Public awareness concerning the multifunctionality of Cypriot agriculture

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Abstract

Agriculture's multifunctionality constitutes a core dimension in the design of rural development policies of the European Union, recently reformed through the introduction of Reg. EC/1305/2013. Within a generalized rural development context, agriculture plays numerous roles; in Cyprus three sectors other than the production of food and fiber are particularly affected: the environment, including the management of water reserves as water is the scarcest resource on the island and irrigation accounts for more than 70% of the total water consumption, rural amenities, through the protection of the agricultural cultural heritage and the livelihood of rural areas, and the continuation of the farming profession, which is endowed with non-use values. This study presents the findings of a survey regarding the degree to which Cypriots are interested in the aspects of life on the island which are affected by the multifunctional character of agriculture. Using Likert-scale questions, 300 respondents were interviewed concerning their opinions and attitudes towards four of these aspects: environmental quality, management of water resources, rural amenities and the maintenance of the farming profession. The analysis indicates that Cypriots are aware of the roles that agriculture plays. Then, in order to examine the validity of this conceptual framework of multifunctionality, a confirmatory factor analysis (CFA) was employed. The results of the CFA revealed that Cypriots incorporate these four aspects within the same framework, thus understanding the distinct effects of multifunctionality on their everyday life. The results of this study can be used in the implementation of Reg. EC/1305/2013, as they reflect public preferences concerning the orientation of agriculture.

1. Introduction

The multifunctionality of the agricultural sector has been well-documented, especially during the past 20 years, since its emergence within the agricultural policy agenda debate. The term refers to the fact that agriculture produces externalities thus influencing society in numerous ways without, nonetheless, the results of these externalities being incorporated in market prices of agricultural products (OECD, 2001). Agriculture is not the only multifunctional human activity but its unique characteristics and its linkages to land use and to rural livelihoods stimulate the debate

about it. According to Lankoski and Ollikainen (2003) the external effects of multifunctional agriculture can be categorized as those affecting the environment, rural amenities and food security. The latter externalities, however, can only be considered at a larger scale and are only rarely included in academic research about multifunctionality.

Proponents of multifunctionality claim that the maintenance of rural landscapes and amenities, the protection of environmentally sensitive areas and the continuation of traditional farming practices (e.g. rice production in Japan) are externalities (OECD, 2001) and, as such, they provide additional arguments in favour of intervention in the farming sector. The multifunctional character of the farming sector has been incorporated in rural development and agricultural policies of the European Union (EU). Regulations (EC) 1782/2003, (EC) 73/2009, (EC) 864/2004 and (EC) 1698/2005 in the past and the recently introduced Regulations (EC) 1305/2013 and (EC) 1307/2013 recognize that farming should always protect the environment, including biodiversity and agricultural landscapes, but also prioritize measures aiming at the amelioration of the performance of the agricultural sector in order to ensure the sustainable development of rural areas.

In order to facilitate the examination of the multifunctionality of agriculture, a positive and a normative approach have been proposed. The former recognizes multiple functions of agriculture, but favours policy measures to arrange their provision as long as they are perceived and valued by society. The latter approach also acknowledges the multiple roles of agriculture but accepts as a given that the sector has to play multiple roles and to perform particular functions for the benefit of society (Vermersch, 2001, Allaire and Dupeuble, 2002, OECD, 2003). When a positive approach is adopted, public attitudes are central in decision-making concerning the agricultural sector; policy measures are to be considered if and only if the aspects of everyday life affected by the multifunctional character of agriculture constitute an issue of interest for society as a whole. On the contrary, within a normative approach society is obliged to deal with agriculture's externalities.

Many authors have examined the effects of price policies (Peterson et al., 2002, Romstad, 2004a, b); others employed stated preference techniques in order to attach monetary values to non-traded outputs of agriculture (Yrjola and Kola, 2004, Kallas et al., 2007, Ragkos and Theodoridis, 2011). The attitudes of farmers towards multifunctionality have been examined by Kvakkestad et al. (2015) by means of a Likert scale, identifying that they are aware of their numerous roles in the rural development process. Howley et al. (2014) examined the environmental attitudes of the general public and of farmers within the framework of agriculture's multifunctionality, revealing similar aspirations for the environment as a whole but severe differences in factors affecting the productivist strategies of farmers.

The purpose of this study is to examine public awareness concerning the issues which are influenced by agriculture's multifunctionality. Based on a positive approach, if these issues are not interesting for the public or if the public shows little awareness, the implementation of relevant policies cannot be supported. However, the first step of the analysis is based on a normative approach; multifunctionality is described as a set of pre-determined dimensions (latent variables), based on the above discussion. This means that in this paper the facts that agriculture is multifunctional and that it affects the everyday life of the public are adopted *a priori*. Then, data from a survey of the Cypriot public are used in order to examine the validity and reliability of the theoretical latent construct and to validate the argument that the public comprehend the various effects of agriculture and are concerned about them.

The empirical analysis within this study employs the Confirmatory Factor Analysis method (CFA) in order to establish the validity and reliability of the latent construct. CFA is particularly useful for cases where the dimensionality of a complex notion or phenomenon is established - either theoretically or based on prior empirical research - and the researcher seeks to ascertain whether a scale or a latent construct, usually based on a set of survey questions, is consistent with this predetermined dimensionality. Within the social sciences framework, the CFA method has been used to test the validity and reliability of such latent variables and constructs. Narayan and Cassidy (2001) implemented the CFA method to empirically validate a theoretical model for the measurement of social capital, which they constructed by detecting its various dimensions through an extensive literature review. The use of CFA has also been reported for the exploration of people's understanding of place; Ardoin et al. (2012) proposed a four-dimension typology of place based on previous theoretical considerations and sought to test its fit based on survey data. When it comes to food consumption, Pieniak et al. (2009) assessed the cross-cultural validity of a hypothetical latent structure linking eight motives for food choice with attitude and behaviour toward traditional food using survey data from six EU countries. Bredahl (2001) had previously launched a similar research in order to assess the attitudes of EU consumers towards genetically modified food. Pardo et al. (2002) also applied CFA in

order to examine the level of awareness and knowledge of biotechnology in Europe. In the agricultural sector, Milfont and Duckitt (2004) and Bayard and Jolly (2007) used CFA models to assess the reliability of latent constructs concerning the environmental attitudes of farmers; both studies used the CFA to evaluate the measurement quality of the indicators derived from Explanatory Factor Analysis.

2. Agriculture's multifunctionality and implications for rural policies

The multifunctional character of EU agriculture is expressed by small family farms that prevail in the Continent (de Vries, 2000). This "European Model of Agriculture" plays a significant role in maintaining vivid rural areas and protecting the environment and cultural heritage (Casini et al., 2004). EU claims that these small family farms are the ones in charge of running its rural development policies.

The relationships between agriculture and the environment are complex. Conventional farming systems in the EU produce negative environmental externalities which affect soil, air quality and surface and ground water resources. In particular, the main pressures of agriculture on water resources are due to poor management of irrigation and non-point sources of pollution, mainly residuals of agrochemicals (Pretty et al., 2000). CAP reform introduced payments to farmers who adopt integrated or organic farming and incentives to expand fallow lands and forests (Axis II, Reg. (EC) 1305/2013); organic farmers have been documented as the most environmentally aware (Läpple, 2013) and so have been organic food consumers since many years (Davies et al., 1995).

Agriculture's role in rural development is undeniably significant. Functions such as safeguarding rural populations, protecting cultural heritage and maintaining the farming trade are some of its non-traded outputs affecting rural amenities. In particular, agricultural activities have shaped the cultural heritage and the mere identity of rural regions; hence the countryside is endowed with a wide range of folklore features, such as traditions, music, dances and architecture. The public perceives farmers as the keepers of this "agricultural cultural heritage" (Abler, 2003), thus recognizing concrete links between farming and culture.

Apart from its role in the rural development process and its externalities concerning cultural and social functions, agriculture has traditionally been viewed by society as a particular trade, inextricably woven with life in the countryside. A modern approach of the farming profession should essentially integrate environmental and societal aspirations apart from the purely economic role of farmers (Deverre, 2002). In fact, as Cayre et al. (2004) point out, the engagement in farming is motivated by social and ethical motivations. According to Harvey (2003) society as a whole regards farming in a positive way, which is a result of the development process in western societies. After the industrial revolution, farmers were the "losers", who did not have the opportunity to leave the "poor" countryside and seek a modern way of life in urban areas. The "winners" of this process, civilians, retain a "romantic" view for farmers. Within this context, the CAP recognized farmers as a disadvantaged trade even from its origins (Potter and Burney, 2002).

3. State-of-the-art in sectors affected by agriculture's multifunctionality in Cyprus

During the past decades Cyprus has seen an impressive expansion of the service sector. Over time, trade in services (in particular, travel services, transport, financial services, as well as other business services) has acquired a pivotal role in the economy (EC, 2013). This development pattern has reduced the importance of agriculture. The Cypriot farming sector contributed by 2.1% to the GDP, by 4.9% to employment and by 15.2% to exports (www.moi.gov.cy, 2013). However, its contribution is vital for incomes and employment in highland rural areas, where tourism and manufacturing are limited. Note also that organic farming accounts for less that 2% of the total cultivated area.

Features of agricultural cultural heritage are widespread in rural areas of the island, including monuments, festivals, museums and buildings (windmills, bridges, oil mills etc). The importance of these cultural resources has been recognized and efforts are made in order to incorporate them into rural development strategies. The Rural Development Program, in force since 2007, endorses investments and actions to protect cultural features.

The main environmental problem in Cyprus is water management. Low annual rainfalls threaten surface and ground water reserves on the island. Numerous policies have been applied during the past decades in order to mitigate the problem and to ensure a more sustainable use of water in the country (for instance the establishment of

desalinization facilities and the encouragement of water recycling). In addition, water supply breakdowns in Cypriot households have been extensively applied to reduce water consumption on the island. Nonetheless, the farming sector accounts for 70% of the total water consumption in Cyprus, thus irrigation policies are of vital importance not only for the farming sector, but also for the economy as a whole. Apart from water use, however, serious efforts have been undertaken during the past few years in the field of renewable energy. After 2006 a New Support Scheme increased the interest for soft energy and since 2007 the public interest for investment has been increasing substantially. Nowadays Cyprus is one of the leading countries in the use and construction of solar water heating systems (EREC, 2009).

4. Methodological framework

4.1. Survey design and administration

The empirical analysis in this paper is based on a survey of the opinions of the Cypriot public regarding the multifunctional character of agriculture on the island. For this purpose a questionnaire was designed including questions about the diverse functions of the Cypriot agricultural sector, apart from the production of food and fiber. Using a 5-point Likert scale (Totally agree, Agree, Neither agree nor disagree, Disagree, Totally disagree), respondents were firstly asked to state the degree to which they believe that agriculture influences nine (9) aspects comprising the overall quality of living on the island. Afterwards, respondents were presented with four latent constructs, describing particular dimensions of agriculture's multifunctionality on the island. Each one of the four latent constructs included five items (statements) to which respondents were asked to indicate their level of agreement or disagreement by means of a 5-point Likert scale.

Table 1. Latent variables and items describing the multifunctional character of the Cypriot agriculture

Latent variables	Items	Statements
Water management (**Q2.Total**) *Awareness regarding the problems of water management in Cyprus*	Q2.1	"I am concerned about the reduction of water reserves in Cyprus"
	Q2.2	"I support water recycling and desalinization initiatives"
	Q2.3	"Water should be used in all economic activities (agriculture, industry, tourism) regardless of the problems caused
	Q2.4	"I would prefer constant water supply for my household despite the consequences for the water resources in Cyprus"
	Q2.5	"I have been informed about water saving techniques at home and at work"
Environmental consciousness (**Q3.Total**) *Attitudes towards environmental-friendly products and energy consumption*	Q3.1	"I buy organic food because it is healthier"
	Q3.2	"I buy organic food because it is more environmental friendly"
	Q3.3	"I try to decrease energy consumption in my everyday life"
	Q3.4	"The investment to soft energy (solar, wind etc) in Cyprus should be increased"
	Q3.5	"I prefer to consume products from firms following environmental-friendly standards"
Agricultural cultural heritage *Interest for the protection of the agricultural cultural heritage*	Q4.1	"I like traditional festivals organized in villages"
	Q4.2	"I visit rural areas for recreation"
	Q4.3	"I am interested in folklore"
	Q4.4	"Traditional stories, festivals and habits do not belong to modern times"
	Q4.5	"I like the way of living in the countryside"
Farming profession *Positive attitude towards farming and interest in its protection*	Q5.1	"I would like to become a farmer"
	Q5.2	"Agriculture in Cyprus should be continued"
	Q5.3	"Agriculture is important for Cyprus"
	Q5.4	"The future of the Cypriot farming sector is ominous"
	Q5.5	"Farmers are entitled to a favourable treatment for their professional issues"

The four latent variables, presented in Table 1 along with their corresponding items, account for respondents' awareness towards water management, their environmental consciousness, their opinions regarding agricultural cultural heritage and their attitudes towards the farming profession. Notice in Table 1 that some of the items (Q2.3, Q2.4, Q4.4, Q5.4) were worded in order to have a negative sense in relation to the whole latent construct. This way it was easier to detect satisficing (i.e. respondents who gave "automated" answers in order to make a statement - see Krosnick (1991)) and to renew the interest of bored or tired respondents. These questions were answered with the same Likert scale as the others but the corresponding variables were coded reversely.

The sampled population consisted of the total adult population in the Republic of Cyprus. The country was divided in four areas (strata), following the official administrative division of the country: Nicosia, Paphos, Limassol, Larnaca-Famagusta (these two areas were merged for the purpose of sampling in this study). Then, the stratified random sampling method was used, yielding a sample of 407 respondents in total. The questionnaires were completed by means of in-person interviews; respondents were approached by trained enumerators. The response rate was very high (81%), which produced a total of 330 questionnaires. After removing cases of item non-response the final valid sample consisted of 300 questionnaires.

4.2. Statistical analysis of the data

Data concerning the influence of agriculture on the quality of living on the island were analyzed using a Friedman test. The Friedman test is the nonparametric alternative to the one-way analysis of variance (ANOVA) with repeated measures. Friedman tests the null hypothesis that k related variables come from the same population. For each case, the k variables are ranked from 1 to k. The test statistic is based on these ranks (SPSS, 2002).

In order to examine the validity and reliability of the latent constructs included in the survey design the Confirmatory Factor Analysis (CFA) was used. In other words, the employment of the CFA aimed to demonstrate that the four latent variables describe the same notion – agriculture's multifunctionality – in a consistent manner and that they can all be included within the theoretical framework established by the review of relevant literature and by empirical observation. CFA is a well-established method and it is not necessary to go into many details about the theoretical background of the approach. Comprehensive and sophisticated presentations of the model can be found in Bollen (1989), Thompson (2004) and West et al. (2012), while a description of CFA for applied researchers can be found in Brown (2006).

The most commonly used goodness-of-fit measures are (Ardoin et al., 2012) (a) the root mean square of approximation (RMSEA) and the standardized root mean square residual (SRMR) (Hooper et al., 2008), (b) the normed fit index (NFI) and (c) the comparative fit index (CFI) as well as (d) the goodness-of-fit index (GFI) (Tanaka and Huba, 1985) and (e) the adjusted goodness-of-fit index (AGFI). Indicator (a) should ideally be <0.05 but values close to 0.1 are acceptable and values >0.1 do not necessarily mean unsatisfactory goodness-of-fit (Arbuckle, 2007). Values of indices (b) and (c) higher than 0.95 are acceptable (Schumacker and Lomax 2004; Yu and Muthén 2002) while for indices (d) and (e) a cutoff value of 0.90 generally indicates acceptable model fit (Baumgartner and Hombur, 1996).

The CFA model constructed for the examination of the opinions of the Cypriot public towards aspects of the multifunctionality of agriculture is presented in Figure 1. In the tree diagram multifunctionality is comprised of three dimensions: effects on the environment (ENV), protection of the agricultural cultural heritage (ACH) and maintenance of the farming profession (FP). ACH and FP constitute latent variables including five items each (see Table 1), while ENV comprises two variables which are latent constructs themselves (environmental consciousness (EC) and water management (WM)) (see also Table 1). EC and WM were constructed by averaging the individual scores of each respondent in each one of the five items they include. The validity of EC and WM was verified by the acceptable Cronbach's a (0.684 and 0.831 respectively, see Table 4) and the significant Pearson's correlation coefficients for each item across the sum of each respondent's scores.

5. Empirical results

The mean scores describing the influence of agriculture on nine aspects of the quality of life on the island are presented in Table 2. The most acknowledged of the relationships is the one between agriculture and the maintenance of culture and tradition with a mean score of 3.94, followed by the environmental ones (appealing
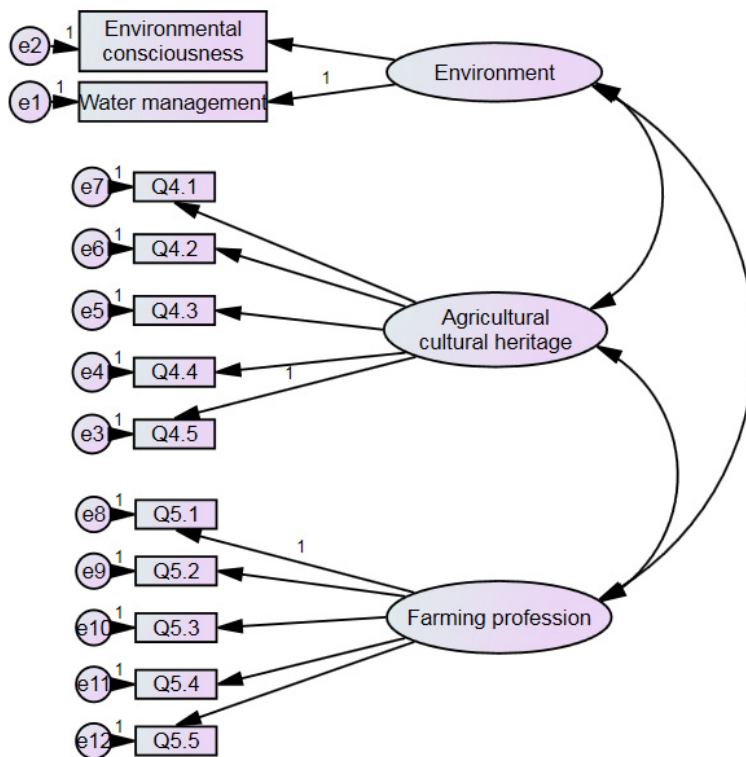

Fig. 1. Theoretical latent construct - Tree diagram describing the multifunctionality of agriculture

landscapes, environmental quality, healthy living conditions). Food security is also reported to be safeguarded by agriculture (3.58). The contribution of agriculture on social and rural development aspects, on the other hand, are slightly less acknowledged, considering that the mean scores for population maintenance, satisfactory incomes and job creation are 3.32, 3.23 and 3.11 respectively. An even more loose relationship is reported between agriculture and tourism (mean score 2.97), but this finding was expected because farm tourism activities are less developed on the island compared to mass tourism. The Friedman test revealed that there is a statistically significant difference in the perceptions of the Cypriot public about the aspects of the quality of life in Cyprus - reported in Table 2 - and the influence of agriculture on them ($\chi^2(8) = 373.67$, p = 0.000).

Table 2. Awareness of agriculture's influence on various aspects comprising the quality of life in Cyprus

Aspects of multifunctionality	Mean	Std. Deviation
Satisfactory incomes in rural areas	3.23	0.96
Tourism	2.97	0.89
Environmental quality - Biodiversity	3.72	0.84
Reduction in unemployment/Job creation	3.11	1.10
Maintenance of culture and tradition	3.94	0.83
Appealing landscapes	3.85	0.94

Food security (Self-sufficiency)	3.58	0.81
Healthy living conditions	3.68	0.94
Population maintenance in rural areas	3.32	1.12
Cronbach's a	0.782	

The mean scores of respondents regarding the items of the latent construct are reported in Table 3. When it comes to water management, respondents are particularly aware of the management of water reserves on the island, but the scores of the Q2.3 and Q2.4 are relatively low indicating that Cypriots are in favor of investments which require water use and would prefer that the measure of water breaks would stop. The opinions of Cypriots are split about the contribution of organic product consumption to environmental protection and to human health, while they state a higher rate of awareness about soft energy. They also seem particularly interested in the protection of agricultural cultural heritage and state a high rate of interest in actively participating in related activities. As for the farming profession Cypriots agree that farmers are entitled to favorable treatment and that agriculture should be continued on the island, while a non-trivial part of the respondents would be willing to get engaged in farming themselves.

Table 3. Mean respondent scores for each item of the latent construct

	Mean	Std. Deviation		Mean	Std. Deviation
Water management (WM)			Agricultural cultural heritage (ACH)		
Q2.1	4.12	0.94	Q4.1	3.74	1.10
Q2.2	4.24	0.96	Q4.2	3.55	1.10
Q2.3	2.36	0.95	Q4.3	3.31	1.09
Q2.4	2.46	1.10	Q4.4	3.17	1.16
Q2.5	3.68	0.87	Q4.5	3.84	0.84
Environmental consciousness (EC)			Farming profession (FP)		
Q3.1	2.99	1.14	Q5.1	2.71	1.23
Q3.2	2.89	1.12	Q5.2	3.80	1.08
Q3.3	3.69	0.95	Q5.3	3.79	1.06
Q3.4	4.30	0.80	Q5.4	2.20	0.86
Q3.5	3.42	0.85	Q5.5	3.57	1.08

Table 4 presents the goodness-of-fit measures of the model. None of the reported measures is completely satisfactory; however most of these measures are only marginally less than the ideal values. Specifically, the RMSEA and RMSR are only a little over 0.1 and GFI is pretty close to the critical value of 0.9. A test of alternative specifications of the original model, however, did not improve the goodness-of-fit measures. In addition, the chi-square of the estimate is very high (p-value<0.000) and the unstandardized coefficients of the variables (factor loadings) are significant at the 99% level. Hence, the overall quality of the model is acceptable.

The results of the CFA are reported in Table 4. This model, also presented in Figure 1, is the one initially estimated, as no unreasonable values were detected (for instance negative correlations between items and latent constructs). Note that for each one of the three latent constructs of the CFA model the coefficient of one variable is constrained to 1. ENV explains more than 50% of the total variance of EC and WM, while ACH and FP explain somewhat less of the variance of the five items each one comprises (45.0% and 46.9% respectively). This is due to the fact that they account for a very small percentage of the total variance of the two items which were worded reversely in the first place (Q4.4 and Q5.4). Nonetheless, the two items are retained in the CFA model design because the estimation of the model without these two items did not yield any considerable improvement in the goodness-of-fit measures nor in the total variance accounted for, although Cronbach's a was improved (0.821 and 0.808 respectively). In addition, an examination of the modification indices between errors within the same latent construct did not reveal any unreasonably big values, which would require modifications of the initial model.

Table 4. Results of the Confirmatory Factor Analysis – Factor loadings, variance accounted for and goodness-of-fit

Factor	Item	Unstandardized coefficients	Standard error	Estimate/ st. err.	a-Cronbach of the latent construct	Variance accounted for (%)	Mean variance accounted for by factor (%)
Environment	EC	1.000			0.684	50.7	52.2
(ENV)	WM	0.823***	0.195	4.221	0.831	53.7	
Agricultural	Q4.5	1.000			0.753	44.4	45.0
cultural	Q4.4	0.599***	0.132	4.549		8.4	
heritage	Q4.3	1.277***	0.131	9.751		43.7	
(ACH)	Q4.2	1.522***	0.137	11.104		61.0	
	Q4.1	1.608***	0.141	11.435		67.6	
Farming	Q5.1	1.000			0.752	19.7	46.9
profession	Q5.2	1.848***	0.233	7.949		86.2	
(FP)	Q5.3	1.732***	0.219	7.902		78.7	
	Q5.4	0.301***	0.101	2.983		3.6	
	Q5.5	1.345***	0.186	7.222		46.2	

Chi-square = 257.274	RMSEA = 0.116
df = 51	GFI = 0.875
p = 0.000	AGFI = 0.808
	NFI = 0.825
	RMSR = 0.113
	CFI = 0.853

*** Significant at the 99% level

The correlations and covariances between the three latent constructs of the analysis are reported in Table 5. The correlations between ENV and ACH as well as between ENV and FP are low (0.331 and 0.274 respectively) indicating that the Cypriot public understand that environmental issues and social functions of agriculture are different. However, there seems to be higher correlation between ACH and FP (0.556), which shows that the maintenance of the farming profession and the protection of the agricultural cultural heritage are considered within a common generalized socioeconomic context by a part of the Cypriot public. Note, nonetheless, that none of the correlations reported here exceed the 0.80 threshold, which would raise concerns about multicollinearity in the data set (Pieniak et al., 2009).

Table 5. Correlations and covariances among latent variables

Covariances		Correlations	
ENV-ACH	0.103***	ENV-ACH	0.331
ENV-FP	0.083***	ENV-FP	0.274
ACH-FP	0.170***	ACH-FP	0.556

6. Discussion – Policy implications

The Cypriot farming sector is multifunctional as it affects a range of social, economic and environmental aspects of life on the island. Agricultural activities interact with the environment and influence culture, employment and incomes. Among these, the continuation of the farming profession also affects society as a whole.

The results of the CFA can be used in the implementation of Reg. EC/1305/2013, as they reflect public preferences towards the orientation of agriculture, including irrigation water management. Indeed, the latent construct highlights the axes where agricultural and rural development policies should be targeted and the items describing each axis reveal the particular aspects of each dimension worth intervention through policy measures. Therefore, decisions about the cropping pattern, rural development and price policies should always incorporate public opinions, attitudes and preferences. Special attention needs to be directed to the values of the farming trade, as the Cypriot public understand that its continuation is different that the environmental issues and social functions of agriculture, which provides an argument for interventions in the farming sector.

The conceptual framework presented and analyzed in this study is not exhaustive when it comes to the investigation of multifunctionality. There are also other sectors affected by agriculture's externalities which should be incorporated in this framework. This is particularly important if the same methodological approach is to be implemented for surveys in other countries. There, the dimensions of multifunctionality and the items describing them should be revised in order to match the idiosyncrasy of local agriculture.

Another interesting perspective after this study is the detection of causal relationships between public awareness for these topics and the particular characteristics of respondents and of agriculture in the study area. This way more concrete policy recommendations can be yielded, which will assist the design and implementation of targeted measures. Methodological tools such as Structural Equation Modeling (SEM) could be proved extremely useful to this end.

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