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Estimating the social value of multifunctional agriculture (MFA) with choice experiment

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Abstract: The convergence policy in agriculture, existing in many forms, has globally become one of the main concepts in agricultural development with the "sixth industrial movement" in South Korea and Japan; the multifunctional agriculture (MFA) policies proposed by van der Ploeg and Roep being good examples. The goal of this study is to test three hypotheses through the economic valuation of MFA. In the first part of the research, the importance of agricultural production activity and the core element of the rural complex were evaluated. In the second part, an assessment of three strategies of MFA and its eleven specific attributes was conducted. In the third part, the applicability of the triangular policy of van der Ploeg's strategic frameworks of MFA was analysed.

Keywords: choice experiment; fusion rural development; rural development; sixth industry; sustainable development; South Korea; valuation non-common goods; willingness to pay

The classification of multifunctional agriculture (MFA) is based primarily on the concepts outlined by van der Ploeg and Roep (2003): a framework that accentuates diversification explicitly toward MFA, with multifunctional diversification, extending beyond the limits of typical multi-crop or multi-livestock production of conventional agriculture. In addition to the core business of traditional agricultural activities, the main idea is that rural development and performance improvement can be achieved through three alternative strategies of deepening, broadening, and re-grounding, which are applicable to the expansion of farm business activities and can simultaneously be grouped as new activities, markets, and managerial solutions (Finocchio and Esposti 2008):

(i) deepening mainly refers to the integration of new unconventional activities into the conventional agricultural system, such as the reorganisation of production with more complex and integrated practices, the innovation of the products, and the enhancement of the qualitative aspects. These activities typically add value to agriculture, such as direct dealing or processing of agricultural products (van der Ploeg and Roep 2003);
(ii) broadening mainly refers to the development of non-food production activities that reflect new market requirements and could possibly create a new income source. An example is the use of farming structures as farm holidays (e.g. on-farm activities, care farm activities) (Baldock and Beaufoy 1993; Renting et al. 2009);
(iii) re-grounding mainly concerns all non-agricultural activities that are complementary to the main agricultural ones. The purpose is to provide alternative employment options. It is the most widely used strategy as it involves more extensive forms of integration between farms and the local environment (e.g. maintenance of gardens, production of animal feed, silviculture), in achieving natural services (Menghini et al. 2014).

MFA ranges from primary food production to meeting social requirements that had not previously been taken into consideration in the agricultural industry, such as biodiversity recovery, environmental decon-

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tamination, amenity restoration, utilisation of cultural resources, and food security (Belletti 2002).

This study initially attempts to assess the impacts of social benefits generated by farmhouse visits on the development of fusion agriculture, such as the sixth industry movement or MFA. It estimates the recreation and existence values of MFA and observes the relationship that citizens (the subjects of the experiment) experience with agricultural production dependence, the basis of the fusion industry, and of other service activities of MFA.

Further, MFA was structuralised for the first time by van der Ploeg and Roep (2003). It was described as an agricultural technique based on resource recycling; reducing dependence on external resources through re-grounding, such as environmental or extensive agriculture; direct trading that allows production activities to extend beyond their conventional value; deepening of elements, including processing; and broadening, which utilises nature or landscape to achieve external impacts from activities such as field visits, social farms, and care farming. Finally, this study attempts to analyse the feasibility of a successful adaptation of the horizontal development of these techniques to South Korea, as implemented in Europe. It is expected that by estimating the benefits of each attribute, it will be possible to establish criteria for MFA development in South Korea.

Most research on the existence value of public goods and recreational value in rural areas has focused on assessing the value of a specific field rather than the multilateral functions of agriculture. Yrjola and Kola (2004) classified the multilateral functions of agriculture into food security, animal welfare, rural viability, food safety, environment, and landscape, and estimated their values using contingent valuation method (CVM).

In South Korea, estimation of paddy farming's landscape using a contingent ranking method (CRM) by Kwon and Yun (2004) and estimation of water resource value using choice experiment (CE) are representative examples of valuing noncommon goods. Also, Novikova et al. (2019) assessed the overall landscape value of agriculture by CRM and proposed the need for expansion of expenditure on rural landscapes in Europe's Common Agricultural Policy (CAP) and countries. Researches about MFA include those of van der Ploeg and Roep (2003) and Menghini et al. (2014), which used Farm Accountancy Data Network (FADN) to classify strategic attributes and assess their weight in entire agricultural industry and impact on National Values Assessment.

The research by Finocchio and Esposti (2008) and Schimmenti (2016) analysed the elements that had an impact on rural development and MFA under the EU CAP. The research conducted by Finocchio and Esposti (2008) contained a revealed preference analysis, using FADN data, with respect to the degree of multifunctionality, area, age of the farmer, and agricultural machinery ownership but not multi-agricultural strategic attributes. In summary, valuations of public goods, such as the natural environment of agriculture, have applied CVM, CRM, and CE techniques and MFA analyses regional characteristics by country and suggests strategic directions. MFA and agriculture are much comprehensive value chains, which need to be comprehensively analysed and the direction of development based on the results.

EXPERIMENTAL DESIGN APPROACH

The "agricultural production dependence" condition was added to the three strategic components suggested by van der Ploeg and Roep (2003) – deepening, broadening, and re-grounding – to observe its relationship between the three strategies and agricultural production.

To identify attributes and levels of the resources existing around a rural village in detail, an interview was conducted with the village leader, and a provisionally designed survey based on a virtual, multifunctional farm was developed with many attributes for the respondents to select from, with reference to Menghini (2014) and Aguglia et al. (2009); such detailed attributes are indicated in Table 1.

Deepening, the first strategy of MFA, has four components: general agricultural product direct sales; environmentally friendly farm product sales; the management of restaurants; and construction material types of facility. Agricultural products were classified into eco-friendly or ordinary products and restaurants, which offer locally grown products, were considered due to possible preference for such factors.

Broadening, the second strategy, suggested rural service activities, such as field trips and accommodation and experience activities, including participation in nature breaks, involvement in traditional cropping practices, such as planting, weeding, irrigation, and harvesting; rural ecological experiences; and traditional front-yard cleaning with bamboo broomsticks. Broadening activities include handicrafts, such as making bamboo brooms, colanders, and straw shoes, and cooking experiences, such as making mozzarella cheese, field trips to rural areas, and finally, accommodation in rural ar-

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Table 1. Detailed eleven attributes of MFA (multifunctional agriculture)

MFA strategy	Attribute	Description
Agricultural production dependence	income level of agricultural production dependence	20, 55, 85%
DPN (deepening)	conventional direct market	◯; X
	organic direct market	◯; X
	restaurant	◯; X
	material type of facility*	shelter, wooden, brick, steel
BDN (broadening)	experience activities programs	nature breaks, ecosystem, harvesting, cooking, handicrafts, field trips
	accommodation type	hotels, Hanoks, campsites, farm stays
RGN (re-grounding)	eco-friendly agricultural area	◯; X
	landscape	good, normal, bad
	biodiversity (encounters)	3, 18, 33 species/h
	multi-diversity agriculture (circulation of agricultural resources)	resource recycling, multi-variety small-scale production *vs.* high-input, single-variety large-scale production
	dependence on renewable energyusage	0, 45, 90%
Distance	distance from residents	70, 120, 170, 220 km

*Sustainability and eco-friendliness of the facility by construction materials; ◯ – yes; X – no; Hanok – Korean traditional house

Source: Authors' own processing

eas that includes stays on farms or in traditional Korean houses or Hanoks (Korean traditional houses).

Finally, with respect to the re-grounding strategy, van der Ploeg and Roep (2003) defined their triangular multifunctional agricultural policy as optimised input-induced rural development. It can be assumed that re-grounding must be primary out of the three strategies. Re-grounding also relates to the quality of essential agricultural resources. The respondents' perception of rural areas, with regard to their cleanliness, environmentally friendly nature, natural landscape, water, and the activity of natural services, may considerably affect the level of benefits generated. Therefore, as attributes that represent re-grounding, the sustainability of agriculture, which is defined by the degree to which dependence on external inputs can be minimised and dependence on the use of internal resources can be maximised to conserve the rural culture, were defined as resource recycling, multi-variety small-scale production, and high-input, single-variety large-scale production, respectively.

To design the choice sets for stated preference models, a set of attributes affecting the choice of MFA sites was developed to reflect the actual or virtual characteristics of the resources in the MFA. Table 1 presents the set of attributes and levels spanned by the CE set. Given that each attribute was not controlled to be discrete, as shown in Table 1, there are $2^5 \times 3^4 \times 4^2 \times 5^2$ possible alternatives. Therefore, this variation needs to be treated in as few alternative sets as possible. For violations of the independence of irrelevant alternatives (IIA) attribute of the conditional logit model, to ensure IIA of the testing requires at least three alternatives, which were satisfied in this case by having the "stay at home" option as discussed by Louviere and Woodworth (1993) and Adamowicz et al. (1994).

The orthogonal main effect design used SAS programming, which can secure orthogonality between the attribute variables of the experimental design (Adamowicz et al. 1994). Among the selection groups, selection alternatives with an absolute advantage or disadvantage were removed, after which 60 groups were set up. They were paired randomly then, to be distributed as three survey papers, each with 10 pairs of selections.

Graduate school students majoring in agriculture explained the survey to the respondents and announced that it was a one-time visit. Each respondent was asked to imagine MFA, and under the assumption that they were willing to visit rural areas for recreational purposes, they were asked to choose a desired area from the attribute choices. This model assumes that the IIA in the conditional logit model estimates does not significantly distort the alternative choices. In terms of alternative selection, the model was constructed for alternatives 1

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Table 2. Characteristic of survey sample (number of respondents = 250)

Characteristic		Results (%)
Sex	male	42.4
	female	57.6
Age	years (average; std. dev.)	39.5 ± 12.6
Marital status	married	57
	single	42.9
Region	near Seoul (capital)*	63
	middle of South Korea	25
	south of South Korea	12
House income	≤ USD 10 000	5.6
	USD 10 001–USD 20 000	12.5
	USD 20 001–USD 35 000	32.6
	USD 35 001–USD 50 000	16.9
	USD 50 001 ≤	32.2
Education	up to high school graduate	21.7
	college	56.6
	post-graduate	21.6

*50% of population live in near Seoul

Source: Authors' own processing

and 2 recreational opportunities by the combination of fractional factorial designs that are unique to each other, and an alternative 3, "stay at home", was suggested to avoid limiting the characteristic combinations of alternatives.

The survey was conducted in May 2017 and was intended for individuals, aged between 20 and 70 years and considered their origin of birth for using the stratified method because of avoiding difference of local tendency. A survey of 250 respondents was conducted in Seoul bus and train station high-traffic and the possibility of gathering all county residents and characteristics of the survey are in Table 2.

METHODOLOGY

The selected experimental method is an alternative model (a multiple comparative model) to two comparative CVM voting models. It is a discrete choice model similar to a probability utility model, in which a range of virtual alternatives is selectable. Supposing that the satisfaction rate of individual n choosing the j^{th} alternative forms a linear function, it can be expressed as Equation (1) in a random utility model (RUM).

$$U_{nj} = V_{nj} + \varepsilon_{nj} = \beta X_{nj} + \varepsilon_{nj} \quad (1)$$

where: U_{nj} – utility function when respondent n selects j^{th} option ($j = i, \ldots, J$); V_{nj} – property when respondent n selects j^{th} option; X_{nj} – presumable property when respondent n selects j^{th} option, ε_{nj} – random variable.

Subjects will seek an alternative that can maximise their satisfaction, depending on the MFA conditions, and select one, which is close to the desired X_{nj}, β, and ε_{nj}. On the other hand, researchers would have to analyse the choice behaviour while only the choice X_{nj} of the subject is known. Assuming that the random variable follows the Type I extreme value distribution, the probability of individual n choosing alternative j is indicated in Equation (2), and β can be estimated through the maximum likelihood estimation model.

$$P_{nj} = \frac{\exp\left(V_{nj}\right)}{\sum_{i=1}^{J}\exp\left(V_{nj}\right)} = \frac{\exp\left(V_{nj}\right)}{\sum_{i=1}^{J}\exp\left(V_{nj}\right)} \quad (2)$$

where: P_{nj} – probability that respondent n chose option j.

To estimate the MFA value using a selective experiment, the probability of individual n choosing alternative j can be expressed as a linear function in Equation (3), where no_{nj} is person's utility obtained from choosing ③ in Table 3.

$$U_{nj} = \left(1 - no_{nj}\right) \times \times\left(\beta_1\left(\chi_{1nj} \times 1.1\right) + \beta_2\chi_{2nj}, \ldots, + \beta_k\chi_{knj}\right) + + \beta_{no}\chi_{nonj} + \varepsilon_{nj} \quad (3)$$

where: no_{nj} – respondent selects "stay at home" ③ (dummy variable); χ_1 – travel cost in KRW; $\chi_2, \ldots, \chi_k$ – variables.

In this study, each individual responding to a 10-experiment combination is considered to be independent of individual selection. There may be a dependent relationship between the choices since they were made by a single individual. However, the issue does not seem important, since all the combinations were randomly selected. Furthermore, IIA does not affect the tendency to choose alternative 3 in Table 3 in terms of the ratio of selecting each combination, assuming the logit model, and the utility function can be assumed to have holistic independence determined by 1 and 2.

To observe the degree of willingness to pay (WTP) change as the attributes of MFA change, an indirect utility for each (damaged) attribute prior to change is set as V_{nj}^0 and V_{nj}^1 as the utility afterwards. The compensating variation generated at this point can be derived using Equation (4):

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Table 3. Examples of the MFA (multifunctional agriculture) opportunity questions

	Alternatives		
	①	②	③
Income level of agricultural production dependence (%)	55	20	
Eco-friendly/conventional agricultural area	eco-friendly area	conventional area	
Excellence in landscape	good	normal	
Agricultural biodiversity – fireflies, frogs, sawyers (species/h)	33	18	
Resource recycling, multi-variety small-scale production/single-variety high-input large-scale production	resource recycling,multi-variety small production	resource recycling, multi-variety small-scale production	
Degree of renewable energy usage and independence – solar, wind power (%)	0	45	stay at home
Conventional fresh/processed direct product sales market	◯	◯	
Organic fresh/processed product direct sales market	X	X	
Restaurant	◯	◯	
Type of facilities' material	shelter	bricks	
Experience activities	nature break	field trip	
Accommodation type	campsite	farm stay	
Distance (km)	120	220	

◯ – yes; X – no

Source: Authors' own processing

$$CV = \frac{1}{\mu}\left[\ln\sum_{j=1}^{J}\exp\left(V_j^0 - ln\sum_{j=1}^{J}\exp(V_j^1)\right)\right] \quad (4)$$

Using Equation (4), the solvency for each attribute per unit change of the agricultural attribute details can be estimated. The payment can simply be derived using Equation (5) (Haab and McConnell 2002), and the individual WTP measure per unit of change for each attribute (Δq) can be estimated by marginal utility (β_y) for income.

$$WTP = -\frac{\Delta q \beta}{\beta} \quad (5)$$

RESULTS

Eleven attribute details of deepening, broadening, and re-grouping of MFA and essential conditions, such as the level of production activities and WTP measure for recreation in rural areas were estimated using the conditional logit model described in Equation (3). The estimated results are summarised in Table 4. Model (1) includes estimates of the attributes' details from the three MFA strategies. A model with individual factors, such as gender, age, and income, is specified in Model (3), and in Models (2) and (4), the marginal effect is applied to compare the importance of the attributes.

Travel cost was used as the distance for value estimation of each attribute's beneficial effect due to the difficulties in determining the traveling cost in various attribute levels and the difficulties faced by respondents in making their decisions. To convert the distance into the cost, the measurement result of the Rural Tourism and Local Economy was referred. Among the total average expenditure USD 96, the round-trip fuel cost is USD 31 and was converted into the 2011 gas price/L, then the gas price/L was converted again into the price per distance of USD 1.1, calculating L as the fuel efficiency of 10km per car, thereby making the distance cost equal to distance × USD 1.1.

In terms of the average rural area experience cost, 2.3% and 3% economic growth rates for 2012 and 2013 were applied, respectively, as well as 3.5% for 2014 as reported by the OECD to the nominal price of the cost per distance.

Unlike expected, significant results could not be obtained with respect to the importance of agricultural

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Table 4. Conditional logit estimation results

Strategy	Attribute (variable)	Description	Model (1)	Model (2)	Model (3)	Model (4)
DPN (deepening)	conventional farm produce market	yes = 1, no = 0	–0.22653***	–0.036***	–0.21414***	–0.03356***
	organic farm produce market	yes = 1, no = 0	0.16784	0.02667	0.16395	0.0257
	restaurant	yes = 1, no = 0	–0.01943	–0.00309	–0.01924	–0.00302
	steel	*vs.* wooden	–0.19108**	–0.03036**	–0.01009**	–0.00158**
	brick	*vs.* wooden	–0.00432	–0.00069	0.00013	0.00002
	shelter	*vs.* wooden	–0.02693	–0.00428	–0.03209	–0.00503
BDN (broadening)	natural break	*vs.* field trip	0.47896***	0.07611***	0.46175***	0.07237***
	harvest/cooking	*vs.* field trip	0.1695	0.02694	0.17589	0.02757
	handicrafts	*vs.* field trip	0.09532	0.01515	0.0849	0.01331
	eco-experience	*vs.* field trip	0.22508***	0.03577***	0.23129***	0.03625***
	Hanok	*vs.* hotel	0.11478	0.01824	0.12934	0.02027
	campsite	*vs.* hotel	–0.29981***	–0.04764***	–0.30226***	–0.04738***
	farm stay	*vs.* hotel	–0.15911	–0.02528	–0.1577***	–0.02472
RGN (re-grounding)	environmentally friendly rural areas	yes = 1, no = 0	0.30821***	0.04898***	0.31309***	0.04907***
	landscape	G = 2, N = 1, B = 0	0.36461***	0.05794***	0.37296***	0.05846***
	biodiversity	3, 18, 33 species/h	0.00834***	0.00133***	0.00885***	0.00139***
	renewable energy usage	%	0.00199	0.00032	0.00202	0.00032
	resource recycling agriculture	yes = 1, no = 0	0.06162	0.00979	0.06305	0.00988
Individual factors	No.	–	–2.89787***	–0.46051***	–2.23512***	–0.35033***
	gender × TC		–	–	–0.00118	-0.00018
	gender × No.		–	–	0.16351	0.02563
	age × TC		–	–	0.00011***	0.00002***
	age × No.		–	–	–0.01523	–0.00239
	income × TC		–	–	–0.0000***	0.000001***
	income × No.		–	–	–0.00047	–0.00007
TC (travel cost)		distance × USD 1.1	–0.00227**	–0.00036***	–0.00316**	–0.0005**
Agricultural production dependence		%	0.00164	0.00026	0.00149	0.00023

***P-value under 3%; **P-value under 5%; G – good, N – normal, B – bad; No. – no variable on the model; no – dummy variable, choice of alternative ③ = 1, choice of alternatives ① or ② = 0 (for further explanation see Table 3)

Source: Authors' own processing

production dependence or they were significant yet considered to be unimportant because visitors do not take into consideration the importance of farmer dependence in agriculture. Such results appear to be caused by: (i) the tendency of the respondents to perceive recreational activities and agricultural production dependence to be dissimilar (unrelated), the respondents being somewhat unfamiliar with the concept of MFA; or (ii) the tendency of the respondents to focus solely on recreational activities rather than production activities. It is understood that to estimate the benefit of agricultural production dependence, it must be separated from MFA or classified by key agricultural production dependence to estimate the element-specific value of agricultural production dependence, using the overall value estimated by CVM.

It can be inferred that the preferences according to the behaviour of the subjects regarding recreation facilities in the form of MFA are related to the individual benefit that can be obtained from agricul-

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ture in the form of facilities or amenities similar to those in urban areas and advanced technology.

The deepening strategy attributes also estimated that a market for organic farm produce was considered preferable to a conventional farm produce market, and that wooden structures were preferred over steel structures for farm facilities. However, the existence of farm restaurants, bricks, and stop-gaps was not significant.

In terms of the broadening strategy, nature breaks were preferred to field trips, whereas ecology experience was a much-preferred activity. Regarding the accommodation, Hanok (Korean traditional house) and farm stays did not return significant results, whereas hotels were preferred to campsites. Such tendencies lead to conclusion that the main purpose of recreation in rural areas lays in relaxing the body and mind rather than travelling *per se* and that staying in rural areas is considered to be inconvenient. For the development of MFA, an improvement in farmers' education to achieve a more intimate relationship between facilities and the environment is required.

For the re-grounding strategy, as expected, the landscape displayed the highest preference level, although environmentally friendly rural areas showed a similarly high preference level. Significant results were also obtained for biodiversity. A much higher level of preference was shown for the re-grounding strategy than for the deepening or the broadening strategies, indicating that visitors reacted far more sensitively to the landscape and environment for MFA.

Models (2) and (4) reflected the average marginal effect to compare attributes' result values, considering changes in the level of difference in the attribute parameters. Summarizing the individual preferences for MFA in accordance with the estimation coefficients, Model (2) excluded individual tendencies.

It was observed that visitors gained the greatest benefit from a natural break (0.076) in green rural areas, an excellent landscape (0.058), environmentally friendly rural areas (0.0489), securing safe agricultural food production and biodiversity (0.0013), followed by eco-experience (0.0357) and field trips to high-biodiversity areas. To summarise, the most-preferred recreational activity for MFA related to green, environmentally friendly rural areas with a beautiful landscape where nature breaks are available. The coefficients changed but the relative ranking did not change in Model (1), which did not consider the marginal effect; Model (3), which considered individual tendencies; and Model (4), in which marginal effects were considered. Therefore, it can be claimed that Model (2) represents the relative ranking. The same results were obtained in the benefit estimation of the compensating surplus.

For nature breaks for recreational purposes, re-grounding activities, such as natural and eco-friendly agriculture, must be a priority.

In other words, for a multifaceted approach to agricultural policy for rural development, such as the MFA of Europe or the sixth industry movement of Japan and South Korea, adding value through agricultural processing and local food restaurants, deepening through eco-friendly intensification, broadening of the available service industry, landscape improvement through rural environment development, eco-friendly agriculture improvement to conserve biodiversity and the provision of safe food, and lastly, re-grounding activities, such as increased resource recycling and environmentally friendly sustainable agriculture, constitute the most important factors.

Models (3) and (4) in Table 4 were tested for the existence of an interaction between the attribute variables and the respondents' gender, age, and income. Overall, the individual attribute variables did not show any stochastic significance. The results suggested that longer-distance and higher-cost travel to rural areas were preferred by older people and lower-income people rather than by higher-income people. Such a finding indicates that respondents with a higher income had a tendency to seek travel which involved somewhat shorter distances and was less expensive, whereas the lower-income groups can be seen to prefer long-distance rural area travel.

A significant attribute variable compensation surplus can be estimated, as shown in Table 5, using Haab and McConnell's (2002) marginal willingness to pay (MWTP) estimation method and the coefficients from Models (1) and (3). MWTP refers to a one-time payment per household for each unit of improvement of individual attributes.

The attribute that held the highest rating and value in promoting the multifunctional nature of agriculture happened to be the natural breaks of the broadening strategy. It was estimated that, for each household taking a nature break, there was USD 146 worth of benefit, whereas the figure was USD 73.1 for eco-experience, though staying at a campsite rather than a hotel reduced the benefits.

For the re-grounding strategy, the benefit was observed to increase to USD 117.7 when the landscape was beautiful, with a USD 98.9 increase being observed per environmentally friendly rural area ratio increase.

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Table 5. Estimated value of attributes of MFA (multifunctional agriculture) per household (USD)

Strategy	Attributes	Model 1	Model 2
DPN (deepening)	conventional farm produce market	–67.7	–67.7
	steel	–6.1	–3.2
BDN (broadening)	natural break	146.0	145.9
	eco-experience	73.1	73.1
	campsite	–95.6	–95.5
RGN (re-grounding)	environmentally friendly rural areas	98.9	99.0
	landscape	117.7	117.9
	biodiversity	2.8	2.8

Source: Authors' own processing

In addition, a secure ecosystem and moderate levels of biodiversity (reflected by observation of more than 15 species/h) increased the benefit by USD 2.8.

In contrast, in the case of deepening, a negative surplus was indicated for an organic farm produce market, whereas non-sustainable and cold materials, such as steel, also brought a negative surplus.

CONCLUSION

This study sought to determine the relationship between attributes by estimating the benefits generated from rural area field trips in terms of predicting the development of fusion agriculture, such as the sixth industry movement or MFA, with particular relevance to the assessment of the importance of agricultural production dependence, under the assumption that the recreational and existence values depend upon the activity level. Furthermore, an assumption was made that gradual development is necessary for MFA, taking the primarily structured triangular multifunctional agricultural policy (deepening, broadening, and re-grounding) developed by van der Ploeg and Roep (2003). As the future developmental model of the sixth industry movement; from this model, 11 attributes were structured and the benefits of each attribute were estimated to be used later in a stated preference model to assess the values and preferences for each attribute.

First, the null hypothesis that in terms of carrying out agricultural production dependence and MFA a significant preference value will be detected, could not be rejected or accepted due to statistically insignificant results or very minor effects even when significant. Such a result allows the prediction that MFA can be regarded as an aspect that is completely different from conventional agriculture, or that, in terms of recreation, one which has a strong tendency to fulfil self-objectives and not consider production activity as recreation. This research met a limitation in terms of constructing a null hypothesis.

Second, the multifunctional agricultural value triangle is defined as deepening, broadening, and re-grounding; however, in terms of carrying out MFA development strategies, the natural environment and landscape improvement might consequently be a priority, and, as a second step, the conclusion could be reached that the broadening and deepening strategies might be carried out at a South Korean political level.

For the re-grounding strategic policy, active support from the government is needed because, in many cases, agricultural environment-related issues, such as environmentally friendly rural area complexes, environmental improvement, and landscape and biodiversity conservation, tend to be overlooked or avoided. It was also not possible to draw out a result in terms of deepening and particularly broadening strategies in which a short-term outcome cannot be achieved or where the longer-term re-grounding strategy does not take place. Additionally, agricultural production dependence seemed to be either an essential factor or an uninteresting one to citizens. Assuming that a citizen visits a multifunctional agricultural area for recreational purposes, fair landscape (USD 117.7) and a natural break (USD 146) in an environmentally friendly agricultural area (USD 98.9) with unspoiled nature turned out to be the most preferred option.

This study does not end at merely estimating the values of the individual multilateral functions of agriculture but separates South Korean MFA into 11 attributes to estimate its benefit as a farm income resource which is generated in parallel with agriculture, a process that is currently being undertaken. While van der Ploeg (van der Ploeg and Roep 2003) composed MFA into the horizontal value triangle of deepening, broadening, and re-grounding, this study suggests that the re-grounding strategy must take priority in order to increase the environmental values provided by MFA. On the other hand, to explain the non-significance of agricultural production dependence, despite the apparent relationship between agricultural productivity and MFA, whereby MFA cannot proceed without agricultural production dependence, further research on this topic is needed. Furthermore, the test is limited as the test subjects had difficulties in making decisions because of the presence of too many variables. To sup-

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port the results of this research, another study is necessary for which a single multifunctional agricultural area is assigned using the revealed preference model analysis method as well as the values for each attribute.

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