Survivability from a Managerial Economic Perspective: Dairy Farming and Rice Farming in Japan

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Over the past few years, Japanese agricultural holdings have been facing challenging conditions in terms of fluctuating food demand as well as a decline in food prices. This paper clarifies managerial survivability from two standpoints: temporary and permanent, applying two analytical methods. First, we employ 'Expense-income analysis' to investigate temporary managerial survivability (TMS), which is realised when an agricultural holding's gross income is above or equal to operating expense. Second, we employ Minimum Required Operating Scale (MROS) analysis to investigate permanent managerial survivability (PMS), which is realised when a holding can afford one additional unit of the scarcest resource. We analyse the dairy and rice farming sectors in Japan. Our findings reveal that it is not only imperative for holdings to enlarge their farming scale, but also to more essentially take into account improvements in managerial environments.

Key words: expense-income analysis, minimum required operating scale analysis, dairy farming in japan, rice farming in japan

1. Theme and procedures

(1) Introduction

Over the past few years, Japanese agricultural holdings have been facing challenging conditions in terms of fluctuating food demand as well as a decline in food prices triggered by a growth in the buying power of retailers and a rise in feed grain prices. In addition to grave state of the managerial environment, an upward trend in the number of people abandoning farming as they age and the deficiency of successors endangers the survival of agricultural holdings. However, managerial status differs depending on each FS and this sort of ambiguity complicates the process of finding a universal solution. In this context, this paper investigates the managerial survivability of Japanese agricultural holdings from an economical perspective, such as gross income and operating expense for each classification of farming scale (FS). We do estimate the number of cows and area of paddy field that can be considered sustainable based on the number of holdings in each classification of FS keeping managerial survivability, under the present condition. This study, moreover, discusses background of the managerial environment and expense structure, both of which could affect the current managerial survivability, and considers solutions for improving managerial survivability of dairy farming and rice farming.

(2) Literature review and framework of analysis

With the intention of discussing managerial survivability, we surveyed the literature and looked for a method applicable to this type of analysis.

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Niiyama (1997) writes that 'it is vital for agricultural holdings to repeatedly earn a sufficient profit to source the factors of production for the next term on a permanent basis, which makes the holdings sustainable' and 'the amount of gross income must exceed the total production cost.' Shedding light on that condition, 'gross income exceeds the total production cost,' as a minimum necessary requirement, this paper tries to discuss survivability in each FS based on statistical data. In plain terms, the primary condition for survivability is gross income surpassing total cost, with this equilibrium state generally known in accounting as the Break-Even Point (BEP). MAFF (2016a) concludes that the 'BEP signifies the point when neither profit nor loss is generated since the total sale is equivalent to costs of production, and the total sale is formulated as,

Break - even total sales = Fixed cost / {1- (variable cost)／(total sales)}

An analytical method, employing the calculated value of break-even total sales and analyzing the relation between income and cost, is known as 'Break even analysis.' This analysis is effective for agricultural holdings to define the break-even point caused by variation in production yield, price or cost structure (such as ratio of variable cost and fixed cost) and to elaborate management plans on a fixed scale (fixed amount of facilities or devices) (Tsukuda et.al, 2006 and Sakoda, 2009). However, this method does not achieve comparability between profit structures at different managerial scales – i.e. with different facilities, devices and machinery. Therefore, Break-even analysis is incompatible with our purpose of clarifying the profitability in holdings from each FS based on statistical data. To overcome this limitation, this study examines survivability with multiple indexes on the coverage of gross income against operating expense; we call this analysis Expense-income analysis.

Although managerial survivability indicated by Expense-income analysis helps understand the condition of temporary operations, it has less meaning for permanent potential. In fact, Niiyama (2014) points out that 'permanent managerial survivability is strictly limited by the availability of the scarcest resource, and it hinges on whether gross income can cover the procurement cost of the scarcest resource.' Furthermore, she defines the managerial scale at which the cost of one additional unit of the scarcest resource is affordable as the 'Minimum Required Operating Scale (MROS).' She further explains that, 'formerly, land was regarded as a scarce resource in Japan, but at present, that is replaced by full-time farmers (especially their successors),' and since there exists a wide range of career choices to attract young people away from the agriculture sector, 'it is necessary to achieve the annual per capita compensation for family labour above or equal to the average wage in other industries.' 'The farming scale of achieving this balance is understood as MROS.'

Based on the above specification, this paper clarifies managerial survivability from two standpoints: temporary and permanent, based on two types of analytical methods.

First, we employ Expense-income analysis to investigate temporary managerial survivability (TMS). Expense-income analysis examines a farming scale that an agricultural holding's gross income is above or equal to cost, which is TMS. We consider the following three inequali-ties to be defining of Expense-income analysis.

Gross income ≧ Operating expense ----------(i)[1)]

Gross income ≧ Operating expense + Estimated value of family labour[2)] ----------(ii)

Gross income ≧ Operating expense + Estimated value of family labour + Equity capital interest[3)] +

Rent for owned land [4] ----------(iii)

This research primarily deals with equation (i) and (ii), but with some attention to equation (iii) on the issue of internal reserves. The reason for adopting (ii) arises from the current situation in Japanese agriculture, in which agricultural holdings have historically paid little attention to the perspective of estimated value of family labour. To be precise, in family-run farming, profitability has often considered independent of the appropriate estimated value of family labour. Instead, it has been determined only by whether a family-run farm business can cover payments for external factors of production. Although lower business risk achieved from discounting the estimated value of family labour is one of the merits of operating a family-run farm, we regard the condition in which family farmers achieve appropriate estimated value for their labour as *intrinsic* or *ideal* managerial survivable. This is captured in inequality (ii). In contrast, inequality (i) is suggestive of a more *pragmatic* survivability response to the actual situation, in which the estimated value for family labour is not factored in.

Second, we employ MROS analysis to investigate permanent managerial survivability (PMS). MROS analysis measures the extent to which a farming scale can ensure that the successor will continue farming. As Niiyama (2014) suggests, PMS is achieved when over the MROS that is the scale satisfying the following inequality:

The annual per capita compensation for family labour ≧ The average wage in other industries
----------(iv)

MROS analysis examines an operating scale satisfy (iv). This paper subsequently adopts the average wage for manufacturing labour as the key standard for measuring MROS. Thus this study examines both Expense-income analysis and MROS analysis, and, based on those results, discusses the survivability of agricultural holdings in Japan.

(3) Data and analytical methods

In this paper, we analyse the dairy and rice farming sectors in Japan, because they encompass large parts of Japanese agriculture and are both facing challenging circumstances. Each sector has the following characteristics.

Both products are vital for Japanese agriculture. For dairy farming sectors, domestic raw milk covers over 60% of the total consumption of dairy products in Japan; furthermore, milk is not only an important source of protein but is also considered unsuitable to import due to its physical condition and cost. Although the dairy farming sector is literally necessary for supporting the nation's life, it is pressured economically by external factors, including decreasing retail prices and increasing production costs due to rising international feed grain prices. As to the rice sector, the number of rice farming holdings amounts to almost 70% of the total single-crop farming holdings. Rice is staple food for the Japanese people, and it is the main element of both the agricultural industry and people's dietary habitats in Japan. Moreover, rice paddy fields are the basis of the rural landscape as well as people's lives and culture. Despite being highly important to the domestic food supply, Japanese rice farming holdings are also encountering a continuous decline of rice prices and domestic demand. Based on the situation characterised above, even though Japan's dairy and rice farming are vital agricultural sectors, both of them have been facing danger of collapsing, a severe situation that encourages us to investigate those two sectors in our study.

Due to the lack of statistical data for agricultural corporations, this study uses the following

macro-level datasets relevant to the family level from the MAFF: 'Statistics of Production Cost for Agricultural Products' and 'Statistics of Production Cost for Livestock Products.' Within these datasets, we sampled[5] only holdings man-aged by families, including legal entity types and excluding solely commissioned holdings (MAFF, 2016a). This restriction to family-run farms nevertheless represents around 98% of the total agricultural holdings. On the other hand, since the levels of classification of FS are set up relatively smaller compared with actual situations, it is noticeable that a lot of non-corporative holdings are counted as its samples. We applied national-level data to our analysis of rice farming. For dairy farming, in contrast, we used only data from Hokkaido because this prefecture, which has a different and more large-scale production structure, supplies about 50% of the total domestic production of raw milk. In this study, farming scale is identified as the number of livestock in dairy farming holdings, and the cultivated acreage (ha) of paddy for rice farming holdings. The detailed analytical methods used in this study are described below.

First, for the Expense-income analysis, although this equilibrium is normally calculated in units of business, because we use production cost statistics, the equilibrium is calculated in units of product.

By transposing terms from the right side to the left side of the inequality in (i) and (ii), we obtain the following;

Gross income − Operating expense ≧ 0---------- (i')

Gross income − (Operating expense + Estimated value for family labour) ≧ 0 ---------- (ii')

The components of each term in (i) and (ii) are described below:

Gross income = Value of main product + Value of by-products

Operating expense = Total expense of production (Cost of property, plant, equipment and material + Labour cost[6]) + Payment interest + Land rent[7] − Family labour cost.

Subsidy = Received amount – Contribution amount[8]

Here, Family labour cost is evaluated derived from actual family labour time and the opportunity cost calculated from average wage per hour in other industries. Generally, since elderly people have few opportunities for off-farm labour, their opportunity cost can be regarded as 0 or lower than the younger generation. Nevertheless, in this study we evaluate the same opportunity cost for all ages when evaluating survivability.[9] Total expense of production also includes purchases, self-sufficiency and depreciation.

Second, for MROS analysis, the annual per capita compensation for family labour is calculated from the following equations, which are derived from the profitability index found in the production cost statistics.

For dairy farming:

The annual per capita compensation for family labour = Total annual compensation for family labour per head of dairy cow × the number of dairy cow in a household / the number of labourers in a household ---------- (iv'd)

For rice farming:

The annual per capita compensation for family labour = Total annual compensation for family labour per cultivated hectare for paddy-rice production × Cultivated acreage of paddy-rice production in a household / the number of labourers in a household ---------- (iv'r)

Total compensation for family labour in a household = Gross income − Total production cost + Estimated value of family labour

Total production cost = Total production expenses (Cost of property, building, equipment and material cost + Labour cost) + Interest ex-pense + Land rent + Equity capital interest + Rent for self-owned land

2. Managerially survivable classified scales of Japanese dairy farming: Results and discussion

(1) Classification of farming scales with temporary managerial survivability using Expense-income analysis

First, we analysed the different farming scale (FS) under the condition (i) Gross income ≧ Operating expense. The calculation (i') 'Gross income − Operating expense' in odd years from 2003 to 2013 is shown in Fig.1. FS's under the condition where the calculation (i') is more than or equal to 0 are considered to be temporarily managerially survivable (TMS). We found that all the FS's meet condition (i') (Fig.1). If the estimated value of family labour is not factored in, all FS's can be considered as TMS.

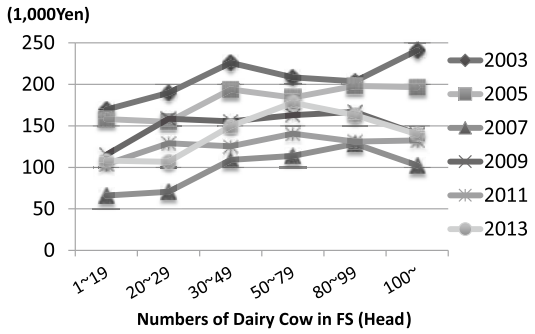

Fig 1. Difference between Gross Income and Operating Expense: Dairy Farming

Source: Statistics of Production Cost for Livestock Products

Second, we analysed FS's which meet the condition (ii), that is, where the left side of the equation (ii') [Gross income − (Operating expense + Estimated value for family labour)] is more than or equal 0 (see Fig.2). With family labour costs included, most FS's cannot be classified as TMS. FS's with 30 or more head in 2003, when the conditions were relatively better, were considered as TMS, while only FS's with 80 or more head were TMS in 2007, a year when the conditions were worse. Overall, it was found that FS's with 50 or more head can often be considered TMS, but only FS's with 80 or more head of cows can be considered stable from the perspective of survive managerially.

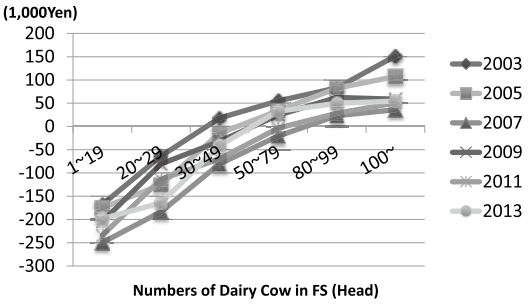

Fig 2. Difference between Gross Income and the sum of Operating Expense and Estimated Value for Family labour: Dairy Farming

Source: Statistics of Production Cost for Livestock Products

Third, using the Census of Agriculture and Forestry 2010, we calculated the percentage of the total number of dairy holdings in Hokkaido in 2013 under condition (i) and total amounts of cows in these holdings. As shown in Fig.3, while only 27.4% of the total dairy holdings are temporary managerially survivable, this comprises 55.7% of all dairy cows.

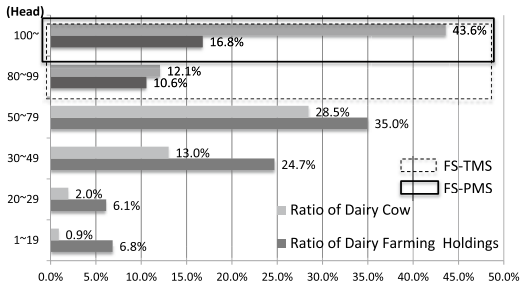

Fig 3. Ratio of Dairy Farming Holdings and Dairy Cow

Source: Statistics of Production Cost for Livestock Products
1) Total number of dairy farming holdings is 7,276
2) Total number of dairy cow is 549,508

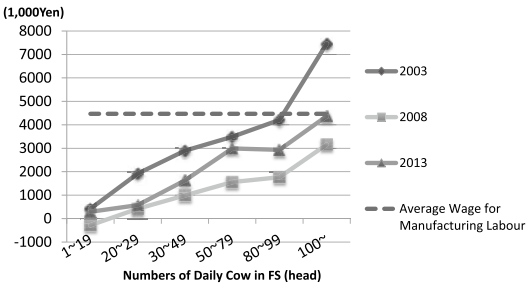

Fig 4. Compensation for Family Labour: Dairy Farming

Source: Statistics of Production Cost for Livestock Products

(2) Classification of farming scales with the permanent managerial survivability using MROS analysis

The purpose of MROS analysis to identify FS's that achieve permanent managerial survivability (PMS) is described below. We analysed whether FS's meet condition (iv) Annual per capita compensation for family labour ≧ Average wage for manufacturing labour.

The annual per capita compensation for family labour (ACCFL) in each FS and the average wage for manufacturing labour (AWML) in 2003, 2008 and 2013 are summarised in Fig. 4. The FS's for which the curve of ACCFL crosses or exceeds the AWML line are considered PMS.

Fig. 4 shows that only those FS's with 100 or more head in 2003 can be classified as PMS. It was also found that the ACCFL of FS's with 80 or more head almost met the AWNL in 2013, but that no FS's met condition (iv) in 2008, a year when the grain prices were extremely high. While only FS's of 100 or more head are considered PMS, and this represents only 16.8% of the total dairy holdings, this nonetheless represents 43.6% of all the dairy cows in Hokkaido (Fig.3).

(3) Characteristics of managerial expense and gross income

Here, managerial expense and gross income, which determine managerial survivability, are analysed.

First, the managerial expenses and the absolute amount and ratio of the feed cost whose ratios are relatively higher than other items are shown in Fig. 5. Figure 5 shows that, while the operating expense remained low for FS's with 30 to 49 head, it increased for FS's with 50 or more head. As for the feed cost, it was found that the absolute amount levelled off or only slightly increased at progressively higher FS. Feed costs averaged 53.9% of operating expenses and thus any fluctuation impacts dairy farm management greatly. In fact, Fig. 6 shows that

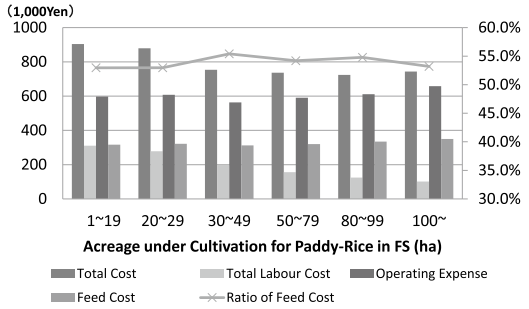

Fig 5. Cost Structure for Each Classification of Farming Scale in 2013: Dairy Farming

Source: Statistics of Production Cost for Livestock Products

mixed feed prices went up consistently until 2008 and that this rise was the main cause for the small range of managerially survivable FS's in 2008. For the reference, the total cost and total labour cost are also shown in Fig. 5, elucidating that both costs generally declined as management size increased, improving managerial efficiency.

Regarding gross income in dairy farming, it is important to shed light on challenges relating to pricing. As shown in Fig. 6, the primary retail price and producer price of milk had been decreasing significantly until 2007, with the producer price of milk even dropping below the social average production cost in 2005.The disparity widened from the latter part of 2006, as feed prices rose significantly, through 2008. As mentioned above, although the fluctuation in feed costs undoubtedly impacts management, a more structural problem is that the fluctuation in milk prices does not correspond to feed prices. Since milk prices did not go up as feed prices rose, the government intervened and finally managed to raise producer price by 3 yen/kg for 2009 and 8 yen/kg for 2009, respectively (Niiyama, 2015).

(4) Strategies and discussion points of improving managerial survivability

Based on Expense-income analysis and MROS analysis of Japanese dairy farming, we calculated TMS and PMS, and identified the background characteristics of managerial expenses and gross income. This section considers solutions for improving managerial survivability of dairy farming based on the analysis of these characteristics.

First, Expense-income analysis indicates that all FS's can meet the TMS conditions, but 80 or more head are necessary to meet the TMS conditions when factoring in the estimated value for family labour. MROS analysis shows that only FS's with 100 or more head can meet PMS conditions. Given this condition, there is significant anxiety about the prospect of permanent dairy production in Hokkaido because the percentage of the number of cows in holdings with 100 or more head is only 43.6% in Hokkaido. A future decline in production volume and managerial survivability in Hokkaido, the main dairy production site in Japan, might impact the whole dairy farming. On family farms, when compensation for family labour is insufficient,

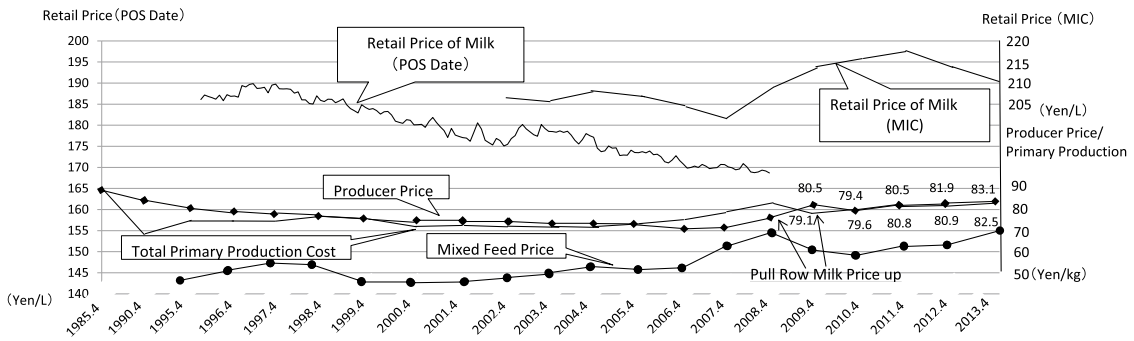

Fig 6. Retail Price of Milk, Primary Producer Pric, Primary Production Cost and Mixed Feed Price

Source: Statistics on Commodity Prices in Agriculture and Retailing Fig.3 in Niiyama (2015) (translated)

1) MIC = Ministry of internal Affairs and Communications

2) Original date of Fig.3 in Niiyama: Retail Price is from 'Retail Price (Drinking Milk)' provided by Agriculture and Livestock Industries Corporation (original date is point of sale date) and 'Retail Price Survey (Tokyo)' provided by MIC. Producer price and Production cost are from 'Statistics of Production Cost for Livestock Products.'

3) Total primary production cost per kg and primary producer raw milk price are both calculated from the yield of 3.5% butterfat equivalent.

they continue operation by cutting down on living costs, and thus we cannot affirm that the real-life result will match our estimation. However, it should not be justified that they continue dairy farming through a form of self-exploitation of family labour, so an improvement in the conditions for dairy farms is strongly needed.

Based on the results, logically one measure for improving managerial survivability is to further increase managerial scale.[10] In general, decreases in cost per unit of output with increasing managerial scale will result in an improvement in operation conditions and managerial survivability. However, in order to maintain the current count of dairy cows in Hokkaido, structural change is necessary to deal with the 310,000 non-TMS dairy cows. To that end, at least 3,100 holdings,[11] accounting for about 50% of non-PMS dairy holdings in Hokkaido need to rapidly reorganise their size to 100 or more head. However, this possibility seems unlikely given how radical a change it is and the fact that the increase of holdings with 100 or more head has not been significant in recent years.

Therefore, it is necessary to improve the operating environments as production market enabling FS's with fewer cows to managerially survive, and creating the managerially survivable conditions for more dairy farms.

The recent operating environments of dairy farming[12] have been characterized by the shortage of butter, suggesting that the milk supply tends to be insufficient. As mentioned before, there is a long-term downturn of the producer price of milk. In addition, during the period of the latter 2006 to 2008, when the feed cost soared, milk price did not correspond to the rise in the feed cost and producer price of milk fell greatly below the average production cost.

Until that rise in feed cost, even FS's with 80 to 100 head could meet the condition of PMS in years such as 2003. However, for the worst years such as 2008, when the rise of feed prices was beyond the governmental intervention in raising up the milk prices, even FS's with 100 or more head could not meet the PMS. Given this situation, the concern for the future of dairy production in Japan cannot be addressed without improving the operating environment. One factor explaining the decreasing milk price, namely competition by dominant retailers and consolidation of market power of big retailers over producers and milk makers, has been pointed out (Kinoshita et al. 2006, Suzuki 2008, Niiyama 2011). Research has also isolated factors explaining the unresponsiveness of milk prices to escalating feed costs, which compromises managerial survivability of dairy farming (Suzuki, 2009). Therefore, in order to improve their operating environments, it is necessary to improve the market power balance and to prepare market conditions so that producer prices can adjust when the costs of production increase.

3. Managerially survivable classified scales of Japanese rice farming: Results and discussions

(1) Classification of farming scales with the temporary managerial survivability using Expense – income analysis

First, we analysed which farming scales (FS's) achieved condition (i): Gross income + Subsidies ≧ Operating expense. Fig. 7 summarises the trends in this calculation (i') 'Gross income + Subsidies − Operating expense' (for the years 2004 to 2006, and 2011 to 2013).[13]

Fig. 7 indicates that, in all years, FS's with equal to or more than 0.5 ha meet condition (i). As a result, this scale of rice farming holdings can be considered temporarily managerially survivable

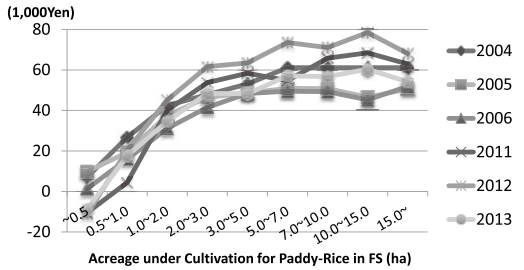

Fig 7. Difference between Gross Income (Including Subsidies) and Operating Expense: Rice Farming

Source: Statistics of Production Cost for Agricultural Products

(TMS), if the estimated value of family labour is not factored in.

Without subsidies, in all years, FS's with equal to or more than FS's with 1.0 ha meet the condition 'Gross income ≧ Operating expense.'

Second, we analysed the FS's where (ii): Gross income + Subsidies ≧ Operating expense + Estimated value of family labour. Fig. 8 illustrates that, in all years, FS's of less than 1.0 ha do not meet condition (ii). Holdings with 1.0-2.0 ha met the condition in a few years. Over the period of analysis, gross income was below operating expenses for many FS's, which suggests that their managerial survivability is inconsistent. Therefore, we can say that managerially survivable FS's meeting the *intrinsic* or *ideal* condition with the consideration of estimated value of family labour,

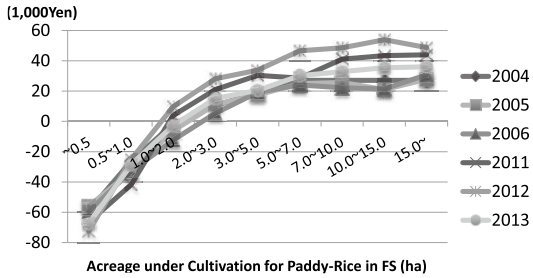

Fig 8. Difference between Gross Income (Including Subsidies) and the sum of Operating Expense and Estimated Value for Family Labour: Rice Farming

Source: Statistics of Production Cost for Agricultural Products

are those with 2.0 or more ha.

Without subsidies, in FS's of less than 2.0 ha, gross income was below operating expenses in all years.

Third, we calculated the percentage of the total rice holdings and the total acreage under paddy cultivation in holdings which were managed under the *intrinsic* condition of survivability in 2010.[14] Fig. 9 shows the distribution of the number of holdings and amount of farmland by FS. According to the chart, 11.2% of the total rice holdings and 51.8% of the total area met the *intrinsic* condition.

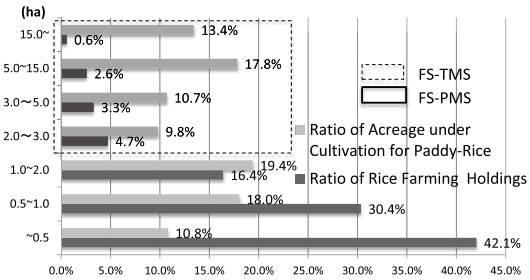

Fig 9. Ratio of Rice Farming Holdings and Acreage under Rice Cultivation in 2010

Source: Statistics of Production Cost for Agricultural Products
1) Total number of rice faming holdings is 1,169,297
2) Total number of acreage under cultivation for paddy-rice is 1,368,682

(2) Classification of farming scales with the permanent managerial survivability from MROS analysis

In this section, we examine whether FS's achieve permanent managerial survivability (PMS) under condition (iv) Annual per capita compensation for family labour ≧ Average wage for manufacturing labour. Fig.10 shows the changes in annual per capita compensation for family labour (ACCFL) of rice farming by FS and the average wage for manufacturing labour (AWML), excluding subsidies. Fig.10 shows that, without subsidies, the ACCFL for all years, and all FS's, are below the AWML. Fig. 11 indicates that, with subsidies, only

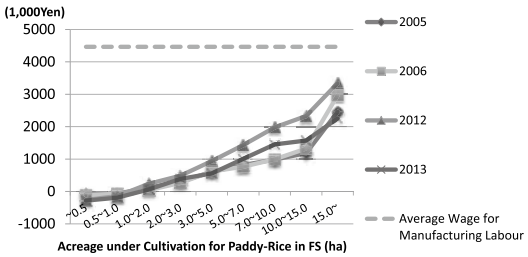

Fig 10. Compensation for Family Labour: Rice Faming

Source: Statistics of Production Cost for Agricultural Products

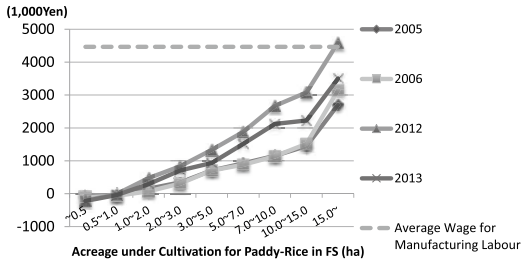

Fig 11. Compensation for Family Labour (Including Subsidy): Rice Farming

Source: Statistics of Production Cost for Agricultural Products

FS's of 15.0 or more ha in 2012 can be considered MROS. Based on this result, it can be said that rice farming holdings have not met MROS in any FS's, with the one exception of FS's with 15.0 or more ha with subsidies in 2012.

(3) Characteristics of operating expense and gross income

As conducted in the case of dairy farming, we analysed managerial survivability using the metrics of operating expense and gross income.

First, operating expenses, as well as the absolute costs and ratios of for farm machinery, are shown in Fig. 12. In this figure, operating expenses for FS's with 2.0-3.0 and under ha greatly decreases, but generally stay flat for FS's with more than 2.0-3.0 ha. The absolute costs of farm machinery are high in FS's with less than 2.0 ha and, for other FS's, almost stay flat, while the ratios are flat or slightly increase. This means that, in small FS's, though the absolute amount of farm machinery cost is large, its ratio is lower than that for large FS's because other costs are also significant. Takei (1984) points out that 'excessive investments for farm machineries' increases operation expenses, such that gross income of small FS's is low. These data imply that in small FS's, investments in farm machinery is excessive relative to other FS's, but we cannot say that is the main factor driving higher operating expenses. The costs, including not only farm machinery cost but others as well, seem to be excessive on the whole.

For reference, the total cost and total labour cost are shown in Fig. 12. It reveals that both costs decline with scale, and management efficiency is improved.

Regarding gross income in rice farming, it is important to highlight the challenges with wholesale price. The decline in wholesale prices is a main factor in the decrease of gross income. Fig. 13 is a graph of the rice demand, supply and price over 20 years. The wholesale price dropped from approximately 22,000 yen per 60 kg in 2004 to about 16,000 yen in 2013. The problem of excess supply was seen as a key factor in the price decline, but recently, the imbalance between the rice demand and the rice supply has been improved.[15] In spite of

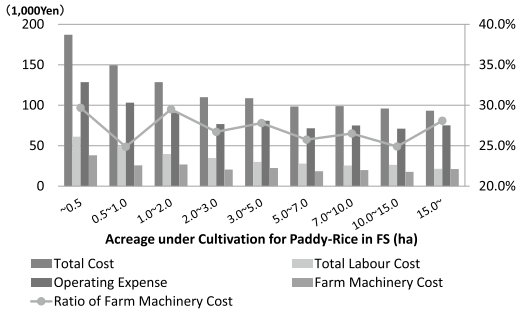

Fig 12. Cost Structure for Each Classification of Farming Scale in 2013: Rice Farming

Source: Statistics of Production Cost for Agricultural Products

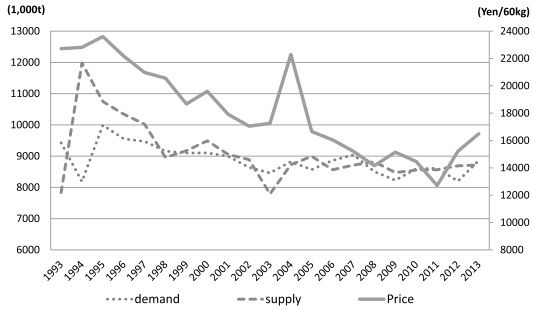

Fig 13. Transitive Graph of the Rice Demand, Supply and the Rice Price

Source: Food Balance Sheet, Statistics on Crop

1) The amounts of rice demand were calculated using the equation: the amount of domestic production minus the amount of export and fluctuation of stock.
2) The amount of supply means the total harvest of wet rice and dry rice showed in 'Statistics on Crop.'
3) The data of rice price (transitive graph) is based on the result of bidding at the National Rice Pricing Consortium up to 2005.

the recent trend, the price decline has continued. To accommodate this, other interventions should also be considered, which will be taken up in the next section.

(4) Strategies and discussion points of improving managerial survivability

Based on Expense-income analysis and MROS analysis of Japanese rice farming, we calculated TMS and PMS. Below, we elucidate the structural characteristics of operating expenses and gross income. On the basis of the results, this section concludes with strategies for expanding managerial survivability of rice farming.

First, according to Expense-income analysis that excludes the estimated value of family labour, FS's of equal to or more than 0.5 ha meet the *pragmatic* condition of TMS.

When including the estimated value of family labour, only those of equal to or more than 2.0 ha, which represents only 11.2 % of the total rice holdings and 51.8 % of the total acreage under paddy cultivation, meet the *intrinsic* or *ideal* condition of TMS.

Second, according to the MROS analysis, in almost all the years and for nearly all FS's, the ACCFLs are below the AWML, which means that the condition of PMS is rarely achieved.

These results imply nothing less than a crisis, with very few number of holdings meeting the conditions of managerial survivability in the temporary and the permanent.

In reality, however, many holdings smaller than the FS's achieving TMS manage to survive. There are two reasons for it. One is that, similar to dairy farming, family farmers compromise the estimated value for family labour, which means they compromise their livelihoods to survive. As with dairy farmers described in section 2, full-time farming holdings in rice faming accomplish this by cutting down on their living costs, but most of rice farming holdings cover the unrealised estimated value for family labour with another strategy: they earn income from other sectors. The income is divided into two categories: agricultural income from different sections and non-agricultural income from spare-time occupations. Given the fact that part-time farming holdings represent approximately 70-80 % of FS's under 3.0 ha (MAFF, 2010), it is clear that non-agricultural income can have a big impact on perpetuating rice farming.

Based on the reality mentioned above, we consider ways to improve future managerial survivability of rice farming section.

As is the case with dairy farming, expanding scale is one method. The decrease in costs due to the increase in managerial scale will result in an improvement in operating environments and managerial survivability.

However, considering the inevitable decrease in rice demand and assuming that the overall production declines, it seems unlikely to expand the scale of the holdings, whose number is enough to maintain the production－we cannot identify the scale from

the current statistics of production－, to equal or more than managerially survivable FS's right away. Therefore, we also need to consider improvement of the managerial environment in rice farming sector to improve its managerial survivability.

There are particular features of rice farming holdings that cannot be compared to dairy farming. It is important to consider these in discussions of the managerial environment.

Firstly, policies on production adjustment have changed significantly in the rice sector. The government intended to stabilize the market price by the production adjustment employing the allocation of production amount target. With the reduction of the disparity between its demand and supply achieved, in terms of rice as a staple food, the government has already decided to abolish the allocation of production amount targets by 2018. Instead, farmers and handling vendors and associations will do the production adjustment based on the outlook of demand and supply presented by the government (MAFF, 2014). At the same time, in order to deal with the future decrease in rice demand while trying to conserve paddy fields, the policy of diverting rice to non-staple food products, such as sake brewer's rice, rice for food processing, and animal feed, has been enhanced with subsidies.

Secondly, the market structure and the pricing have changed for rice. It has been pointed out that with the market shrinking, slight surpluses or deficiencies have led to great fluctuations in prices, which has led to require of adjustments in the system of market pricing (Nakamura, 2014). Specifically, the amount of rice dealt with by wholesalers and the National Federation of Agricultural Cooperative Associations, who having played a central role in distribution, has decreased, with distribution now more spread out among numerous unspecified agents. Many a little purchase and sale make a mickle impact on the market price. On the other hand, after the abolishment of the Rice Pricing Center in 2011, a corporation for fair and transparent pricing, open places of pricing has been lost, and pricing has been opaque(Nakamura, 2014). The increasing buying power of vendors and wholesalers has been also observed (Ono, 2010). It is important to consider those factors and take measures to appropriate market structure and pricing system and to deal with the downward price trend, under the market shrinking.

Thirdly, the instability of government policies on subsidies supplied for rice production or rice farming holdings has been pointed to. The policies have depended heavily on the political conditions, which has resulted in uncertainty for rice farming holdings trying to make predictions about their future. Recently, it has been decided that direct subsidy payment for rice as a staple food will be discontinued in 2018. In exchange, the government has enhanced incentives for the diversion to rice to non-staple foods, as mentioned above.

Finally, it is important to consider the variety of economic characters comprising the landscape of rice farm management. The behaviour of part-time farming holdings is assumed to be different from that of full-time farming holdings, which depend exclusively on agricultural income from rice farming[16]. Furthermore, full-time farm holdings can be further divided into two categories: mixed farming and mainly rice farming. The behavioural orientations of these two categories are assumed to be different. The different behavioural principles will lead to the different responses to changes in policies and market structure, and are likely to influence future trends in rice farming.

The statistics we used in this paper do not divide the FS's of 15.0 or more ha into sub-categories such as 30.0 ha and 40.0 ha. Therefore, even if a FS over 15.0 ha meets the condition of TMS and PMS, the results do not reflect its scale precisely. This

limitation should be kept in mind.

As the production styles of rice farm holdings have become diverse, it has been becoming more and more difficult to lump all rice farming holdings together and take universal measures. In terms of farm management, many stand at a critical crossroad: they in the devoting more spare-time to non-agricultural occupations and will thus face the choice about whether to continue rice farming or not, or, as is the case with full-time agricultural holdings, they will face the choice of whether to expand rice farming or diversify. In addition, social policies have increasingly favoured regional development in less favoured areas, such as mountain areas where rice farming is main industry, and to consider maintaining paddy fields as a basis for not only food production but also other goods, such as environmental conservation. While resolving the overlapping problems, a full-fledged policy discussion is needed for the sake of determining the types of subsidies and its targets and citing the reasonable grounds.

4. Conclusion

This research examined the managerial survivability of the struggling Japanese dairy and rice farming holdings in the condition of TMS and PMS, referring to the statistical data from the MAFF. In the result of Expense-income analysis, first, we find dairy farming holdings with 80 or more head and rice farming holdings with 2.0 or more ha satisfy the *intrinsic or ideal* condition of TMS. Second, using benchmark of MROS, we found that dairy farming holdings with 100 or more head and no scale of rice farming holdings meet the conditions for PMS. In addition, that only 16.8% of dairy farming holdings (representing 43.6% of the head of cows) and none of rice farming holdings satisfy MROS, suggests that both the dairy and rice sectors are literally on the verge of collapsing in the current economic context. From these findings, beyond the possibility for enlarging their FS, it is critical to take into account the managerial environments and other forms of efficiency in order to increase the number of holdings which are survivable. Nonetheless, the analysis in this paper is based on aggregated statistical data from the MAFF, which limits the scope for proposing a practical measurement or treatment. Especially for managerial efficiency, the solutions would depend on each agricultural holding. Deepening this analysis required.

We conclude this paper by discussing contribution of these findings and future perspectives. The analysis was conducted from the viewpoint of not only whether a family-run farm can cover payments for external factors of production, but also whether family farmers should derive appropriate compensation for their labour that is above the average wage in the manufacturing sector. The results highlighted the scope of the challenges facing the dairy and rice sectors in Japan. However, to take this research further, it would be useful to analyse actual business data, identify the actual realities of management, and consider appropriate measures for agricultural holdings that produce other agricultural products.

This paper takes into account factors which could affect managerial survivability such as national market trends, price behaviour and international feed grain price. While relevant policy debates, such as impacts from liberal trade policies, such as TPP, and the diverse opinions and simulation results by economists are important, these kinds of discussion are beyond of our research scope.

One final challenge to address is that this paper only focuses on average status in each FS, and it can be assumed, despite belonging in the same FS, that idiosyncratic management effort can affect

survivability. Furthermore, there are survivable holdings with even smaller scale than FS's that we found to be un-survivable, and it is necessary to consider holdings' management effort. Nevertheless, the study taking into account that factor is beyond our research and we hope this line of analysis can be done.

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Notes

1) For the analysis of rice farming, subsidies are taken into consideration as the farmers' source of income because, in Japan, they cover some amount of the gross income gained from rice. Therefore, for rice, we analysed cases that include or exclude subsidies; for dairy farming, we did not make this comparison as the subsidies are negligible and no available data exists.

2) The family labour cost is calculated by multiplying family working hours by an average hourly wage based on wage data for business establishments with five to 29 workers in the construction, manufacturing and transportation/postal industries in the Monthly Labour Survey Report (by the Ministry of Health, Labour and Welfare) (MAFF, 2015).

3) The equity capital interest is calculated by multiplying equity capital – gross capital minus debt capital – by an annual interest rate of 4% (MAFF, 2015).

4) The rent for owned land is based on a rent for similar farmlands (having capabilities similar to the farmland for a crop subject to the survey) within the same region (MAFF, 2015).

5) Statistics of Production Cost for Livestock Products defines producers minimally as holdings which raise dairy cow of more than 1 head and sell the milk. The Statistics of Production Cost for Agricultural Products defines as producers those holdings which cultivate paddy-rice and sell more than 600 kg of un-milled rice per year.

6) Labour cost= Wages for employees + Estimated value of family labour

7) The land rent for a crop subject to the survey is calculated by multiplying the actually paid farm rent by the contribution rate for the relevant crop.

8) Contribution amount refers to an accumulated fund providing income compensations for agricultural holdings, and its statistical data is only available until 2006.

9) It is necessary for full-time agricultural holdings to earn compensation as much as living expense, and an analytical framework with opportunity cost is incompatible with the analysis of the survivability of the holdings. Also in the statistical data evaluated, compensation for labour is not considered different between generations.

10) Although it might be considered relatively easy to increase the managerial scale, scaling based on revenue does not easily translate to diversification of management style. In general, this depends on individuals' predisposition and conditions, thus we elected not refer to the possibility of management diversification in this section.

11) This number was estimated from the data of the number of dairy cows and holdings in the 'Census of Agriculture Forestry 2010.'

12) The milk production adjustment is privately (non-governmentally) announced, mainly by Japan Dairy Council. In this system, about 95% of milk is uniformly collected from dairy farmers and transported to the plants of milk makers in the same area by designated producer's organizations which are located in 9 areas spread out over Japan. The producer milk price is set through negotiation between these designated producer's organizations and the milk makers.

13) Since there are no data for subsidies in rice farming from 2007 to 2010, these years are excluded.

14) We used data from the 'Report on Results of 2010 World Census of Agriculture and Forestry in Japan.'

15) The same trends of rice demand and supply (from 1960) can be found on page 1 of the MAFF report, 'Brief Summary of Rice Economy.'

16) In the past, regardless of managerial profit and loss, part-time farmers continued rice farming to retain their landholdings. After land values began to decline as the next generation took over, the number of those who

abandoned their land increased.

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