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Factors affecting the adaptation of farmers to innovations according to extension workers: The case of Aegean Region*

Yayımcılara göre çiftçilerin yenilikleri benimsemesini etkileyen faktörler: Ege Bölgesi örneği

ABSTRACT

Objective: In this study, the adoption of innovations, which is the main performance indicator in extension organizations examined with the help of data collected from 966 extension workers in the Aegean Region. The main purpose of the study was to determine the effective factors in the adoption of innovations in agricultural extension.

Material and Methods: The research was data collected from public, private companies, extension workers working in farmers' organizations, and dealers by using a survey in eight provinces in the Aegean Region. In the interpretation of data, descriptive statistics such as percentages, and averages, and Kruskal Wallis, chi-square, T, reliability tests and factor, correlation, and logistic regression analyses were employed for interpret the data.

Results: An extension worker in the region averagely serves 1559 farmers. Although one-fourth of the extension workers in the region are women, the levels of benefiting of services by women farmers are low. The rate of extension activities in working hours (26.4%) and farmers' adoption rates of innovations/suggestions (56%) are low. Extension workers give 1.5 suggestions/innovations per year to farmers in the region. The adoption levels of innovations are high for fruits and vegetables production.

Conclusions: The age of extension workers, their occupational satisfaction, extension share in the working hours, and the number of days devoted to farmers' visits, the number of farmers reached, the farmers' education levels, attending in-service training, as information sources to utilize the market mechanisms, and giving the place for economic, social, and environmental dimensions besides technical increase the adoption rates of the farmers to innovations in the region.

Keywords: Adoption of innovations, Aegean Region, agricultural extension

ÖZ

Amaç: Çalışmada yayım örgütlerinde başlıca performans göstergesi olan yeniliklerin benimsenmesi Ege Bölgesindeki 966 yayımcıdan derlenen veriler yardımıyla incelenmiştir. Tarımsal yayımda yeniliklerin benimsenmesinde etkili faktörlerin belirlenmesi çalışmanın ana amacını oluşturmaktadır.

Materyal ve Yöntem: Araştırma verileri Ege Bölgesi'ndeki sekiz ildeki kamu, özel şirket, çiftçi örgütleri ve girdi bayilerinde çalışan yayımcılardan anket yoluyla toplanmıştır. Verilerin yorumlanmasında yüzdeler ve ortalamalar gibi tanımlayıcı istatistikler ve Kruskal Wallis, ki-kare, T, güvenilirlik testleri ve faktör, korelasyon, lojistik regresyon analizleri kullanılmıştır.

Araştırma Bulguları: Bölgede bir yayımcı ortalama olarak 1559 çiftçiye hizmet vermektedir. Bölgede yayımcıların dörtte biri kadın olmasına rağmen kadın çiftçilerin hizmetlerden yararlanma düzeyi düşüktür. Mesaide yayım etkinlikleri (%26,4) ve çiftçilerin yenilikleri/önerileri benimseme (%56) oranları düşüktür. Yayımcılar çiftçilere yılda 1,5 adet öneri/yenilik aktarmışlardır. Yeniliklerin benimsenme düzeyi meyve ve sebzelerde yüksektir.

Sonuç: Yayımcıların yaşı, mesleki memnuniyeti, yayımın mesaideki payı ve çiftçi ziyaretleri için ayrılan gün sayıları, ulaşılan çiftçilerin sayısı, çiftçilerin eğitim düzeyi, hizmet içi eğitim alınması, piyasa mekanizmalarının bilgi kaynağı olarak kullanımı, teknik kadar ekonomik, sosyal ve çevresel boyutlara yer verilmesi benimseme düzeyini arttırmaktadır.

Anahtar Kelimeler: Yeniliklerin benimsemesi, Ege Bölgesi, tarımsal yayım

INTRODUCTION

Extension has made significant contributions to agricultural production and development since the last century. In these contributions, knowledge and innovation are important factors in agriculture as in other sectors, and they trigger the development of agriculture and the increase of competitive capacity. Achieving efficiency in extension, which has a central function in the production, introduction, and dissemination of knowledge / innovation in agriculture, is vital for change (Van der Bor et al., 1995; Csaki, 1999; Balit, 1993), and the utilization of innovations also contributes to the increases in socio-economic benefits of research, and extension (Strauss et al., 1991). Agricultural extension, which is the adult education efforts carried out with the aim to increase the living standards and satisfactory life in rural areas, carries out activities for the adoption of innovations and behaviors for the desired change. For this purpose, extension transfers innovations/suggestions with the different goals on productivity and production increases, reduction of production costs, protection human and environmental health, etc. to rural areas. The rate of adoption of innovations/suggestions, which is the output of extension, is accepted as a performance evaluation criterion in organizations/projects (Engel, 1990). Different approaches have been employed to improve the efficiency of the extension, which is at the center of the process. (Roling, 1989; Wagemans, 1990).

A pluralistic structure is dominant in Aegean Region due to the extension activities carried out by public organizations, private sectors, input sellers, chambers of agriculture and farmer cooperatives. In the study, the factors affecting the adoption of agricultural innovations in the Aegean Region are examined from the perspective of extension workers. For this purpose, extension workers were asked to what extent the farmers adopted to innovations and the effects of personal characteristics and extension factors were investigated. As the data of 2019, agricultural land in Turkey (230995034 hectares) of 12%, and those employed in the agricultural sector (27,2 million people), 17% are in the Aegean Region. 13,3% of the country's agricultural production value (51,3 billion US$) is realized in the region. Annual export revenue is about 181 billion dollars in Turkey and its 3,1% (5,6 billion US$) belongs to agriculture. The region has a 24.4% share in the country's agricultural products exports value (TUIK, 2019).

In the study, some personal characteristics of extension workers, innovation / extension suggestions, target groups, priority issues, the level of adoption of innovations and the reasons for rejection, sources of information for innovations, factors affecting the adoption rate of farmers were examined and the recommendations were developed. In the study, all provinces and different extension organizations in the Aegean Region were included, and suggestions for organizations and activities were developed.

MATERIAL and METHOD

This research was conducted with approval from the Local Animal Ethics Committee of Animal Experiments of KOS 13 26.09.2012.

The research data were collected from public, private companies, extension workers working in farmers' organizations, consultants, and input dealers by using a survey in eight provinces in the Aegean Region in 2015-2016. Interviews were made with extension workers in the centers of the provinces in the region and in the designated districts. Simple Random Sampling method used to calculate the number of interviewed public extension workers, input sellers and farmers. The number of interviews in public extension organizations (in Ministry of Agriculture and Forestry) calculated as 549 with a 99% confidence interval and a 5% margin of error. From 972 input sellers in the region by 95% confidence interval and 5% margin of error for each province were calculated totally 213 dealer interviews. Although full participation of the extension workers from cooperatives, chambers of agriculture, consultants, and companies (processing, marketing inputs, and agricultural products, etc.) was desired for surveying, 204 of them filled the questionnaire form. After all, a total of 966 extension workers were interviewed in the study from 56.8% in the public sector, 22.1% in input dealers, 8% in consultants, 6.1% in private companies, and 6.7% in farmers' organizations. The distribution of extension workers by province is as follows; 21.3% Izmir; 17.9% Manisa; 17% Aydin; 10.2% Denizli; 8.7% Mugla; 7.1% Usak; 8.9% Afyon and 8.9% Kutahya (Table 1).

With the questionnaire, some personal characteristics and activities of the extension workers were collected. Attitudes, behaviors, and opinions were determined by using the five-point Likert scale. In the interpretation of data, the descriptive statistics such as percentages, and averages, and Kruskal Wallis, chi-square, T, reliability tests and factor, correlation, logistic regression analyzes were employed for interpreting the data. All innovation/ suggestions such as new practices, techniques, technology, knowledge, skills, and behaviors transferred by extension to farmers are expressed as "innovation" in the study.

Table 1:. Number of extension workers by provinces and extension organizations

Çizelge 1. *İllere ve yayım kuruluşlarına göre yayımcıların sayıları*

Provinces									
Province	Izmir	Manisa	Aydin	Denizli	Mugla	Usak	Afyon	Kutahya	Total
Number	206	173	164	99	84	68	86	86	966
Percentage, %	21,3	17,9	17,1	10,2	8,7	7,0	8,9	8,9	100
Status of Extension organizations									
Status	Public	Firms	Input sellers		Cooperative/ chambers		Consultants		Total
Number	549	59	213		65		80		966
Percentage, %	56,8	6,1	22,1		6,7		8,3		100

RESULTS and DISCUSSION

Personal characteristics

The average age of the extension workers in the Aegean Region was found to be 38; 26.5% are women; 58.9% are of urban origin, 14.2% are agricultural vocational high schools, 74.9% are agricultural faculties/graduates of the college. 18% of the extension workers have postgraduate, including those who continue. Extension workers are recommended to live in rural areas as it provides advantages in terms of awareness and integration (Arnon, 1989). 81.8% of the interviewees work in the district / town or villages. Satisfaction affects the motivation and productivity of employees and makes positive contributions to the realization of organizational goals (Yilmaz and Dilmac, 2011). Extension workers with 11.1 years of professional experience (Table 2) have a medium level of satisfaction with their work in terms of economy and profession.

Table 2. Some personal characteristics of extension workers

Çizelge 2. *Yayımcıların bazı kişisel özellikleri*

Characteristics	Group	Number	Percentage, %
Gender	Female	252	26,5
	Male	698	73,5
	Total	950	100,0
Origins	Rural	392	41,1
	Urban	562	58,9
	Total	954	100,0
Education	Agricultural high school	137	14,2
	Faculty, university	829	85,8
	Total	966	100
Postgraduate education	No	794	82,2
	Yes	172	17,8
	Total	966	100,0
Working place	Urban	169	18,2
	Rural	761	81,8
	Total	930	100,0

Note: some totals are lower than 966 as some of the interviewees did not respond.

Extension activities

The number of farmers that extension workers can visit varies between 20 and 100 farmers per week, depending on the region, transportation facilities, product variety, and organizational objectives (TOKB, 1987; Expere, 1974). There are 2000 farmers per extension workers worldwide, but only 10% of these farmers being served (Feder, et al, 1999, Swanson et al, 1989). It is known that extension workers in the European Union devote 75% of their time to extension activities (Boyaci, 1996).

In the Aegean Region, extension workers devote their time 26.4% extension (farmer training) and 24.7% bureaucratic activities. Extension workers have transferred an average of 7.5 (1.5 per year) innovations to farmers in the last five years. 30.9% of the innovations developed within the institutions themselves.

An extension worker serves an average of 1559 farmers in the Aegean Region. For this purpose, they are able to spend 9.8 days in a month for field visits and reach 56% of the farmers in their areas. The average age of the most contacted farmers is 45.4 years, and their education period is 6.2 years. Extension workers target medium-sized, small, and large enterprises, respectively, and 16.2% of those who benefit from extension services are women farmers (Table 3). Extension workers with high levels of satisfaction in their jobs transfer more innovations to the rural areas (Table 4).

Table 3. Some extension indicators in the region

Çizelge 3. *Bölgedeki bazı yayım göstergeleri*

Extension indicators	Mean	Standard deviation
Number of farmers responsible for extension	1559	4411
Number of days devoted to farmer visits in a month	9,8	6,3
Percentage of the responsible farmers who are regularly interviewed (%)	56,2	29,4
Average age of the most frequently contacted farmers	45,4	7,2
Average education years of the most frequently contacted farmers	6,2	2,1
The share of large-scale farms in target groups in extension activities (%)	29,6	22,4
The share of middle-scale farms in target groups in extension activities (%)	36,3	19,4
The share of small-scale farms in target groups in extension activities (%)	34,1	25,2
The share of male farmers in target groups in extension activities (%)	83,8	16,5
The share of female farmers in target groups in extension activities (%)	16,2	16,4

Table 4. Number of innovations transferred according to the job satisfaction, T Test

Çizelge 4. *İş memnuniyetine göre aktarılan yenilik sayısı, T Testi*

Satisfaction levels	Number of innovations	Number	Mean●	Standard deviation	T Value	Degrees of freedom	P value
Occupational satisfaction	Low	401	3,32	1,158	-1,756*	601	0,08
	High	202	3,49	1,116			
Economic satisfaction	Low	402	3,42	1,107	-2,064**	602	0,04
	High	202	3,61	1,088			

The level of significance ** α <0,05; * α <0,1   ●Likert scale 1: not at all   5 a lot

Level of adoption of innovations

Performance in extension organizations and projects is measured by the adoption and continuity of innovations (Engel, 1990). In some extension organizations, in the case of farmers' innovation adoption level below 80% is accepted as low performance (Saidin and Idris, 1995). In addition to the transfer of new practices and technologies for change in rural areas, the diversity of innovations is important for the farmers to choose. The average number of innovations that extension workers have conveyed to farmers in the last five years is 7.5, and there is no difference between provinces. According to extension workers, the rate of adoption of innovations by farmers is 56.2% (In the interviews conducted with farmers in the region within the scope of the research (Boyaci, 2016), farmers had stated that they implemented 5.4 out of 10 innovations suggested). In this study, the suggestions made by the publishers to the farmers, including inputs, methods, soft or hard technologies, defined as innovation. The fact that something heard or used for the first time by farmers is important for it considered an innovation. According to extension workers, the adoption level of farmers is different in provinces, and the rate of adoption in Aydin, Izmir, Mugla, and Manisa is above the regional average (Table 5). According to the extension organizations, there is no difference in the number of innovations developed in the last five years, but the adoption rates are different. The rate of adoption is highest in dealers, followed by consultants, firms, cooperatives/chambers, while the rate of adoption in the public organization is the lowest (Table 6).

Table 5. Number of innovations and adoption levels by provinces, Kruskal Wallis Test

Çizelge 5. *İllere göre yenilik sayıları ve benimsenme düzeyleri, Kruskal Wallis testi*

Variable	Province	Number	Mean	Mean Rank	Chi square value	Degrees of freedom	P value
The number of innovations transferred to farmers in the last five years	Izmir	134	7,81	301,90	4,685	7	0,698
	Manisa	103	8,50	318,09			
	Aydin	99	7,37	292,16			
	Denizli	64	8,03	331,26			
	Mugla	53	5,75	277,07			
	Usak	53	7,57	313,69			
	Afyon	51	6,24	315,05			
	Kutahya	52	6,73	288,95			
	General	609	7,45				
Proportion of farmers adopting innovations	Izmir	195	59,9	495,81	33,941***	7	0
	Manisa	169	58,1	478,06			
	Aydin	149	61,0	501,84			
	Denizli	98	51,2	408,75			
	Mugla	76	59,3	495,88			
	Usak	68	52,1	414,10			
	Afyon	80	44,6	339,04			
	Kutahya	80	52,9	422,44			
	General	915	56,2				

The level of significance: *** α <0,01

Table 6. Number of innovations by organizations and the level of adoption, Kruskal W. Test

Çizelge 6. Kuruluşlara göre yenilik sayıları ve benimsenme düzeyi, Kruskal W. Testi

Variable	Status	Number	Mean	Mean rank	Chi square value	Degrees of freedom	P value
The number of innovations transferred to farmers in the last five years	Public	372	7,36	312,35	5,508	4	0,239
	Firm	36	6,33	287,36			
	İnput sellers	119	6,78	274,77			
	Cooperative/chambers	30	8,80	318,55			
	Consultant	52	9,63	325,98			
	General	609	7,45				
Proportion of farmers adopting innovations	Public	523	49,72	391,69	78,618***	4	0
	Firm	52	64,13	539,88			
	İnput sellers	202	65,69	556,2			
	Cooperative/chambers	63	62,56	521,27			
	Consultant	75	65,33	546,01			
	General	915	56,23				

The level of significance: *** α <0,01

Crop groups in extension activities

In the region with a high variety of products, extension workers serve an average of 8 different crops. The crop groups that extension workers work in are fruits, vegetables, fodder crops, cereals, industrial crops, nuts, oilseeds and legumes, and ornamental plants, respectively (Table 7). According to extension workers, the adoption level of innovations is different in crop groups. The propensity to adopt is highest for fruits and vegetables, followed by industrial crops. In the cereals and forage crops, on the other hand, the tendency to adopt innovations is low (Table 8).

Table 7. Crop groups that extension workers work with ❺

Çizelge 7. Yayımcıların çalıştıkları ürün grupları ❺

Crop groups	Mean	Standard deviation
Fruits	3,03	1,53
Vegetables	2,77	1,51
Forage crops	2,64	1,50
Cereals	2,60	1,48
Industrial crops	2,22	1,41
Nuts	1,98	1,26
Oilseeds and legumes	1,92	1,23
Ornamental plants	1,46	1,02

❺ Likert scale 1: not at all   5 a lot

Table 8. Adoption levels of innovations by crop groups, T Test

Çizelge 8. Ürün gruplarına göre yeniliklerin benimsenme düzeyleri, T testi

Crop Groups	Level of adoption	Number	Mean	Standard deviation	T value	Degrees of freedom	P value
Cereals	Low	430	2,75	1,495	2,34**	913	0,02
	High	485	2,52	1,465			
Industrial crops	Low	430	2,03	1,293	3,92***	912,8	0
	High	485	2,39	1,48			
Fruits	Low	430	2,91	1,472	2,92***	913	0
	High	485	3,20	1,55			
Vegetables	Low	430	2,63	1,442	3,49***	913	0
	High	485	2,98	1,542			
Ornamental plants	Low	430	1,37	0,894	2,10**	909,1	0,04
	High	485	1,51	1,077			
Forage crops	Low	430	2,78	1,511	2,21**	913	0,03
	High	485	2,56	1,473			

The level of significance: *** α <0,01; ** α <0,05

Farmer's first approach

The approaches guide objectives, target groups, program, relations, method, and financing in extension (Axinn, 1988). In developing countries, extension and research organizations within the Ministries of Agriculture dominate from setting priorities to information flow. Farmer's first approach is an alternative to general extension models and foresees farmer participation in stages such as problem determination, solution development, monitoring, and evaluation (Chambers, 1994). Although the farmer's first model was not institutionalized in the region, the present level of trends such as farmer priorities, conditions, expectations, and feedback on innovations in the extension agenda was examined (Table 9). To emphasize the influence of the farmer / rural people in determining the extension agenda, these tendencies were briefly expressed as "farmer first" in the study. according to the analysis results the rate of adoption levels of farmers is high in extension workers who considering the elements of farmer first approach (Table 10). The usage levels of the farmer first approach in organizations are different, and it is preferred more in consultants and cooperatives/chambers than public and private sectors (Table 11).

Table 9. Farmers' impact on the extension agenda [5]

Çizelge 9. Yayım gündeminde çiftçilerin etkisi [5]

Tendencies	Mean	Standard deviation
Considering the priorities of rural areas	3,80	0,98
Including farmer knowledge and innovations	3,70	0,93
Suggestions from farmers	2,95	1,03
Providing feedback from farmers	2,94	1,01
Including farmers in setting priorities	2,78	1,10

● Likert scale 1: not at all   5 a lot

Table 10. Extension approach and adoption level of innovations, T Test

Çizelge 10. *Yayım yaklaşımı ve yeniliklerin benimsenme düzeyi, T Testi*

Tendency	Level of adoption	Number	Mean	Standard deviation	T Value	Degrees of freedom	P value
Farmer first	Low	423	3,09	0,632	-5,49***	893,864	0
	High	474	3,33	0,684			

The level of significance: *** α <0,01

Table 11. The effect of farmers on extension according to organizations, Kruskal Wallis Test

Çizelge 11. *Kuruluşlara göre çiftçilerin yayıma etkisi, Kruskal Wallis Testi*

Tendency	Status	Number	Mean	Mean rank	Chi square value	Degrees of freedom	P value
Farmer first	Public	546	3,15	449,77	16,887***	4	0,00
	Firm	55	3,20	475,38			
	Input sellers	199	3,21	480,28			
	Cooperative/chambers	62	3,26	492,37			
	Consultant	77	3,47	565,01			
	General	939	3,20				

The level of significance: *** α <0,01

There is a significant relationship between extension workers' in-service training and the adoption of innovations. Considering that the shelf life of knowledge is calculated as two years for experts in agriculture and five years for extension workers (Misra, 1991), the importance of updating knowledge and skills increases exponentially. The numbers and adoption rates of innovations developed and transferred to farmers is higher in extension workers who receive regular in-service training (Table 12).

Table 12. Innovations and at in-service training, T Test

Çizelge 12. *Yenilikler ve hizmet içi eğitim, T testi*

Variable	Group	Number	Mean	Standard deviation	T value	Degrees of freedom	P value
In-service training and number of innovations	Low	406	2,42	1,108	-2,68**	606	0,01
	High	202	2,68	1,093			
In-service training and adoption level of adoption innovations	Low	429	2,33	1,064	-3,64***	909	0
	High	482	2,59	1,143			

The level of significance: *** α <0,001; ** α <0,05

General objectives in extension

General objectives of extension in the region are improving product quality, increasing production and productivity, consumer health and food safety, reducing environmental damage, and reducing input costs (Table 13). The existence of these objectives, which are grouped into three groups as technical, economic, and social-environmental, are different by provinces. Technical in Mugla, Manisa, Denizli, Izmir, and Aydin; economical in Manisa, Denizli and Mugla provinces; and social-environmental objectives in Denizli, Izmir, Manisa, Mugla, and Kutahya are higher priorities (Table 14). The priorities are also different in extension organizations. Technical, economic, and social-environmental objectives are taken more place in consultants, dealers, and cooperatives/ chambers than firms and public organizations (Table 15).

Table 13. The general objectives in extension activities[5]

Çizelge 13. *Yayım çalışmalarında genel hedefler[5]*

Objectives	Mean	Standard deviation
Improving crop quality	4,27	0,92
Increasing production and yield	4,24	0,95
Consumer health and food safety	4,22	0,95
Reducing environmental damages	4,05	1,04
Reducing input costs in production	3,93	1,02
Ensuring farmer and workers health/safety in production	3,89	1,07
Decreasing manpower costs in production	3,83	1,04
Improving existing product / application	3,82	0,95
Adapting existing product / application to new conditions	3,77	0,93
Decreasing energy costs in production	3,75	1,07
Developing new products / applications	3,44	1,11

● Likert scale 1: not at all   5 a lot

Table 14. Priority objectives in extension by provinces, Kruskal Wallis Test

Çizelge 14. *İllere göre yayımdaki öncelikli hedefler, Kruskal Wallis Testi*

Objectives	Province	Number	Mean	Mean Rank	Chi square value	Degrees of freedom	P value
Technical	Izmir	198	19,66	453,77	22,41***	7	0
	Manisa	164	19,99	498,00			
	Aydin	153	19,66	460,12			
	Denizli	97	19,93	493,33			
	Mugla	78	20,19	505,58			
	Usak	65	18,09	356,22			
	Afyon	78	18,44	395,99			
	Kutahya	84	19,07	442,08			
	General	917	19,52				
Economic	Izmir	198	11,20	421,41	23,71***	7	0
	Manisa	164	12,11	519,86			
	Aydin	153	11,50	457,67			
	Denizli	97	11,90	493,56			
	Mugla	78	11,81	486,00			
	Usak	65	10,60	381,42			
	Afyon	77	11,03	413,73			
	Kutahya	85	11,51	467,65			
	General	917	11,51				
Social and environmental	Izmir	198	12,52	486,51	22,81**	7	0
	Manisa	164	12,35	480,6			
	Aydin	153	12,00	435,04			
	Denizli	97	12,62	496,68			
	Mugla	78	12,26	479,75			
	Usak	65	11,14	360,25			
	Afyon	79	11,28	387,23			
	Kutahya	84	12,17	468,15			
	General	918	12,15				

The level of significance: *** α <0,01; ** α <0,05

Table 15. Comparison of priority objectives by organizations, Kruskal Wallis Test

Çizelge 15. Kuruluşlara göre öncelikli hedeflerin karşılaştırılması, Kruskal Wallis Testi

Objectives	Status	Number	Mean	Mean Rank	Chi square value	Degrees of freedom	P value
Technical	Public	532	19,33	441,25	12,05**	4	0,01
	Firm	54	18,78	404,31			
	Input sellers	195	19,93	502,11			
	Cooperative/chamber	61	19,56	463,5			
	Consultant	74	20,36	503,02			
	General	916	19,52				
Economic	Public	532	11,41	447,24	9,84**	4	0,04
	Firm	54	10,78	387,59			
	Input sellers	196	11,73	491,97			
	Cooperative/chamber	61	11,85	495,45			
	Consultant	74	11,88	478,29			
	General	917	11,51				
Social and environmental	Public	533	11,95	439,35	17,24***	4	0
	Firm	54	11,56	389,73			
	Input sellers	195	12,63	514,05			
	Cooperative/chamber	61	12,57	497,12			
	Consultant	74	12,45	474,57			
	General	917	12,15				

The level of significance: *** α <0,01; ** α <0,05

Some organizational values

The adoption of behaviors that encourage interaction with inside and outside the organization in management will help institutionalize innovation and governance in organizations Boyaci, 2020). The values such as taking initiative, satisfaction with working conditions, encouragement of cooperation with different segments, innovation-oriented activities, regular monitoring and evaluation of activities, clear definition of organizational policies, processes, values, goals, individual willingness, and environment to teamwork, not being too bureaucratic, and equivalence of responsibilities are divided into two groups as individual freedom and institutional behaviors/operation (Table 16).

Table 16. Some values in extension organizations ❺

*Çizelge 16. Yayım kuruluşlarındaki bazı değerler*❺

Group	Values	Mean	Standard deviation
Individual freedom	I can easily use initiative in my work	3,65	1,08
	I am satisfied with the working conditions	3,19	1,15
	I can do teamwork	2,81	1,20
organizational behavior	Collaboration with different organizations is encouraged	3,09	1,05
	Innovation drives corporate activities	3,08	1,02
	Studies are regularly monitored and evaluated	3,07	1,13
	The policies, processes, values, and goals are clearly defined	2,94	1,17
	The institution does not work with overly bureaucratic rules	2,76	1,16
	Authorities and responsibilities in the institution are equivalent	2,63	1,2

❺ Likert scale 1: not at all 5 a lot

The adoption levels of innovations are different according to the level of values in organizations. While individual freedom levels are higher in firms, consultants, dealers, they are low in cooperatives/chambers and public organizations. Values related to corporate behavior /operation, which are considered important in terms of innovation, are high in consultants, companies, and dealers, and low in cooperatives/chambers, and the public (Table 17). The adoption rates of innovations transferred to farmers by organizations with more values related to individual freedom and organizational behavior/operation are higher (Table 18).

Table 17. Comparison of individual and institutional behavior in organizations, Kruskal W. T.

Çizelge 17. *Kuruluşlardaki bireysel ve kurumsal davranışların karşılaştırması, Kruskal W. T.*

Behavior	Status	Number	Mean	Mean Rank	Chi square value	Degrees of freedom	P value
Individual freedom	Public	537	9,09	397,09	69,36***	4	0
	Firm	53	10,92	588,43			
	Input sellers	185	10,22	519,61			
	Cooperative/chambers	60	10,10	513,33			
	Consultant	74	10,84	570,83			
	General	909	9,63				
organizational behavior	Public	537	16,94	385,84	101,98***	4	0
	Firm	51	19,88	576,35			
	Input sellers	184	19,02	520,48			
	Cooperative/chambers	59	18,92	514,33			
	Consultant	75	21,09	642,19			
	General	906	18				

The level of significance: *** α <0,01

Table 18. Adoption of innovations according to individual and organizational behavior, T Test

Çizelge 18. *Bireysel ve kurumsal davranışlara göre yeniliklerin benimsenmesi, T testi*

Behavior	Level of adoption	Number	Mean	Standard deviation	T value	Degrees of freedom	P value
Individual freedom	Low	410	9,07	2,418	-6,18	864,95	0
	High	457	10,14	2,675			
organizational behavior	Low	409	17,06	3,889	-6,37	860,93	0
	High	454	18,83	4,279			

The level of significance: *** α <0,01

Reasons farmers reject innovations

The acceptance of innovations is affected by different expectations such as economic, social, psychological, technical, and ecological. The weakness of actor relations, insufficiency of extension activities and economic supports, market uncertainties also reduce the tendency of farmers' adoption. According to the extension workers, the rejection reasons innovations by the farmers were grouped into two groups as farmer-driven and innovation-driven via the results of factor analysis (Table 19).

Table 19. Reasons for farmers not to accept innovations, Factor Analysis

Çizelge 19. Çiftçilerin yenilikleri kabul etmeme nedenleri, Faktör analizi

Factor groups	Factors	Mean●	Factor loads	The explanatory factors (%)	Reliability
Farmer driven	Farmers being traditional	4,11	0,825	46,252	0,821
	Low education level of farmers	3,84	0,822		
	Not believing in the benefits of innovations	3,74	0,706		
	Farmers don't trust innovations	3,78	0,661		
	Lack of information about innovation	3,80	0,640		
Innovation driven	Failure to comply with farmer's conditions and problems	3,62	0,811	17,141	0,768
	Innovations not satisfying farmers	3,49	0,806		
	Does not match farmer priorities	3,62	0,784		
			Total	63,393	

Kaiser-Meyer-Olkin scale validity	0,791	Bartlett test	Chi square value	2918,3***
Degrees of freedom	28		P value	0

The level of significance: *** α <0,01   ● Likert scale 1: not at all   5 a lot

Information sources of innovations in extension

The resources used in the development process of innovations in the extension are grouped under the titles of internet, scientific resources, Ministry of Agriculture and Forestry (MAF) and agricultural policies, farmers and their organizations, and market mechanisms (Table 20).

Table 20. Information sources used in the development of innovations❺

Çizelge 20. Yeniliklerin geliştirilmesinde kullanılan bilgi kaynakları❼

Information sources	Mean	Standard deviation
Internet	3,95	1,07
Scientific sources (research, university, journals, meetings, etc.)	3,68	16,4
MAF and agricultural policies	3,56	1,07
Farmers and farmers organizations	3,48	0,98
Market mechanisms (merchants, exporters, processors, input companies)	2,67	0,98

● Likert scale 1: not at all   5 a lot

The adoption rates are higher among those who consider the market mechanisms, farmers, and their organizations as information sources in the process of innovations and low among those who use MAF and the agricultural policies (Table 21).

Table 21. Adoption level of innovations according to the sources, T Test

Çizelge 21. Kaynaklarına göre yeniliklerin benimsenme düzeyi, T testi

Information sources	Level of adoption	Number	Mean	Standard deviation	T Value	Degrees of freedom	P value
Farmers and farmers organizations	Low	412	3,42	0,918	-2,16**	874,83	0,03
	High	465	3,56	1,022			
MAF and agricultural policies	Low	415	3,65	0,978	2,33**	873,869	0,02
	High	463	3,49	1,147			
Market mechanisms	Low	408	2,53	0,883	-4,01***	869,551	0
	High	464	2,79	1,028			

The level of significance: *** α <0,01; ** α <0,05

In the region, while the ratio of extension workers to use their own experiences and institutional resources in developing innovations is 30.9%, the rate of external resources is 69.1%. The farmers' adoption rate of innovations is higher in extension workers who use their own experiences/institutional resources (Table 22).

Table 22. Adoption of innovations according to the sources, T Test

Çizelge 22. Kaynaklarına göre ve yeniliklerin benimsenmesi, T Testi

Sources of innovations	Level of adoption	Number	Mean	Standard deviation	T Value	Degrees of freedom	P value
Own experiences of individual and organization	Low	379	28,72	24,492	-2,63**	798	0,01
	High	421	33,26	24,399			
Outside the organization	Low	378	71,47	24,256	2,67**	796	0,01
	High	420	66,89	24,213			

The level of significance: ** α <0,05

Significant and positive relationships were found between crop groups and information sources. As an information source internet has a meaningful and positive relationships with all crop groups. In fruits and nuts, there are significant and positive relationships in the use of market mechanisms, MAF, and agricultural policies in addition to the internet, and the usage of these resources increases in fruit groups. Internet, and market mechanisms in industrial crops, and vegetables; internet, MAF, and agricultural policies in cereals, oilseeds, legumes, and forage crops are more preferred as information sources (Table 23).

Table 23. Relationship between crop groups and information sources, Correlation Analysis

Çizelge 23. Ürün grupları ile bilgi kaynakları ilişkisi, Korelasyon analizi

Crop groups	Spearman's rho	Internet	Market mechanisms	MAF, agric. policies
Cereals	**Correlation**	meaningful and positive		meaningful and positive
	Correlation Coefficient	,131***		,126***
	P value	0		0
Oilseeds and legumes	**Correlation**	meaningful and positive		meaningful and positive
	Correlation Coefficient	,092**		,139***
	P value	0,01		0
Industrial crops	**Correlation**	meaningful and positive	meaningful and positive	
	Correlation Coefficient	,077**	,133***	
	P value	0,02	0	
Nuts	**Correlation**	meaningful and positive		meaningful and positive
	Correlation Coefficient	,083**		,127***
	P value	0,01		0
Fruits	**Correlation**	meaningful and positive	meaningful and positive	meaningful and positive
	Correlation Coefficient	,074**	,116***	,071**
	P value	0,04	0	0,03
Vegetables	**Correlation**	meaningful and positive	meaningful and positive	
	Correlation Coefficient	,075**	,139***	
	P value	0,02	0	
Forage crops	**Correlation**	meaningful and positive		meaningful and positive
	Correlation Coefficient	,125***		,171***
	P value	0		0

The level of significance: *** α <0,01; ** α <0,05

Diffusion channels of innovations

In the region, the tools and methods utilized by extension for the diffusion of innovations are listed as individual interviews, group methods, digital tools, TV-radio-video, and printed materials (Table 24). Individual interviews, group methods, printed material, and the usage of digital tools increase the adoption rate of farmers (Table 25).

Table 24. Diffusion channels of innovations ❺

Çizelge 24. *Yeniliklerin yayılma kanalları* ❺

Diffusion channels	Mean	Standard deviation
Individual interviews	4,09	0,99
Group methods	3,93	0,99
Digital tools	3,23	1,15
TV, radio, video film etc.	3,22	16,87
Printed materials	2,83	1,08

● Likert scale 1: not at all   5 a lot

Table 25. The adoption levels of innovations according to diffusion channels, T Test

Çizelge 25. *Yayılma kanallarına göre yeniliklerin benimsenme düzeyleri, T Testi*

Diffusion channels	Level of adoption	Number	Mean	Standard deviation	T value	Degrees of freedom	P value
Individual interviews	Low	411	4,03	1,002	-2,53**	860	0,01
	High	451	4,20	0,948			
Group methods	Low	410	3,87	0,971	-2,52**	861	0,01
	High	453	4,04	0,991			
Digital tools	Low	396	3,16	1,151	-1,88*	835	0,06
	High	441	3,31	1,144			
Printed materials	Low	399	2,76	1,063	-1,88*	834	0,06
	High	437	2,91	1,108			

The level of significance: ** $\alpha <0,05$; * $\alpha <0,1$

Factors affecting innovation adoption

To determine the factors affecting the adoption of innovations by farmers, the model consisted of dependent and independent variables was established. The dependent variable was defined in two groups as low and high adoption rates. Age of extension workers, occupational satisfaction, the share of extension in working hours, number of days devoted for farmer visits in per month, rate of target farmers visited, the education levels of the farmers interviewed, receiving in-service training, using information sources market mechanisms, and MAF, and agricultural policies, and the priority of technical objectives in extension were taken as the independent variables in the equation of the model.

With the analysis, the change in the adoption level of innovations of one unit increase in independent variables was estimated. One-unit increment of independent variables according to the model; age 1.03; professional satisfaction, 1,2; the share of extension activities in working hours is 0.99 times; 1.05 days to visit farmers in a month; the interviewed farmers is 1.03; education level of the farmers is 1.1; in-service training on innovations 1,2; as information source market mechanisms 1,4; the priority of technical objectives in extension increases the rate of innovation adoption 1.1 times. On the other hand, one unit increase in the use of MAF and agricultural policies as innovation source reduces the adoption rate by 0.75 times in the region (Table 26).

Table 26. Factors effective in adopting innovations, Logistic Regression Analysis

Çizelge 26. *Yeniliklerin benimsenmesinde etkili faktörler, Lojistik Regresyon Analizi*

Variables in the Equation	B	S.E.	Wald	Sig.	Exp (B)
Constant	-5,619	0,854	43,259	0	0,00
Age of the extension workers	0,032	0,011	9,426	0,002	1,03
Occupational satisfaction level	0,186	0,088	4,461	0,035	1,20
The share of extension in working hours	0,011	0,005	5,542	0,029	0,99
Numbers of the day in a month for farmer visits	0,045	0,016	8,018	0,005	1,05
Rate of interviewees with targeted farmers	0,025	0,003	58,598	0	1,03
Education level of the interviewed farmers	0,105	0,046	5,228	0,022	1,11
Level of in-service training on innovations	0,150	0,089	4,837	0,042	1,16
Market mechanisms in preparing innovations	0,336	0,103	10,679	0,001	1,40
MAF and agricultural policies in preparing innovations	-0,284	0,091	9,695	0,002	0,75
Priority of technical issues in extension objectives	0,077	0,027	8,218	0,004	1,08

Note: Cox & Snell R Square: 0,326; Nagelkerke R Square: 0,451

CONCLUSION and SUGGESTIONS

Extension activities are carried out to realize individual and social change. The change can be possible by adopting desired behaviors and practices in rural areas. Extension takes at central place of the rural change process because of its functions such as diagnosis, execution, facilitation, transferring, monitoring and evaluation. In this research, factors affecting the adoption of innovations by farmers with the help of data compiled from 966 extension workers working in different organizations in the Aegean Region (Table 27) and suggestions for increasing the efficiency in extension are presented below.

Table 27. Factors affecting farmers' adoption of innovations

Çizelge 27. *Çiftçilerin yenilikleri benimsemelerini etkileyen faktörler*

Factors	Adoption levels of farmers	
	Low level of adoption	High level of adoption
Age of the extension workers (experience)	Younger (low experience)	Old (experienced)
Occupational satisfaction level	low	high
Level of in-service training on innovations	Limited	more
number of days farmer visits per month	low	High
Rate of interviewees with targeted farmers	low	High
Education level of the interviewed farmers	low	High
Individual freedom in extension activities	low	High
Organizational behaviors/operation	low	High
Farmers impacts on extension agenda	low	High
Farmers driven reasons in rejection	high	Low
Innovation driven reasons in rejection	high	Low
Sources of innovations	Outside the organization	Own experiences/ organization
Information sources for innovations	MAF, agricultural policies	Farmers, farmer organizations, market mechanisms
Crop groups in extension	Cereals, Forage crops	Fruits, Vegetables, Industrial crops, Ornamental plants

The age and professional experience of extension workers are important factors, and experienced staff should be ensured to stay in the extension organizations.

- Adoption rates of innovations by farmers is 56%, which is unsatisfactory. This ratio shows that there are deficiencies in both the development and transfer of innovations. It is observed that farmers' conditions and priorities are not sufficiently considered in innovation development process and that sufficient time is not allocated for extension studies. The share of extension activities in working hours should be increased in the region.

- Innovations per year had been transferred to farmers by extension workers. In today's rapidly changing world, this number is unsatisfactory. However, in an environment where an extension worker averagely serves 1559 farmers, it is unlikely that further innovation will be transferred and adopted.

- Employment policy should be planned so that the maximum number of farmers per extension workers is 200, considering communication and transportation facilities. Increasing the number of extension workers and events will increase the number of farmers reached and the level of adoption of innovations.

- Increasing the economic and professional satisfaction levels of extension workers will contribute to the development of innovations and the adoption of farmers.

- Although one out of four extension workers in the region is a woman, the level of benefiting from extension services by women farmers is low. Extension activities for women are also important for providing the expected benefits from the support provided to women farmers in projects.

- Innovations from outside sources of organization have low rate of farmers' adoption. This situation shows that the relations between actors are not strong enough. Complex economic and production structures require compulsory cooperation in the sector.

- In the region general extension goals are listed as improving product quality, increasing production and productivity, consumer health and food safety, reducing environmental damage, and reducing input costs technical issues are at the forefront. Considering the economic, social, and environmental dimensions of agriculture is imperative for sustainability.

- The tendency to adopt innovation is increasing at products with high competition and interaction with the market. For example, propensity to adopt innovation is higher among fruit and vegetable growers. Innovations those take markets into account should be given more space in extension programs.

- The reasons for the rejection of innovations by the farmers in the region can be categorized in two groups as farmer-driven and innovation-driven. The success rate of extension workers, who take farmer priorities, conditions, suggestions, and feedback into their agenda, is increasing. For this reason, arrangements should be made to ensure the participation of farmers and institutionalize them.

- The number and adoption rates of innovations developed and transferred by extension workers who receive regular in-service training are high. Regular in-service training should not be neglected.

- Management approach should be able to embed the innovative philosophy in institutions. To this end, institutional values should encourage individual freedom and participatory, and flexible institutional functioning.

- There are meaningful and positive relationships between product groups and information sources. Using different sources of information will help increase the diversity of vision, cooperation, and adoption.

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