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A Stepwise Innovation toward Viable Educational Services in Agriculture: Evidence from Japan

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Annotation: Although the educational function in agriculture is attracting growing attention as a kind of multifunctionality in agriculture, these services are not yet provided as a viable farm product. This paper explores how the educational externality could be internalized to establish a viable market for these services. We focused on educational dairy farms in Japan and used a questionnaire survey to quantitatively evaluate the attitudes of operators toward establishing viable services. First, a conceptual framework was presented to express operators' orientation toward an economically viable service by incorporating a stepwise internalization process of positive externalities with the help of a social learning network. Then, empirically, statistical tests were conducted and factors that determined this orientation, a viable service determinant function, were explored by the ordered logit model. The result showed that, first, the higher the number of visitors to the farm, the more operators were oriented toward a viable service while no connection with ordinary dairy production was shown. Second, social learning was effective for initiating the internalization process. Third, marketing skills became more important for upgrading the internalization level. Consequently, it is important to create opportunities for those farmers who want to provide consumers with educational services to learn a new role for agriculture and to establish a new income source in a stepwise fashion.

Key words: educational tourism; educational function in agriculture; multifunctionality; rural tourism; farm diversification; product innovation; externality

1 Introduction

Conventional innovation in farm management has been mainly focused on the improvement of technical efficiency in the processes of farm production such as mechanization of farm operation, utilization of chemicals, and creation of high-yield or input-saving varieties. In this respect, hardware process innovation in farm production has been a major target in rural areas. Product innovation in the creation of high-yield or high-quality varieties has been generated from agricultural research and exogenously introduced into rural areas. This is to comply with food demand, which is a basic and permanent mission of the agricultural sector.

In contrast, the aim of this paper is to explore how endogenous product innovation in rural areas can be attained and to support measures for that purpose. This type of innovation is different from conventional innovation in agriculture and the differences set up many hurdles to achieving a new rural innovation.

First, this innovation creates a new demand. Many consumers do not know about new products/services so it is often difficult to expect high profitability in the initial stage.

Second, new products are often provided as new services that utilize not only conventional farm inputs, i.e., land, capital, and labour, but also ecosystem services based on the rural resources. In this sense, these new products are soft innovations, which are intangible. Third, externalities that are accompanied by agricultural production such as multifunctionality, play a crucial role in creation of this type of services. Conventional marketing of farm products does not appropriately express the value of these new products and the market failure of farm resource allocation causes them to be in short supply. Thus, it is necessary to internalize these externalities for a new income source through social-optimal resource allocation. Finally, however, it is quite common for ordinary rural areas to face severe shortages of human resources with enough skills to overcome these difficulties. In those cases, in addition to self-sustaining efforts, additional policy support measures should be undertaken in rural areas.

In short, new rural product innovation requires a new perspective that differs from conventional hardware innovation in farm production technology. This requirement poses many challenges for the farming sector.

Thus, it is necessary to explore how to attain endogenous product innovation for the sustainable evolution of rural economies, but there has been no full-fledged study on this point conceptually or empirically. Therefore, this paper focuses on newly emerging educational services provided by dairy farmers in Japan and presents a stepwise internalization hypothesis to explore a desirable way to achieve a new product innovation.

It is now widely recognized that agriculture has multifunctionality (OECD, 2001, 2003, 2005; van Huylenbroeck and Durand, 2003; Japan Science Council, 2001), or positive externalities to society, in addition to food production. One of the sub-functions of the multifunctionality that has been little investigated is the educational function that enables people to learn about farm life and how food production is conducted, which are often forgotten in modern urban life (Ohe, 2011b). In this respect, educational tourism in agriculture has been attracting growing attention as a newly emerging activity along with the bourgeoning demand for experience-oriented tourism. Examples of such activities that have already been implemented are the FACE (farming and countryside education) program in the UK (Graham, 2004; for more recent developments, Gatward, 2007), Ferme Pédagogique in France, Fattorie Didattiche in Emilia-Romagna in Italy (Canavari et al., 2009; children's gardening in the USA (Moore, 1995) and educational dairy farms (hereafter EDFs) in Japan (Ohe, 2007).

One problem with these educational services is that their activities have yet to become economically viable (Ohe, 2011a). For this reason, rural and farm experience services have often been studied together with rural and agritourism (for Japanese, Sato, 2010; Ohe, 2010 and for Italian, Ohe and Ciani, 2011). Nevertheless, with the increasing demand for these educational services and, on the other hand, with the mounting competitive pressure in the market for farm products as well as constant price volatility, it is time to focus on clarifying the conditions under which viable educational services can be established as a new income generating farm activity rather than remaining as a simple generator of externality to society without any compensation. This issue has not been fully addressed through an economic approach, although case studies were sporadically conducted (for instance, Sato, 2008; Yamada, 2008).

In response to this need, this paper approaches this issue with a perspective on farm diversification by internalizing the externality of these educational services. First, I present a conceptual model under the framework that the internalization process of educational externality is attained through stepwise innovation. I consider on-farm and off-farm factors that stipulate that stepwise process, especially looking at the role of social learning network organizations. Second, by an empirical approach, I focus on Educational Dairy Farms in Japan, which is a network organization that provides a pioneering framework for the provision of educational services in agriculture in this country and I quantitatively examine the relationship between the operators' orientation toward viable educational service activity and factors related to farm activity by statistical tests. Subsequently, I estimate an orientation determinant model of viable educational services and explore factors to determine that orientation. Finally, policy recommendations are presented for more effective support measures to attain the viability of educational tourism services.

2 Literature Review

In the arena of agriculture, since the classic work by T. W. Schultz (for instance, Schultz, 1971) on education as an investment in human capital, the education of farmers has been considered as essential for the diffusion and adaptation of new technology in agriculture in developing countries (Foster and Rosenzweig, 1995). This is basically the same in the tourism industry except for one thing, that is, the addition of the importance of service management

due to the characteristic of service goods that tourism has. The importance of raising human capital that serves its own industry has not changed in any industry, as producer education that aims at those who serve the industry (Airey and Tribe, 2005; Fidgeon, 2010). Nevertheless, what this paper addresses is in the area of consumer education rather than producer education. As far as the author knows, Shichinohe et al. (1990) was the earliest to point out the existence of the educational function in agriculture as consumer education; this was then followed by sporadic case studies as already mentioned.

Issues on the diffusion of agricultural technology were taken up as a good example of social learning (Goyal, 2007). Leeuwis and Pyburn (2002) conducted comprehensive studies on the social learning network in agriculture. Sociological approaches were mainly used in social learning in agriculture as follows: technological innovation in genetically-modified crops (Oreszczyn et al., 2010), farmers' markets (Hinrichs et al., 2004), organic farmers network (Kroma, 2006), and sustainable or environmentally friendly agriculture (Nerbonne and Lentz, 2003; Andrew, 2003; Naiper and Tucker 2001; Ingram, 2010). With social learning in environmental research, issues on environmental education and raising awareness of the environment have been studied (Measham, 2006; Raymond et al., 2010). In agricultural and development economics, social learning studies are concentrated on technology transfer in developing countries (Conley and Udry, 2001; Munshi, 2004; Yamauchi, 2007). On the contrary, in tourism research, Fisher (2004) explored the demonstration effect from the perspective of imitation and social learning and Koutsouris (2009) dealt with social learning related to sustainable tourism; however, these two studies were descriptive. Studies on social learning issues are very limited in tourism research compared with agricultural research where quantitative analyses with economic frameworks have been conducted actively.

On topics of farm diversification, van der Ploeg et al. (2009) conducted a sociological investigation and Sharpley and Vass (2006) examined the connection of rural tourism with farm diversification. As to rural tourism studies under an economic framework, OECD (2005) explored the issues of internalization of externality generated by multifunctionality in agriculture, including rural tourism. In comparison with a wide range of econometric tourism research in general (for instance, Barros (2005) and Barros and Machado (2010)), although econometric analyses of rural tourism are increasing (Tchetchik et al. (2008) on rural tourism market evaluation and simulation, Vanslenbrouck et al. (2005) and Ohe and Ciani (2011) on hedonic pricing, Ohe (2011a) on measuring labour productivity of rural tourism), econometric research papers on rural tourism have not been accumulated enough and these papers did not focus on farm educational services per se.

Finally, regarding our aim of empirical economic studies on educational services and travel in agriculture, Ohe (2007, 2011b) took a stance on the internalization of the educational externality by presenting an economic framework and conducted empirical evaluations of EDFs. Although it is crucial to clarify the conditions for viable educational services, from what is described above, no study has thus far answered the questions of social learning and stepwise innovation of educational services and tourism in agriculture. Therefore, this paper throws light on the topics that remain to be explored and tries to further the establishment of viable educational services.

3 Conceptual Framework: Stepwise Internalization Process of Educational Externality in EDF services



Figure 1. Internalization process of educational externality

Here, I present a conceptual framework of a stepwise internalization process to establish a basis for the empirical examination in the latter half of this paper. Figure 1 depicts an operator's subjective equilibrium in the provision of educational experience services by vertically measuring values and the level of farm activity horizontally. Out of three right upward lines, there are two marginal cost curves depicted because farm activity including the operation of EDF activity generates positive externality as a multifunctionality of agriculture. The private marginal cost curve PMC is indicated by the upper right upward line and the social marginal cost curve SMC is indicated by the lower line. The vertical distance between the two curves indicates the educational externality. The reason why the two marginal cost curves have different forms is that the educational externality depends on the level of diversification, which determines the shape of the SMC curve (Ohe, 2011b). The middle right upward line is the average variable cost curve AVC because AVC curve always comes under PMC curve in the diminishing return area that we consider here.

The right downward curve illustrates the operator's marginal revenue curve of educational experience services, MR0. If there is no externality at all, then the ordinary subjective equilibrium, or the private optimal point, is attained at point e0 where the PMC curve meets MR0. Nevertheless, the subjective equilibrium points vary from one operator to another, actually depending on the attitudes and managerial efforts as to where the operator positions the educational experience services in the farm activity. In this respect, I consider three main cases that represent the stepwise process toward the internalization of the externality as described below to simplify the discussion, although I asked more than three questions on attitudes in the questionnaire survey as mentioned later.

The first phase is the case wherein the operator provides educational experience services on the SMC curve. In this case, the operator does not fully recognize the existence of the educational positive externality that he/she generates, or provides these services as a volunteer, even if the operator recognizes that externality. This means that internalization of the educational externality is not conducted at all. Thus, this subjective equilibrium point is attained as the private optimal at e0 and educational experience services are offered to Os0, shorter than the social optimal supply level Osn. The second phase is the case whereby the operator does not act to recover the social marginal cost that equals the amount of externality the operator generates, but only to recover at least the material cost although the operator recognizes the externality. In that case, the operator provides the services as a semi-volunteer and only the average cost is recovered. Thus, the operator's subjective equilibrium is attained as the average cost optimal at e1 where the average variable cost AVC0 meets MR0 with providing service Os1. The operator can partially recover the externality, i.e. e1j out of gj and ge1 is left uncompensated. This means that the social optimal resource allocation is not achieved as an economic activity and thus the orientation toward a viable economic activity is not established yet.

In the last phase, the operator charges for every educational experience service as a result of managerial efforts, meaning that the externality is completely internalized. The social optimal is attained on SMC curve at en where we can say that the complete internalization of the externality is achieved because the operator takes into account the social cost that should be compensated. Also, the two marginal cost lines, PMC and SMC curves, are overlapped at least at the point of en due to the downward shift of the PMC curve. I assume that this downward shift of the PMC is caused by stepwise innovation starting from e0 to en through e1. This is the stepwise process of the educational internalization. At the last phase, the orientation toward a viable economic activity is firmly established.

The next empirical questions are to clarify what and how factors inside and outside of farms stipulate the operators' behavior that enables them to cause stepwise innovation or the downward shift of the PMC curve to the SMC curve.

4 Hypothesis: Significance of Network Organizations

As one of the factors that generate the stepwise innovation, I focus on the social learning effect among operators in the network organizations in addition to on-farm factors. To explore the significance of network organizations, I characterize the two contrasting types of network organizations that undertake new activities in rural areas (Table 1). The second column shows various factors related to traditional network organizations in rural areas. A typical example is the hamlet organization, which originates from the banding together of members of the local community and acts as a body to organize and perform the collective work in the hamlet. Further, these network organizations are now expected to act as a body to undertake new village businesses such as rural tourism. Rural community-based activity is the root of this type of organization, so that these organizations are basically constituted of community members. In this context, entry and exit of members from outside of the community are not easy. Thus, that type of organization is closed rather than open to those outside of the local community and I term this type a 'closed network organization'. Because of this characteristic, it is easy to suppose that the optimal size would not be large. This optimal size will remain relatively small and therefore an organization limited to local residents will be a suitable size for this type of organization.

| Table 1. Features and roles of network organizations in rural areas | | | | | |
|---|--|--|--|--|--|
| Туре | Closed Network Organization | Open Network Organization | | | |
| Origin | Club of local community | Club of like-minded individuals | | | |
| Characteristic | Territorial | Personal | | | |
| Entry/exit | Difficult | Easy | | | |
| Territorial limitation | Yes | No | | | |
| Optimal size | Small | Large | | | |
| Effective areas | Traditional collective work in the hamlet, rural business activity | Social learning of new activity, new market formation | | | |
| Examples | Conventional hamlet bodies | Educational dairy farms, open dairy farms | | | |

Now I look at the open network organization (third column). This type of organization has the following features in contrast to the closed network type. This open network type is based on like-minded relationships or personal relationships or connections. Therefore, the membership is not limited territorially, so that entry and exit are easier than in the former type. This type has an advantage in sharing and acquiring information and developing ideas based on such shared information; thus, it is suitable for activities by independent individuals rather than those acting as a body for conducting business that needs strict decision-making. Thus, the Educational Dairy Farms and Open Dairy Farms that are mentioned below are typical examples of these types of network organizations.

Innovation in the way of utilization of local tangible and intangible resources will cause a reduction in management costs by a downward shift in the cost of resource utilization. Such innovations in utilization of local resources are not always hardware related, but are more often software related, which are also difficult to generate (Ohe, 2011a). Thus, as the conceptual framework, it is realistic to assume empirically that this downward shift will occur in a stepwise manner rather than occurring all at once.

Although the conventional agricultural organization has been mostly a closed network organization, which is closer to the Coleman type of network, the open network, which is closer to the Burt type network, has not been well investigated (Coleman, 1988; Burt, 2001). Social learning among people concerned is expected to work on the stepwise downward shift in the cost of resource unitization. Since the social learning effects have not been tested in the case of new rural services, such as educational experience services, in agriculture and rural tourism, this paper will try to fill this gap in research.

5 Two Social Learning Organizations for Operation of an Educational Dairy Farm

To be an associate of Educational Dairy Farms, a farmer must attend a course on principles, safety and hygiene, and communication skills as well as presentation of a case study provided by Japan Dairy Council, which is a national dairy farmers' organization. The Council administers the certification for recognition as an Educational Dairy Farm and presents various capacity building courses for those with certification as an Educational Dairy Farm as well as dairy farmers at large in Japan.

In addition to the Educational Dairy Farms organization, we need to look at another organization, which is called Open Dairy Farms. It was established in 2000 and is a

nationwide organization of dairy farmers who conduct an open-door policy to visitors from outside of the community. Although also supported by the Japan Dairy Council as a secretariat, membership is voluntary with no requirement of a technical course. Open Dairy Farms is autonomous, having its own board and consisting of six regional branches comprised of member farmers. This organization has played an important role for its member farmers by providing a forum for sharing experiences, information, and ideas and also in shaping a longterm vision and philosophy for open-door farm activity, e.g., by often conducting dairy events at local and national festivals. Although its main purpose is not to provide an educational service, Open Dairy Farms has supported the evolution of educational dairy farms as a banner of the open-door policy of dairy farms. In this regard, Educational Dairy Farms has developed together with Open Dairy Farms. Interestingly, Educational Dairy Farms and Open Dairy Farms have the common feature of a typical open network organization. In reality, these two networks have overlapping memberships as shown in Table 2.

It is considered that the two networks, through which member farmers exchange information and strengthen networking among members formally and informally, have worked complementarily as social learning places, which generate a network externality that leads to a downward shift of the SMC curve. This complementary relationship then generates the stepwise innovation of internalizing externalities by enabling members to firstly recognize a new role for agriculture and then to come up with an orientation for internalizing educational externalities. This is our working hypothesis, which we test empirically below.

6 Data

Data are based on a survey on the attitudes of members of the organization, Educational Dairy Farms. The author conducted this survey to gain an understanding of the operation, problems related to educational activities and the operators' attitudes, and the survey was sent to all of 257 Educational Dairy Farm members by surface mail from October 1st to December 31st 2009. The response rate was 79.4% (204 farms). Other farm data related to EDF activities were also used. These data were provided by the Japan Dairy Council, which is an administrative body of the Educational Dairy Farm program. Information was obtained on milk production (as of 2009), acreage of forage and pasture (as of 2009), number of milk cows (as of 2009), the year the operators received certification as an Educational Dairy Farm, and the number of visitors (as of 2008).

7 Results of Statistical Tests

First, the experience services offered by the EDFs are summarized in Table 3. A short lecture by the farmer, milking and feeding cattle are the three major services, which shows that experiences related to operation of a dairy farm are more popular than food cultural experiences such as butter making and ice cream making. This is because the main activity of these farms is not tourism, but milk production.

Table 4 contrasts the present attitudes toward EDF activity and future intentions. Among the present attitudes, 'cost covering' and 'volunteer' account for 60% of responses, which would indicate a non-profit activity or that respondents have no orientation toward viability of the educational experience services indicating that those operators provided educational services at the private optimal or the average cost optimal. On the other hand, those who expressed 'marketing' and 'aiming at viable activity' only accounted for one fourth of the total responses, and these respondents are supposed to have an orientation toward viable services indicating that those operators aimed at the social optimal. Now turning to future intentions, those with no orientation toward viability dropped to about 40% while nearly 50% of operators expressed their intention to seek viability. Thus, it is safe to say that many operators intend to establish viability of educational services in the long run.

| Table 3. Offered educational dairy farm services | | | |
|--|-----------|--|--|
| Experience services | No. farms | | |
| Lecture by farmer | 185 | | |
| Milking | 156 | | |
| Feeding | 154 | | |
| Giving bottle to calves | 143 | | |
| Cleaning barn | 112 | | |
| Brushing animals | 95 | | |
| Field work | 68 | | |
| Tour of farmyard | 183 | | |
| Horseback riding | 33 | | |
| Butter making | 133 | | |
| Cheese making | 37 | | |
| Ice cream making | 54 | | |
| Ham/sausage making | 14 | | |
| Cutting sheep wool 15 | | | |
| Notes: Data source as for Table 2. | | | |

| Notes: Data source as for Table 2 |
|-----------------------------------|
|-----------------------------------|

| Table 4. Attitudes toward educational experience services (present and future) | | | | | | |
|--|------------|-------------|------------|-------------|--|--|
| - / | Pr | esent | Future | | | |
| Items | Percentage | Sample size | Percentage | Sample size | | |
| Volunteer | 28.4 | 58 | 17.2 | 35 | | |
| Cost covering | 31.9 | 65 | 24.0 | 49 | | |
| Measure of marketing | 7.4 | 15 | 23.0 | 47 | | |
| Aiming at viable activity | 16.7 | 34 | 24.0 | 49 | | |
| Nothing in particular | 7.8 | 16 | _ | | | |
| Decrease/quit | _ | — | 1.0 | 2 | | |
| Don't know | _ | _ | 2.5 | 5 | | |
| Others | 5.4 | 11 | 5.4 | 11 | | |
| No answer | 2.5 | 5 | 2.9 | 6 | | |
| Total | 100.0 | 204 | 100.0 | 204 | | |

| Table 5. Connection between orientation to viable activity of educational diary farm (EDF) and farm attributes (%) | | | | | |
|--|-------------------|-------------------|--------------|--|--|
| Items | Orientation of vi | able EDF activity | Tost posults | | |
| | No | Yes | Test results | | |
| Labour size for dairy activity (real term) | 3.7 | 3.3 | En.s. | | |
| Milk production (year/ton) | 471.5 | 553.5 | Nn.s. | | |
| No. milk cows | 130.7 | 307.9 | Nn.s. | | |
| Acreage of feed production (ha) | 34.0 | 31.2 | Nn.s. | | |
| No. activities | 2.1 | 2.9 | N*** | | |
| No. visitors on farm in 2008 | 1150.7 | 2993.8 | E** | | |
| No. times EDF activity in 2008 | 47.2 | 171.3 | N* | | |
| More than 1 times (%) | 51.9 | 69.8 | *** | | |
| More than 100 visitors (%) | 58.3 | 78.1 | *** | | |
| More than 300 visitors (%) | 33.3 | 63.5 | *** | | |
| Main person of EDF activity Female (%) | 30.6 | 39.6 | + | | |
| Kanto area (%) | 13.0 | 26.0 | ** | | |
| Member of Open Dairy Farms (%) | 88.9 | 96.9 | ** | | |

Notes: Data as for Table 2. In area above the broken line, t test was used while Chi-square test was used below the line. Fisher's Exact test was employed when sample size of a cell was less than 5. E=equal variance, N=unequal variance, ***,**,*, + show 1%, 5%, 10%, 20% (reference) significance level and no significance shown by -. Labour size in real terms was calibrated in each activity by the following criteria: full-time labor and mainly responsible for the operation=1, full time and supplementarily responsible=0.5, part-time and mainly responsible=0.25.

| Table 6. Connection between orientation to viable activity of educational dairy farm and farm attributes(2) (%) | | | | | |
|---|-------------------|-------------------|------------------|--|--|
| 1 4 | Orientation of vi | able EDF activity | Track and an 144 | | |
| items | No | Yes | 1 est results | | |
| Type of ownership | | ~ | | | |
| Family | 64.8 | 55.2 | + | | |
| Family (corporate) | 11.1 | 24.0 | ** | | |
| Joint ownership | 1.9 | 3.1 | n.s. | | |
| Agricultural cooperatives | 0.9 | 5.2 | + | | |
| Private sector | 2.8 | 4.2 | n.s. | | |
| Public sector | 3.7 | 2.1 | n.s. | | |
| Third sector | 1.9 | 2.1 | n.s. | | |
| Others | 7.4 | 4.2 | n.s. | | |
| Total | 100.0 | 100.0 | _ | | |
| Activity (multiple answers) | | | | | |
| Milk production | 90.7 | 91.7 | n.s. | | |
| Processing milk products | 15.7 | 50.5 | *** | | |
| Raising beef cows | 2.8 | 11.6 | ** | | |
| Lodging facility | 7.4 | 12.6 | n.s. | | |
| Restaurant | 9.3 | 20.0 | ** | | |
| Direct selling | 12.0 | 34.7 | *** | | |

Notes: Data are as for Table 2. Chi-square test was used and Fisher's exact test was employed when sample size of a cell was less than 5. E=equal variance, N=unequal variance, ***, **, + show 1%, 5%, 10%, 20% (reference) significance level and no significance shown by -.

| Table 7. Connection between orientation toward viable activity of educational dairy farm (EDF) and farm attributes(3) (%) | | | | | |
|---|------------------|--------------------|--------------|--|--|
| Home | Orientation of v | iable EDF activity | Tost results | | |
| nens | No | Yes | restresuits | | |
| Type of menu of experience services | | | , | | |
| Individual | 42.6 | 28.1 | ** | | |
| Set menu | 16.7 | 22.9 | n.s. | | |
| Both | 27.8 | 31.3 | n.s. | | |
| Total | 100.0 | 100.0 | - | | |
| Targeted area | | | | | |
| Neighbouring municipality | 62.0 | 44.8 | ** | | |
| Neighbouring prefecture | 9.3 | 14.6 | n.s. | | |
| No limitation | 19.4 | 29.2 | + | | |
| Case by case | 6.5 | 5.2 | n.s. | | |
| Others | 2.8 | 4.2 | n.s. | | |
| Total | 100.0 | 100.0 | - | | |
| Changes in consciousness after starting EDF (multiple answe | ers) | | | | |
| Teaching | 80.6 | 84.4 | n.s. | | |
| Exchange with people | 89.8 | 88.5 | n.s. | | |
| Value of local resources | 80.6 | 83.3 | n.s. | | |
| Self-confidence/local pride | 76.9 | 83.3 | n.s. | | |
| A new role | 82.4 | 90.6 | * | | |
| Connection to local community | 77.8 | 83.3 | n.s. | | |
| Discovery of material for EDF services | 61.1 | 77.1 | ** | | |
| Extension of network beyond local boundary | 65.7 | 76.0 | + | | |
| Revenue source | 13.9 | 53.1 | *** | | |
| Direct selling of dairy products | 21.3 | 57.3 | *** | | |
| New viable activity | 21.3 | 51.0 | *** | | |

Notes: Data are as for Table 2. Chi-square test was used and Fisher's exact test was employed when sample size of a cell was less than 5. E=equal variance, N=unequal variance, ***,**,*,+ show 1%, 5%, 10%, 20% (reference) significance level and no significance shown by -.

| T4 | Orientation of | viable EDF activity | Test pegults | |
|--|----------------|---------------------|--------------|--|
| nens | No | Yes | 1est results | |
| narging for experience services | | | | |
| Every service | 10.2 | 38.5 | *** | |
| A part of service | 24.1 | 29.2 | n.s. | |
| No charge | 46.3 | 15.6 | *** | |
| Depending on where visitors come from | 7.4 | 11.5 | n.s. | |
| Others | 8.3 | 4.2 | n.s. | |
| Total | 100.0 | 100.0 | - | |
| uture direction (multiple answers) | | | | |
| Using travel agency | 15.7 | 42.7 | *** | |
| Extension of types of visitors | 25.9 | 51.0 | *** | |
| Food combined services | 27.8 | 61.5 | *** | |
| Healing/welfare | 51.9 | 61.5 | + | |
| Collaboration with other local farmers | 38.9 | 64.6 | *** | |
| Lodging facility | 18.5 | 36.5 | *** | |
| Restaurant | 8.3 | 38.5 | *** | |
| Direct selling facility | 24.1 | 62.5 | *** | |
| Collaboration with local community | 55.6 | 74.0 | *** | |
| Nothing in particular | 6.5 | 2.1 | + | |

Notes: Data are as for Table 2. Chi-square test was used and Fisher's exact test was employed when sample size of a cell was less than 5. E=equal variance, N=unequal variance, ***,**,+ show 1%, 5%, 10%, 20% (reference) significance level and no significance shown by -.

From the results shown in Table 4, I classified the attitudes toward the EDF activity into the two groups: 'a means of marketing dairy products' and 'aiming for viable activity' went into a group with orientation toward viability while 'volunteer', 'cost covering' and others went into a group with no orientation toward viability. With this criterion, I conducted statistical tests on the conditions and activity of dairy farming, the behavior as a member of Educational Dairy Farms and attitude toward viability.

Table 5 shows results related to conditions and activity of the dairy farm; there was no statistical connection between the two groups with regard to farm size indicated by such factors as labour size, acreage for forage and pasture, number of milk cows and milk production, which are the input and output factors of ordinary dairy production activity. Additional tests were also conducted to see if there was a relationship between these dairy production indicators and indicators of EDF activity. I found no statistical connection between the number of visitors and times visitors were accommodated with dairy production indicators, indicating no connection between ordinary dairy production activity and EDF activity. In contrast, there were statistically significant differences between the two groups in the number of on-farm activities, which is an indicator of farm diversification, and the number of visitors (especially over 100 and 300 visitors) and times of visits (especially over 11 times) in terms of EDF activity. Thus, those with an orientation toward viable educational activity expressed a higher ratio for these variables than those who did not (from 10% to 1% significance). Those operators located in the Kanto area have an orientation toward viability due to closeness to the most densely populated area in this country. I could also confirm our working hypothesis statistically because the result shows the complementary relationship between Open Dairy Farm members and a positive orientation toward viability (5% significance). Although other network-related variables such as the number of members of each branch of the Open Dairy Farms organization and the year of the membership were also tested, no statistically significant connection was found. This means that belonging to a nationwide network is more effective for a connection with an orientation toward viability than a regional network.

As to the type of farm ownership (Table 6), family farms are the most common type followed by family corporate farms. Taken together, family corporate farms and family farms had a higher ratio of orientation toward viability (5% significance). Activity-wise, a significantly higher percentage of operators with an orientation toward viability conducted activities in addition to milk production than those with no such orientation (50.5%, processed milk products; 34.7%, direct selling; 20%, restaurant), which shows that those operators oriented toward viable EDF activity engage in more diversified farm activity than those not so oriented.

As to the type of menu of educational experience services (Table 7), operators with a viability orientation provided these services less in the form of individual service than those with no such orientation (5% significance). As to the area targeted in offering educational experience services, also shown in Table 7, a lower percentage of operators with a viability orientation targeted visitors only from their municipality than those without such orientation (5% significance), suggesting that they targeted a wider area for their services. With respect to the changes in operators' consciousness after EDF activity, those with a viability orientation had more positive attitudes toward the utilization of local resources and profit-seeking activity, such as selling of dairy products, than those without that orientation (Table 7).

Table 8 shows to what extent charges were made for educational experience services. More operators with the viability orientation charged for every service than those without the viability orientation; also, fewer of the former operators provided services at no charge (1% significance). Finally, in connection with the future direction, those with a viability orientation expressed their willingness to conduct many activities in order to provide viable services (Table 8).

To summarize, first, the members of Open Dairy Farms had a positive connection with the viability orientation of educational experience services. Second, the more visitors EDF operators accommodate, the more positive is their attitude toward the viability orientation.

Third, there were no correlations between the number of visitors or the viability orientation and indicators of farm size such as forage and pasture acreage, number of milk cows and milk production. To put it another way, there is no economy of scale in terms of EDF activity in relation to dairy production.

8 Estimation of Viability Orientation Determinant Model

Bearing in mind the findings above, here I estimate a viability orientation determinant model to clarify the factors that determine the viability orientation of the educational experience services and the degree of influence of these factors by taking into account on-farm present and future factors, and off-farm factors. Thus, the analytical model is described as equation (1) and an estimation model with actual variables is given as equation (2).

H=F (on-farm present, on-farm future, off-farm) (1)

Where, on-farm=vector of on-farm present factors, on-farm future=vector of on-farm planned factors and off-farm=vector of off-farm factors

H=F (NUM, FMALE, CHANGE, AREA, KANTO, TAGENT, DIRECT, FOOD, SL, ε) (2)

Where, H=Level of viability orientation (5-point scale)

NUM=More than 101 visitors (model 1), or more than 301 visitors (model 2)

FMALE=Main person performing EDF activity (female: yes=1, no=0)

CHANGE=Attitude change after starting EDF: (discovery of material: yes=1, no=0)

AREA=Targeted area (neighbouring municipalities: yes=1, no=0)

KANTO=Location of farm (Kanto area: yes=1, no=0)

TAGENT=Future direction 1 (using travel agency: yes=1, no=0)

DIRECT=Future direction 2 (direct selling: yes=1, no=0)

FOOD=Future direction 3 (food combined service: yes=1, no=0)

SL=Social learning effect (member of Open Dairy Farms: yes=1, no=0)

 ϵ =Stochastic error

As the explained variables, based on the hypothesis of the stepwise process, the variable H represents orientation on a scale of 0 to 4 for viable educational activity: unanswered, shrinking or quitting, and undecided=0, volunteer=1, recovering cost=2, a measure of marketing of farm products=3, and aiming at viable activity=4. Among the explanatory variables, as on-farm variables the current practices and future contemplated activities were taken up. First, as on-farm present factors the variable NUM represents the activity level of educational services by considering two cases: more than 101 visitors (yes=1, no=0) in model 1 or more than 301 visitors (yes=1, no=0) in model 2. The variable FMALE expressed who was responsible for the activity, as that person is not only important for the service activity but is supposed to be influential in the viability orientation; especially, females are better adopted for this activity (female mainly responsible of EDF activity: yes=1, no=0).

The variable CHANGE represents changes in consciousness of operators after starting the EDF activity. Specifically, I tested whether an operator discovered material for EDF services from the local resources surrounding the farmyard and obtained a wider perspective not only for management of his/her own farm, but also to local resource management. If so, we can expect further extension of EDF activity (discovery of material for EDF services: yes=1, no=0). The variable AREA expresses how large a target area as a demand potential operators assume, which indicates the market area. I use this variable to test the differences in the sizes of targeted areas on the viability orientation (neighbouring municipalities: yes=1, no=0). The variable KANTO expressed the location of the farm, and it is assumed that the Kanto area, which includes a densely populated metropolitan area, indicates a favourable spatial condition in terms of easy access for people to visit farms (located in Kanto area: yes=1, no=0).

With respect to future contemplated directions, three market related variables that would affect the viability orientation were considered. First, the variable TAGENT represents how to ensure stable demand, which is a crucial factor for the establishment of viable EDF activity. For this purpose, the intention to use a travel agency is tested (using travel agency: yes=1, no=0). A second aspect deals with the sales channel, which is also important for viability, so doing or extending direct selling is taken up as the variable DIRECT (direct selling: yes=1, no=0). A third variable is the content of the EDF service; hence, the variable FOOD denotes the intention of providing services in combination with food (yes=1, no=0). These three factors are supposed to work positively on the viability orientation.

As an off-farm variable, the variable SL connotes the social learning effect that an open network organization can generate (member of Open Dairy Farms: yes=1, no=0). Further, this variable is interpreted as a proxy variable for family farms as well because the member farms are mainly family farms whether corporate or not. Ordered logit model was employed due to the ordered explained variable.

The results of estimation are tabulated in Table 9. The ordered logit model does not give any information on multicollinearity and heteroscedasticity, so I referred to an estimation result by OLS. The OLS result indicated that no heteroscedasticity was observed and the maximum vif was 1.31, indicating no multicollinearity. As a reference, I showed the robust estimate of variance in addition to the standard estimate of variance. There was no distinctive difference between the standard and robust estimates in terms of parameters and significance levels. From these results I accept the results of logit estimation to interpret parameters.

Every estimated parameter had statistical significance, which shows no contradiction with the results of the preceding statistical tests. Results were similar to models 1 and 2. Now let us consider the estimation results in Table 9.

The parameters of the number of visitors in the two models have positive signs implying that operators with at least over 100 visitors have an orientation toward a viable EDF activity. The parameter of the female being mainly responsible was positive, indicating that this factor raises the viability orientation. Since the discovery of materials from surrounding local resources was positive, I can say that this widening perspective on local resources beyond the individual farmyard will raise the possibility of realizing the viability of EDF services. On the other hand, the parameter of a small targeted area or market area was negative, indicating that the market area should be widened for viability. The location parameter of the Kanto area was positive, indicating that easy access to farms works positively in raising the viability orientation.

| Model | # | 1 | # 2 | | |
|--|----------------------|----------------------|----------------------|----------------------|--|
| Estimate of Variance | Standard | Robust | Standard | Robust | |
| Explanatory variables | | Para | ameter | | |
| More than 101 visitors (yes=1, no=0) | 0.6561** (2.22) | 0.6561** (2.00) | _ | _ | |
| More than 301 visitors (yes=1, no=0) | _ | _ | 0.6493** (2.31) | 0.6493** (2.21) | |
| Main person for EDF activity: Female (yes=1, no=0) | 0.5411* (1.90) | 0.5411* (1.90) | 0.6152** (2.13) | 0.6152** (2.11) | |
| Attitude change after starting EDF: Discovery of material (yes=1, no=0) | 0.6451** (2.23) | 0.6451** (2.38) | 0.7055** (2.44) | 0.7055** (2.60) | |
| Targeting area: Neighbouring municipality (yes=1, no=0) | -0.6486** (-2.36) | -0.6496** (-2.36) | -0.6324** (-2.30) | -0.6324** (-2.27) | |
| Location of farm: Kanto area (yes=1, no=0) | 0.6609* (1.85) | 0.6619* (1.65) | 0.7111** (1.99) | 0.7111* (1.78) | |
| Future direction 1: Using travel agency (yes=1, no=0) | 1.1393*** (3.43) | 1.1393*** (3.46) | 1.0245*** (3.04) | 1.0245** (2.99) | |
| Future direction 2: Doing direct selling (yes=1, no=0) | 1.1175*** (3.83) | 1.1185*** (3.66) | 1.0662*** (3.65) | 1.0662** (3.53) | |
| Future direction 3: Food combined service (yes=1, no=0) | 0.6074** (2.07) | 0.6074** (2.02) | 0.6239** (2.14) | 0.6239** (2.12) | |
| Member of open dairy farms (yes=1, no=0) | 1.0711** (2.11) | 1.0711** (2.16) | 0.9593* (1.88) | 0.9593* (1.85) | |
| Sample size | 204 | 204 | 204 | 204 | |
| Log likelihood ratio | -267.1786 | -267.1786 | -266.9749 | -266.974 | |
| LR Chi-square | 91.8*** | - | 92.21*** | - | |
| Wald Chi-square | _ | 79.17*** | _ | 79.98*** | |

Notes: Data are same as Table 2. ***,**,* show 1%, 5%, 10% significance level. LR=likelihood ratio.

Now, turning to the parameters on the future contemplated direction, the parameters of using a travel agency and direct selling were both positive with 1% significance, which means a strong connection with an orientation toward viability. Another parameter of the contemplated directions on the services being combined with food was positive, suggesting that the combination of food and farm experiences will play a role in the realization of viable EDF services. Thus, it is safe to say that market conscious attitudes and skills are crucial for viable educational services.

Finally, regarding the parameters of off-farm factors, the social learning effect of the open network organization was confirmed and, interestingly, the parameter of model 1 with 5% significance is larger than that of model 2 with 10% significance. This indicates that the social learning effect is more effective at the level up to 300 visitors or when there are not a large number of visitors.

To summarize the estimation results, it is safe to say that not only on-farm, but also offfarm, perspectives on resource management are important in operators raising the viability of EDF services. Specific to this point, I compared the degree of influence of variables affecting the degree of the orientation. Table 10 summarizes simulated expected probabilities for each variable from the parameters with standard variance in models 1 and 2 (more than 301 visitors). Expected probabilities over 30% are shown in bold in the table. Among these probabilities that are highlighted, the highest influential variables were in the following order using a travel agency (50.5%), direct selling (40.1%), food combined service (37.5%), Kanto area (36.1%), over 300 visitors (35.2%), the reverse effect of a narrow range of the targeted area or wider target areas (32.9%), and female initiative (31.9%). These expected probabilities show that factors related to marketing conditions become more important in a higher orientation toward a viable EDF activity. I also cannot ignore the other factors because raising the orientation is a stepwise process and, especially, the estimation results revealed the significance of the social learning effect among the operator's network, which generates the network externality to initiate the downward shift of the PMC curve. In this context, the social learning effect initiates the stepwise innovation for internalizing the educational externality that they produce.

| Table 10. Predicted probability of the five attitudes based on the estimation result (%) | | | | | | |
|--|--------|------------|-----------|------------------|-----------|--------------------|
| Variables | Yes/no | Don't know | Volunteer | Cost covering | Marketing | Viable activity |
| More then 101 visitors | Yes | 4.1 | 17.4 | 22.9 | 26.0 | 29.6 |
| More than 101 visitors | No | 10.9 | 31.0 | 24.6 | 19.1 | 14.4 |
| More than 201 visitors | Yes | 3.0 | 14.1 | 20.7 | 26.9 | 35.2 |
| More than 301 visitors | No | 9.3 | 28.7 | 25.8 | 21.1 | 15.1 |
| Main person of EDF activity: | Yes | 4.1 | 16.8 | 21.5 | 25.7 | 31.9 |
| Female | No | 7.5 | 24.5 | 24.5 | 22.7 | 20.8 |
| Targeting area: | Yes | 8.7 | 26.9 | 24.9 | 21.8 | 17.7 |
| Neighbouring municipality | No | 3.5 | 15.9 | 21.8 | 26.0 | 32.9 |
| Location of farm: Kanto area | Yes | 2.7 | 13.3 | 20.7 | 27.2 | 36.1 |
| | No | 7.2 | 23.8 | 24.1 | 22.9 | 22.0 |
| Attitude change after starting | Yes | 4.6 | 18.1 | 22.8 | 25.9 | 28.7 |
| EDF: Discovery of material | No | 10.1 | 30.1 | 24.9 | 19.2 | 15.7 |
| Future direction 1: | Yes | 0.9 | 6.1 | 14.3 | 28.2 | 50.5 |
| Using travel agency | No | 8.5 | 28.1 | 27.1 | 22.0 | 14.4 |
| Future direction 2: | Yes | 20.2 | 10.7 | 18.9 | 28.3 | 40.1 |
| Doing direct selling | No | 8.9 | 28.6 | 26.2 | 21.0 | 15.3 |
| Future direction 3: | Yes | 2.3 | 11.9 | 19.9 | 28.3 | 37.5 |
| Food combined service | No | 9.4 | 29.5 | 26.2 | 20.2 | 14.7 |
| Marshan of On an Dairy Farms | Yes | 5.6 | 20.7 | 23.4 | 24.4 | 26.0 |
| Member of Open Dairy Farms | No | 15.3 | 36.0 | 24.6 | 15.8 | 8.3 |
| Total | - | 6.3 | 21.8 | 23.4 | 23.8 | 24.7 |

Notes: Data were as for Table 2. Expected probabilities were simulated from parameters with standard variance of model 1 and model 2 (more than 301 visitors). Bold numbers are over 30% of expected probability.

9 Conclusions

Although education services in agriculture are attracting growing attention, one problem of these open-door farm policy services is that a viable market has not yet been established. Therefore, it is necessary to clarify on- and off-farm conditions. Based on a survey to Educational Dairy Farms in Japan and from a perspective of exploring a product innovation, this paper examined the operators' attitudes toward the establishment of viable educational services. The main findings and conclusions are as follows.

First, the higher the number of visitors, the greater was the operator's orientation toward a viable service while there was no statistical connection between the input-output factors of ordinary dairy production and the educational activity. Second, the operators that had a human network with a social learning effect beyond the traditional closed communal organizations were more positive toward a viable market orientation than those without such a network. This suggests the significance of social learning effects for operators who participated in the open network organization at the initial process of establishment of viable educational services.

Third, the involvement of women rather than men and services combined with food experiences rather than simple farming experience services per se were factors that raised the viability of educational services.

Fourth, the importance of marketing activities was revealed, such as direct selling of dairy products in the farmyard and the use of a travel agency, which had positive connections with a higher orientation toward the viability of educational services.

In conclusion, making educational services viable does not simply mean that those farms should become tourism ranches. Rather, the balance between the educational function and the economic viability of services should be attained for the exploration of a new social role of agriculture and the creation of a new market. In this respect, public support will be effective in building the capacity of those operators, especially in taking into account the stepwise process of a new market establishing innovation. Finally, further research is needed on the relationship between rural entrepreneurship and this stepwise innovation process.

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