficial, rapid and unplanned urbanisation can cause many problems.

Sprawl is a typical problem in urbanising or rural–urban fringe areas. For example, a new road or railway may divide agricultural land where paddy has traditionally been grown. Houses and industrial lots may subsequently be built on the farm land. These land use changes on the rural–urban fringe are the result of competing demands for land. Even in rural areas, the many demands that exist create pressure to convert agricultural land.

These include demands for (i) living environments, community roads, meeting places, disaster prevention facilities, and house lots for children; (ii) production, farm equipment storage, roads, irrigation systems, and grain storage and processing buildings; and (iii) social infrastructure, highways, and community facilities. At the peak of rapid economic growth in the 1970s, more than 100,000 hectares of agricultural land were converted to urban use every year.

In recent years, demand has decreased. In 2013, 11,500 hectares (ha) of agricultural land and 2,100 ha of forest land were converted to residential use, 700 ha of agricultural land were converted to forests, and 100 ha of forest land were converted to agriculture. Although much agricultural land was converted to urban use, such as residential areas, there was no conversion from residential areas to other land uses or from urban use to agriculture or forestry.

Simply stated, land use change is irreversible. Once the agricultural land is converted to urban land use, it is very difficult or impossible to convert it back to agricultural land. This is one of the main reasons land use planning is necessary.

6.2.4. *Rural Development Policy Under the New Basic Law*

To respond to changes in the situation of food, agriculture, and rural areas, and the nation's expectations for agriculture and rural areas, the Basic Law on Food, Agriculture and Rural Areas was established in 1999. Its four basic concepts were to sustain food provision, fulfil the multi-functionality of agriculture, develop agriculture sustainably, and develop rural areas. Since the law was established,

policies emphasising consideration for conserving and restoring the rural landscape, characteristic rural development that is achieved by the cultivation of agricultural management entities, and the needs of regional agriculture have been carried out under the Agriculture and Rural Areas Development Project to respond to the four basic concepts.

7. Land Use Planning

7.1. Zoning

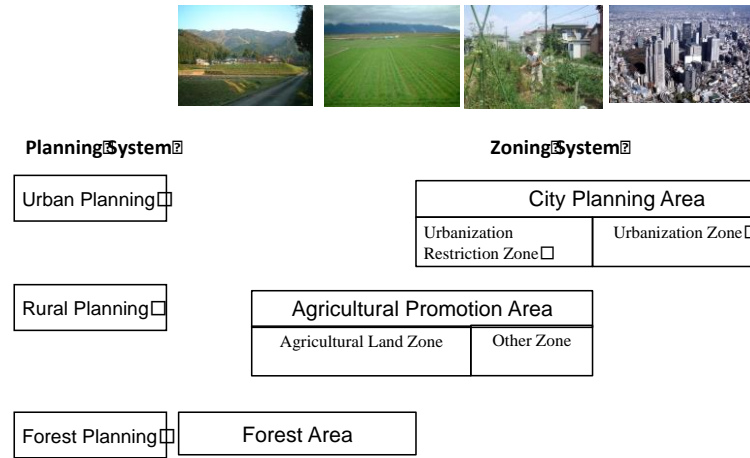
As more land becomes necessary due to changes in people's lifestyles, and safe and convenient life becomes essential to all people, land use conversion is needed, requiring rational and effective land use planning.

Through land use planning, agricultural land consolidation projects can generate new non-agricultural land in rural and urban fringe areas while also increasing the productivity of the agricultural land.

The conversion to non-agricultural land use is more appropriately referred to as modernisation, rather than urbanisation, given that it occurs in rural areas as well as urban ones, as the demand for modern living exists in both locations.

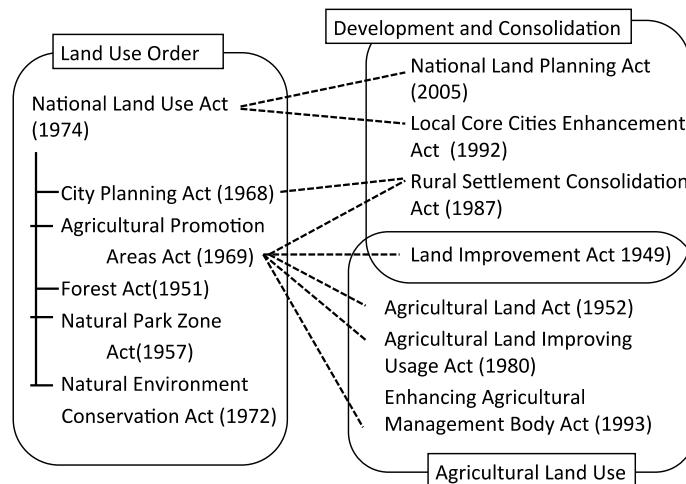
Figure 11 shows land use planning system in Japan. Land use planning consists mostly of urban, rural, and forest planning. The area covered by each plan is not separated clearly, so the plans overlap. It is therefore important to adjust each plan where the target area is covered by plural zoning systems. Figure 12 shows the legislation system relating to rural improvement. The National Land Use Act is the basic act to decide and lead national land use. Five acts fall under it. The right-hand side of the figure shows how the acts relating development and conservation and agricultural land use are arranged. These acts make Japanese rural land use effective and orderly.

Figure 11: Land Use Planning System in Japan



Source: Author.

Figure 12: Legislation System Relating Rural Development



Source: Author

7.2. Land Consolidation for New Land Use Planning

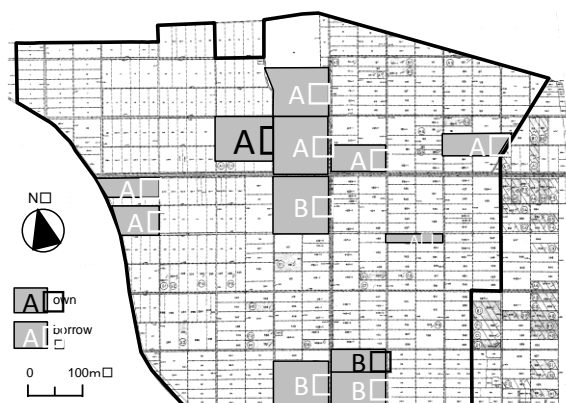
Figure 13 shows a second land consolidation executed in Ehime prefecture. The standard plot size increased from 0.1 ha to 2.0 ha. However, land property remained. So, the accumulation of cultivation rights was also executed (Figure 14).

Figure 13: Revised Land Consolidation Utilising Previous Structure



Source: Yamaji (2013)

Figure 14: Accumulation of Land and Cultivation Rights after Land Consolidation



Source: Yamaji (2013)

8. Discussion on Policy Support

The three examples of the sixth industrialisation detailed in chapter 4 are success stories that can improve on further. However, there are many cases that cannot to be described as successful. Public policy support can contribute improving these situations.

8.1. Increase Productivity through Policy Support

To maintain the sustainability of production, agricultural land should be protected. Land use planning and supporting legislation are important to properly conserve agricultural land. Productivity should also be improved.

Land productivity is the indicator of how many tonnes of agricultural produce farmers can grow per unit area. It is decided by factors such as weather conditions, soil fertility, irrigation and drainage, fertilizer application, and weed and pest control. Labour productivity is the indicator of how many hours is needed to produce a crop per unit area. Land consolidation can improve the performance of this indicator, and land consolidation projects are usually supported by government policies.

Two elements shown in Figure 1—physical resource improvement and human resource improvement—also receive government support.

8.2. Increase Value of the Product through Policy Support

When farmers produce high-quality agricultural products, they should be sold at an appropriately high price. The sixth industrialisation is an effective way to increase farmers' incomes.

Although not directly connected to farmers' incomes, some other methods motivate farmers to continue in agriculture. Advocating the use of local products is one such method. Kashiwa City, in Chiba prefecture, started to increase the ratio of local food in school lunches. At school, students eat local food and learn local agriculture, enhancing farmers' motivation.

8.3. Increase Resilience through Policy Support

Even good-quality agricultural land can be affected by the sudden onset of disasters, so the resilience of agricultural land needs to be increased.

Category 1 disasters—volcanoes, earthquakes, and tsunamis—are difficult to predict. Even if it happens, the area is limited within the relatively small region, so we can help each other. Municipalities, nongovernment organisations, and citizens are aware of and have trained for such events. Category 2 disasters, such as typhoons, heavy rains, strong winds, and cold spells, can be predicted a little before they strike. It is usually possible to be sufficiently prepared for such events. Category 3 disasters

are those that can be reduced or stopped. Global warming, water pollution, soil contamination, land subsidence by pumping, flooding, and landslides belong this category. Many of these potential disasters can be mitigated with public policy support, such as appropriate land use planning or legal restrictions.

Facilities needed for disaster prevention at the village level include facilities for landslide prevention, wind and snow damage protection, fire prevention, storm water drainage, waterway and pond safety, traffic safety, crime prevention, and disaster prevention radio.

The Ministry of Agriculture, Forestry, and Fisheries executes disaster prevention projects for agricultural and rural infrastructure. However, despite efforts to reduce or prevent disasters, they still occur periodically. To assist farmers in such cases, a system of mutual aid is in place, including financial mutual aid insurance for farmers, with support from the national government.

Conclusion

The objective of this paper has been to describe public policy support for supply chain resilience. The author tried to present the current status of Japanese agriculture and its evolution, and land use planning and land consolidation projects to maintain and enhance resilience.

As stated in section 5, agricultural improvement projects are effective for enhancing resilience. In paddy areas, land consolidation for renovating paddy field structure and facilities is recommended. In upland crop fields and orchards, land consolidation is also recommended and agricultural water services are needed where there is no irrigation.

Agriculture should be strengthened. However, the non-production effects of agriculture should not be neglected, and we should ensure that cultivation methods are environment friendly.

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