

Article

Extension Agents' Perceptions of the Role of Extension Services in Organic Agriculture: A Case Study from Saudi Arabia

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Abstract: Extension services (ES) play a crucial role in addressing the various needs of organic farmers and little is known about the extension agents' (EA's) perceptions of organic agriculture and the role of ES in organic agriculture. This study investigated EA's perceptions of the role of ES in organic agriculture. Data were collected via a questionnaire, which was sent electronically to all enlisted extension agents in Riyadh Region, Saudi Arabia. In total, 69 extension agents completed the questionnaire, representing a 54% response rate. Overall, extension agents had slightly positive attitudes toward organic farming but were unsure about their role and participation in this. Furthermore, their perceptions of the role of ES in organic agriculture significantly varied according to their age, work experience in organic agriculture, and education level. These findings have implications for the design of future training programs for the professional development of extension agents and will enable planners, policy makers, and related ministries to devise viable and workable policies and plans that truly reflect the concerns and challenges of extension agents and consider the skills of extension agents that need to be improved. This research will also have positive implications for the national organic agriculture policy, as it provides research-based information on the actual players in the farming systems of Saudi Arabia.

Keywords: organic agriculture; extension agents; extension services; Saudi Arabia



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1. Introduction

The agriculture sector plays a vital role in ensuring food security, realizing economic diversity, and alleviating poverty globally [1]. For many years, agricultural development relied on the intensive use of agricultural inputs to address the increasing demand for food. However, several issues have emerged as a result of this intensification. For instance, the heavy use of chemical fertilizers and pesticides has led to adverse environmental effects [2,3], including soil erosion, the deterioration of soil fertility, and adverse effects on human health [4,5]. Consequently, intensive input-based agriculture conflicts with optimal and sustainable natural resource utilization, driving many countries to adopt eco-friendly, sustainable practices such as organic farming [1,6].

Organic farming has gained enormous popularity and holds great potential as the most appropriate farming system for achieving food security [7,8]. It has three dimensions—environmental, social, and economic—each of which plays an important role in improving food security [9]. In the environmental dimension, organic farming improves soil quality by adding more nutrients to the soil, which enhances food security in the long term [10–12]. It also increases soil fertility through methods such as minimum tillage, green manure application, evidence-based crop rotation, including cover crops, and biological fertilizer application [13].

Furthermore, organic farming protects water resources, improves resistance to diseases and pests, combats desertification by preventing soil erosion, and avoids pesticide and chemical residues, allowing consumers to take advantage of the nutritional value of organic products and acquire healthy diets, all of which further contribute to food security [10,14–16]. In the social dimension, organic farming results in more seasonal workers being hired, more creating job opportunities, promotes entrepreneurship, and decreases immigration in rural areas, which has the potential to contribute to long-term sustainable development in these areas. Furthermore, organic farming enhances social capacity by combining indigenous knowledge with scientific production recommendations. Such efforts empower farmers and local communities, which is consistent with food security requirements [17,18]. In the economic dimension, organic farming is a practical approach for enhancing the overall farm income and increasing the living standards of small and marginal farmers [18,19]. Organic market has been developing dynamically and gained considerable momentum in all over the world in recent years, in particular, USA. Therefore, there is a strong connection between implementation of sustainable development goals and production of organic sector [20]. The application of affordable methods and biological resources instead of chemical fertilizers and pesticides make organic farming cost-effective, and the increased price of organic products and consequently increased profits from their sale further encourage farmers to adopt organic farming [21,22]. There are also a large number of postharvest opportunities to improve the added value of organic products through marketing activities and processing, leading to the further improvement of food security in the long term [23,24].

In Saudi Arabia, the interest in organic farming increased following the announcement of the national transformation plan (2005–2010) issued by the Ministry of Environment, Water, and Agriculture (MEWA). This plan aimed to disseminate and promote organic practices among farmers to balance agricultural production and the conservation of natural resources [25]. It also focused on creating a platform to bring all of the stakeholders together, including MEWA, experts, farmers' cooperatives, the private sector, and farmers [26]. However, over the period 2005–2015, organic farming in Saudi Arabia was ineffective and governed by traditional management practices, contributing less than 5% of total agricultural production, and there was also a lower rate of certified farmers, a decline in farmers involved in organic activities, a limited scale of networking with other stakeholders, and a focus on “organic production practices” instead of certification over the same period [25,27]. It is obligatory for any farmer who wants to practice organic agriculture to obtain organic certification from authentication bodies licensed by MEWA. The organic farming sector has also been faced with various challenges, including a lack of awareness of organic products among consumers, low marketing quality, ineffective extension services, an insufficient quantity of organic inputs, and a lack of qualified experts and agricultural professionals in the field of organic farming. Organic extension in Saudi Arabia is not yet adequately represented throughout the country [25,26,28–30].

In 2016, the Saudi Government announced Saudi Arabia's Vision 2030, which pays more attention to strengthening the organic sector's impact and enabling it to move toward professionalization and sustainability-oriented programs [31]. The aim of this vision is to increase organic production by 300% by investing USD 200 million [32], and its objectives are to overcome the legal and institutional constraints for establishing organic research centers, promote cooperation between the actors in the agricultural value chain, develop partnerships with other actors, and implement standards for good agricultural practices [33]. Between 2015 and 2019, the total amount of organic products increased by 18.4% from 446,000 tons to 526,000 tons, and between 2016 and 2019, the total area under organic production increased from 8852 hectares to 12,516 hectares, with a further approximately 6119 hectares under transformation [25,28].

Agricultural extension and advisory services play a crucial role in promoting rural development and supporting the transformation to organic farming [34,35]. ES help farmers to solve farming-related problems and make better farming decisions by providing timely and relevant information [36]. They also act as “brokers” to facilitate farmers'

networking with various actors in the agricultural value chain [37,38]. In addition, ES mobilize collective action in rural communities by helping farmers to form groups to maximize their competitiveness in local and international markets [39,40].

In many countries, extension agents are an essential source of information for farmers and play a key role in convincing farmers to adopt agricultural innovations [41,42]. Therefore, the first step in transforming to organic agriculture is to educate extension agents on the concept, principles, practices, and certification of organic farming [41,43,44]. According to Shiri et al. [45], the adoption of organic farming by farmers is affected by several factors, including profit and innovation advantages; their perceptions and attitudes toward risks associated with organic production; the amount of information they require; and the role of extension agents in disseminating information. The effectiveness of the ES provided is influenced by (EA's) perceptions and attitudes toward organic farming [27,44]. Therefore, an understanding of EA's perceptions is essential for developing a successful organic educational program and supporting the adoption of organic farming among farmers [46].

There has been a growing interest in analyzing the various aspects of organic farming, but limited information is still available about EA's perceptions of the role of ES in organic farming, in Saudi Arabia. A large amount of research-based information is made available to extension agents by agricultural scientists, so both groups are an important source of information and play a significant productive role in helping farmers to adopt innovations. However, the influence and effectiveness of extension agents depend on the knowledge they possess and how effectively they can communicate with the farmers and disseminate any current knowledge and innovative information. Therefore, the success of extension and educational programs primarily depends on EA's perceptions of and involvement in organic agriculture. The main theme of this study is to identify EA's perceptions toward the role of extension in organic agriculture, and EA's perceptions of organic agriculture.

2. Materials and Methods

2.1. Study Area

Riyadh Region, located in the center of Saudi Arabia, is the second-largest region in the country by both population (8,216,284 people) and land area (404,240 km²) [47]. This region was selected for analysis in the present study because it accounted for approximately 30% of the total agricultural land and 35% of the total organic production in Saudi Arabia in 2018 [48].

2.2. Study Population and Data Collection

The study population consisted of all extension agents employed in Riyadh Region ($N = 127$) [25]. The Directorate of Agriculture provided a contact information list for these extension agents, and an electronic link to a structured questionnaire was sent to each. To achieve an appropriate response rate, three follow-up reminders every two weeks were also sent to those extension agents who had not completed the questionnaire. A total of 69 electronic questionnaires were completed, representing a response rate of 54%.

2.3. Questionnaire

The questionnaire consisted of three sections: the Section 1 collected the respondent's personal data, including their age, level of education, experience in organic farming, experience in agriculture, area of specialization, and current responsibility for organic farming; Section 2 asked for the respondent's perception of organic farming; and Section 3 collected information about the respondent's perception of the role of ES in organic agriculture. The survey questions were adapted from the work of Sisk [49] and Lillard [50] but were partially modified to make them compatible with the understanding of extension agents in the study region to achieve the study's objectives. A panel of experts at the Pennsylvania State University, USA, examined the contents of the questionnaire to confirm its validity and ensure it would measure the intended variables. The Arabic translation of the questionnaire was then reviewed by a panel of experts at the Department of Agricultural

Extension and Rural Society at King Saud University, Saudi Arabia, who had sufficient knowledge of both the Arabic and English languages. This resulted in the modification and rephrasing of several questions to ensure the greatest clarity possible. Prior to data collection, a pilot study was conducted with 30 extension agents to determine the reliability of the questionnaire. A total of 22 questionnaires were returned (73% response rate). The pilot test data were analyzed by calculating Cronbach's alpha reliability coefficient in the SPSS Statistics software, which gave a value of 0.74, indicating a good level of reliability.

2.4. Measurement of Variables

Extension agents were asked to rate their perceptions of nine statements associated with organic agriculture and a further nine statements regarding the role of ES in organic farming using a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The scores of negative statements were recoded prior to data analysis. The following criteria were used to interpret the results: 1.00–1.50 = strongly disagree, 1.51–2.50 = disagree, 2.51–3.50 = neither agree nor disagree, 3.51–4.50 = agree, and 4.51–5.00 = strongly agree. To understand the level of perception for each of the statements, a total scale score was calculated by summing the ratings. Total perceived extension role in organic agriculture scores were calculated out of 100 and divided into three categories based on the percentage of total scores as follows: <50% = low perception, 50–75% = medium perception, >75% = high perception.

2.5. Data Analysis

Data were analyzed using IBM SPSS, ver. 22.0 (IBM Corp., Armonk, NY, USA). Results were presented using descriptive statistics such as frequencies, percentages, means, and standard deviations. Differences in EA's perceptions of organic farming and the role of ES in organic agriculture according to their personal attributes were explored using the *t*-test and one-way analysis of variance (ANOVA), and the effect size of any differences were analyzed by calculating Cohen's *d* (*t*-test) and partial eta squared (ANOVA).

3. Results

3.1. Extension Agents' Characteristics

The background characteristics of the respondents are presented in Table 1. Nearly around half of respondents (46%) were aged between 31–40 years, and most of the respondents held a bachelor's degree (65%) and grew up in an urban setting (60%). More than half of the respondents (65.3%) had no experience in organic agriculture, with an average of 1.37 years. The majority of the respondents (75%) indicated that they had no current extension responsibility for organic farming programs.

3.2. Extension Agents' Perceptions of Organic Farming

The respondents' perceptions of organic farming are shown in Table 2. The majority of respondents ($\geq 50\%$) "agreed" or "strongly agreed" with six of the nine statements on the scale, with agreement or strong agreement being highest for the statement "Pest control methods based on natural or organic sources would reduce the volume of inorganic pesticides applied, which would, in turn, reduce the pollution caused by inorganic pesticides" (87.1% of respondents), second highest for "Developing niche markets for organic production will be beneficial to the agriculture sector in Saudi Arabia" (85.5%), and third highest for "Chemical residues on many fruits and vegetables pose significant health risks to consumers" (83.6%). By contrast, respondents were most inconsistent in their perceptions of the statement "Most organic farming practices can be successfully implemented in my area," with only 23.6% agreeing or strongly agreeing. Overall, respondents had a slightly positive perception toward organic agriculture as a sustainable farming system. The mean score for the EA's perceptions of organic farming was then calculated by dividing the summated mean for all nine statements (33.5), giving a statement mean of 3.73. Since this fell between 3.51 and 4.50, it indicated a slightly positive perception.

Table 1. Descriptive summary of the characteristics of extension agents in Riyadh Region.

Characteristic	Number	%
Age years ($n = 50$; mean = 38.6; SD = 8.90; min. = 23; max. = 56)		
≤30	9	18.0
31–40	23	46.0
41–50	11	22.0
≥51	7	14.0
Education ($n = 52$)		
High School	8	15.4
Diploma of Agriculture	6	11.5
Bachelor's degree	34	65.4
Master's degree	4	7.7
Ph.D.	0	0.0
Childhood residence ($n = 52$)		
Urban	31	59.6
Rural	21	40.4
Experience in OA ($n = 49$; mean = 1.37; SD = 10.6; min. = 0; max. = 16)		
No experience	32	65.3
≤ 5	14	28.6
≥6	3	6.1
Area of specialization in current job ($n = 52$)		
General agriculture	5	9.6
Agriculture extension	3	5.8
Agriculture economics	6	11.5
Plant production	8	15.4
Animal production	1	1.9
Agriculture engineering	10	19.2
Plant protection	7	13.5
Soil	3	5.8
Food sciences	0	0.0
Other areas	9	17.3
Current responsibility for organic farming ($n = 52$)		
Yes	13	25.0
No	39	75.0

3.3. Extension Agents' Perceptions of the Role of Extension Services in Organic Agriculture

The respondents' perceptions of the role of ES in organic agriculture are shown in Table 3. The level of agreement and strong agreement was highest for the statement "More time and adequate funding should be set aside for training in the area of organic agriculture" (85.1% of respondents), second highest for "Extension services in my area need to do more to support organic agriculture" (81.4%), and third highest for "Extension agents play a leadership role in the field of organic agriculture" (77.8%). By contrast, the respondents tended to disagree or strongly disagree with the statements "It is not the job of extension agents to provide information on organic agriculture" (75.9%) and "Extension services in my area have provided adequate training for extension agents regarding organic agriculture" (51.9%). In general, the vast majority of respondents (80.8%) had a moderate perception of the role of ES in organic agriculture (Figure 1), while 17.3% had a high perception and only 1.9% had a low perception.

Table 2. Extension agents' perceptions of organic agriculture ($n = 69$ respondents).

Statement	SD	D	N	A	SA	Mean	Standard Deviation
	%	%	%	%	%		
Most organic farming practices can be successfully implemented in my area.	3.6	20.0	41.8	32.7	1.8	3.09	0.86
Agricultural systems that employ crop rotations, green manuring, and animal waste can be economically comparable to a traditional system using inorganic fertilizers.	1.8	10.9	21.8	49.1	16.4	3.67	0.94
Chemical residues on many fruits and vegetables pose significant health risks to consumers.	3.6	3.6	9.1	34.5	49.1	4.22	1.01
Developing niche markets for organic production will be beneficial to the agriculture sector in Saudi Arabia.	0.0	1.8	12.7	36.4	49.1	4.33	0.77
Most insects can be successfully controlled without using inorganic insecticides.	1.8	10.9	38.2	40.0	9.1	3.44	0.87
Most crop diseases can be successfully cured without using synthetic pesticides.	1.9	9.3	40.7	44.4	3.7	3.39	0.78
Most weeds can be successfully eliminated without spraying herbicides.	3.7	13.0	18.5	57.4	7.4	3.52	0.94
Crops with a higher potential for sustainable production and the capability of producing increased yields with a limited application of inputs should be a greater research priority.	0.0	3.7	33.3	44.4	18.5	3.78	0.79
Pest control methods based on natural or organic sources would reduce the volume of inorganic pesticides applied, which would, in turn, reduce the pollution caused by inorganic pesticides.	3.7	1.9	7.4	51.9	35.2	4.13	0.91

Summated mean = 33.5; Standard Deviation = 4.5; range = 21–43; statement mean = 3.73.

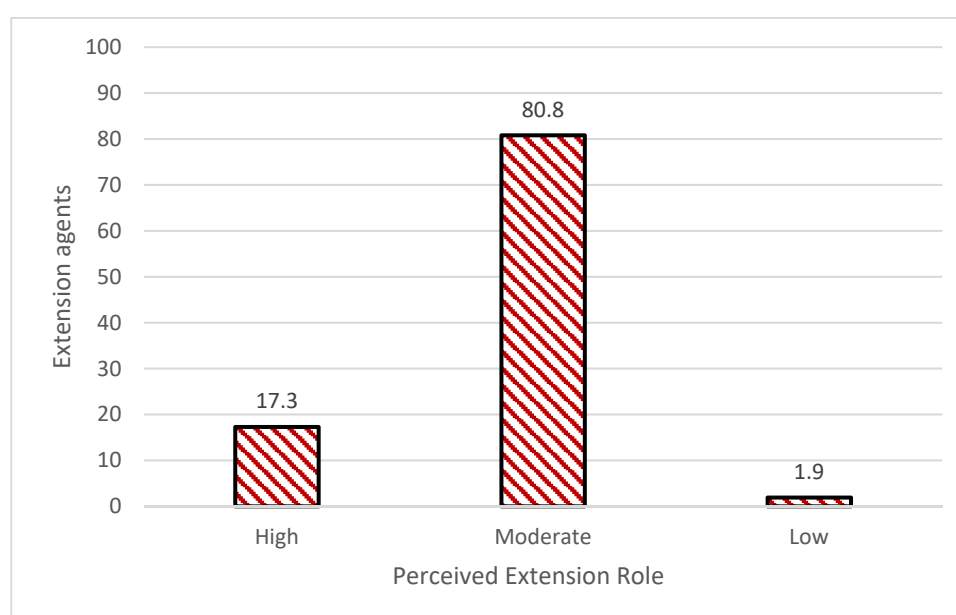
**Figure 1.** Perceived extension role in organic agriculture.

Table 3. Extension agents' perceptions of the role of extension services in organic agriculture.

Statement	SD	D	N	A	SA	Mean	Standard Deviation
	%	%	%	%	%		
Extension agents play a leadership role in the field of organic agriculture.	0.00	3.7	18.5	53.7	24.1	3.98	0.76
In the past, extension services in my area have ignored organic agriculture.	0.00	13.0	33.3%	37.0	16.6	3.57	0.92
Extension services in my area have provided adequate training for extension agents regarding organic agriculture.	9.3	42.6	24.1%	18.5	5.6	2.69	1.06
It is not the job of extension agents to provide information on organic agriculture.	35.2	40.7	11.1	11.1	1.9	2.04	1.04
Extension services in my area have the capability to meet educational needs for organic agriculture.	3.8	22.6	30.2	43.4	0.00	3.13	0.90
My supervisors would be supportive of me spending more time on organic farming programs.	0.00	13.0	31.0	37.0	7.4	3.17	1.11
More time and adequate funding should be set aside for training in the area of organic agriculture.	1.9	1.9	11.1	44.4	40.7	4.20	0.85
Extension services in my area need to do more to support organic agriculture.	1.9	3.7	13.0	44.4	37.0	4.11	90
Extension services in my area have ignored the environmental issues caused by conventional agriculture.	1.9	26.4	20.8	39.6	11.3	3.32	1.05

SD, strongly disagree; D, disagree; N, neither agree nor disagree; A, agree; SA, strongly agree.

3.4. Characteristics Affecting Extension Agents' Perceptions of the Role of Extension Services in Organic Agriculture

3.4.1. Age

Age significantly affected respondents' perceptions of the statement "Extension services in my area have the capability to meet educational needs for organic agriculture" ($p < 0.05$), with a significantly higher level of agreement among respondents up to 35 years of age (mean = 3.42) than among those aged 36 to 56 years (mean = 2.88) (Table 4). The effect size for this statement was considered medium (Cohen's $d = 0.61$). By contrast, respondents were generally in agreement or strong agreement with the other eight statements, regardless of age, although respondents in the ≤ 35 years age group had a slightly more positive perception of their involvement in organic farming than those in the other groups (aged 36–56), it is more likely that younger extension agents positively looking for innovation.

3.4.2. Experience in Organic Agriculture

Work experience in organic farming significantly affected respondents' perceptions of the statements "My supervisors would be supportive of me spending more time on organic farming programs" and "More time and adequate funding should be set aside for training in the area of organic agriculture," with respondents with experience in organic farming having significantly more positive perceptions of both statements than those with no such work experience ($p = 0.026$ and 0.038 , respectively; Table 4). The effect sizes were considered to be moderate for both statements (Cohen's $d = 0.69$ and 0.68 , respectively). Respondents' levels of experience in organic farming did not significantly affect their perceptions of the other seven statements.

3.4.3. Primary Responsibility for Information Related to Organic Farming

Respondents' current responsibility for information related to organic farming did not significantly affect their perceptions of any of the statements, with both groups tending

to have a fairly neutral perception of the statement “Extension services in my area have the capability to meet educational needs for organic agriculture” and generally showing agreement for the other statements (Table 4).

3.4.4. Education Level

The level of education achieved significantly affected respondents’ perceptions of the statements “Extension services in my area have provided adequate training for extension agents regarding organic agriculture” ($F = 2.987$; $df = 3, 48$; $p = 0.040$) and “It is not the job of extension agents to provide information on organic agriculture” ($F = 3.263$; $df = 3, 48$; $p = 0.029$), with extension agents with a diploma being more positive toward both statements than those with a bachelor’s degree (Table 5). However, the effect sizes were considered to be small for both statements (partial eta squared = 0.15 and 0.16, respectively).

3.4.5. Area of Specialization

The area of specialization did not significantly affect respondents’ perceptions of the role of ES in organic agriculture (Table 5). Respondents in all groups were more or less neutral toward the statement “My supervisors would be supportive of me spending more time on organic farming programs”. However, they were generally in agreement with the other eight statements.

Table 4. Comparisons of extension agents' perceptions of the role of extension services in organic agriculture according to their age, experience in organic agriculture, and responsibility for information related to organic agriculture ($n = 69$ respondents; two-tailed t -tests).

Statement	Age					Experience in OA					Responsibility for Information Related to OA				
	Up through 35 Years		36 to 56 Years		Sig 2 - tail	No		Yes		Sig 2 - tail	Yes		No		Sig 2 - tail
	M	SD	M	SD		M	SD	M	SD		M	SD	M	SD	
Primarily extension agents are seen in leadership role in areas of organic agriculture.	4.08	0.77	4.04	0.66	0.82	3.97	0.82	4.06	0.74	0.7	4.23	0.72	3.9	0.78	0.18
In the past, extension agents' services in my areas have ignored organic agriculture.	3.54	0.83	3.73	1	0.47	3.53	0.84	3.71	1.04	0.52	3.85	1.14	3.46	0.82	0.19
Extension agents' services in my area provided adequate training for extension agents regarding organic agriculture.	2.79	1.28	2.62	0.89	0.57	2.66	1.12	2.76	1.03	0.74	3	1.15	2.62	1.04	0.26
Providing information on organic agriculture does not fall in the tasks to be accomplished by the extension agents.	2.08	1.17	2.04	0.95	0.88	2.13	1.18	1.76	0.56	0.24	2.15	1.14	2	1.02	0.65
Extension agents' services in my area has the capabilities needed to meet educational needs for organic agriculture.	3.42	0.71	2.88	1.01	0.038 <i>Cohen's d</i> = 0.61	3.09	0.96	3.31	0.79	0.43	3.15	0.98	3.18	0.86	0.91
My supervisors would be supportive of me increasing my amount of programming on organic farming.	3.21	1.21	3.08	1.01	0.67	2.94	1.04	3.65	0.99	0.02 <i>Cohen's d</i> = 0.69	3.62	0.87	3	1.12	0.07
More time and adequate funding should be set aside for training in the area of organic agriculture.	4.08	1.01	4.35	0.68	0.28	4	0.91	4.53	0.62	0.038 <i>Cohen's d</i> = 0.68	4.38	0.65	4.1	0.91	0.3
Extension agents' services in my area required to do more to support organic agriculture.	3.96	1.12	4.27	0.66	0.23	4.13	0.97	4.18	0.8	0.85	4.31	0.63	4.05	0.97	0.37
Extension agents' services in my area has ignored environmental issues caused by conventional agricultural.	3.35	1.07	3.42	1.06	0.8	3.48	1.06	3.18	1.07	0.34	3.17	1.11	3.41	1.04	0.49

SD = Standard Deviation.

Table 5. Comparisons of extension agents' perceptions of the role of extension services in organic agriculture according to their level of education and area of specialization ($n = 69$ respondents; one-way analysis of variance).

Statement	Highest Education Level								<i>p</i>	Area of Specialization								<i>p</i>
	High School		Diploma of Agriculture		Bachelor's Degree		Master's Degree			Agriculture Extension, Agriculture Economics, and General Agriculture		Plant Production, Protection, and Soil		Agricultural Engineering		Other ($n = 9$)		
	$(n = 8)$		$(n = 6)$		$(n = 34)$		$(n = 4)$			$(n = 14)$		$(n = 19)$		$(n = 10)$				
	M	SD	M	SD	M	SD	M	SD		M	SD	M	SD	M	SD	M	SD	
Extension agents play a leadership role in the field of organic agriculture.	3.63	0.91	4.17	0.40	4.06	0.77	3.75	0.95	0.45	3.79	1.02	4.16	0.60	4.10	0.73	3.78	0.66	0.45
In the past, extension services in my area have ignored organic agriculture.	3.25	1.16	3.50	0.54	3.62	0.92	3.75	0.95	0.75	3.43	1.10	3.95	0.70	3.30	0.48	3.22	1.09	0.12
Extension services in my area have provided adequate training for extension agents regarding organic agriculture.	3.38	1.01	3.33	1.20	2.41	0.98	3.00	0.81	0.04 (partial eta square = 0.15)	2.64	1.15	2.58	1.12	2.60	1.07	3.22	0.83	0.48
It is not the job of extension agents to provide information on organic agriculture.	2.50	1.06	2.83	1.30	1.74	0.93	2.50	0.57	0.02 (partial eta square = 0.16)	1.86	1.02	2.00	1.10	2.00	0.94	2.44	1.13	0.62
Extension services in my area have the capability to meet educational needs for organic agriculture.	3.38	0.91	3.17	0.98	3.15	0.90	3.00	0.81	0.90	3.36	0.74	2.89	1.07	3.50	0.52	3.11	0.92	0.28
My supervisors would be supportive of me spending more time on organic farming programs.	3.25	0.88	3.50	1.04	3.18	1.08	2.25	1.50	0.33	2.93	0.91	3.21	1.08	3.20	1.61	3.33	0.70	0.83
More time and adequate funding should be set aside for training in the area of organic agriculture.	4.00	1.06	4.17	0.40	4.24	0.89	4.00	0.81	0.88	4.29	0.61	4.00	0.94	4.60	0.69	3.89	1.05	0.21
Extension services in my area need to do more to support organic agriculture.	4.00	1.06	4.17	0.75	4.15	0.92	4.00	0.81	0.97	4.07	0.82	4.00	1.00	4.60	0.52	3.89	1.05	0.28
Extension services in my area have ignored the environmental issues caused by conventional agriculture.	3.25	1.10	3.60	0.89	3.26	1.08	4.00	0.81	0.56	3.57	1.15	3.17	0.92	3.60	0.96	3.11	1.20	0.54

4. Discussion

The goal of agricultural extension services in Saudi Arabia is to transfer research from universities to agricultural directors at MEWA and then on to extension agents and finally farmers. Extension agents are responsible for developing and delivering extension programs on organic farming, so enhancing their perception, knowledge, and skills will allow them to transfer the wealth of experience they have more efficiently and effectively.

Ensuring that extension agents have positive perceptions of organic farming is the first step in an overall organic farming strategy. The present study found that most of the extension agents surveyed had a slightly positive perception of organic farming, viewing it as a sustainable farming system in the agricultural context of Saudi Arabia. This may be because extension agents have sufficient understanding of the environmental, social, and economic advantages of developing organic farming. It has also been shown that extension agents who have a positive perception of organic farming are more likely to persuade farmers to convert to organic production [51]. This result is similar to previous findings that extension agents in the Philippines tend to have a positive attitude toward organic agriculture [52,53]. In this context, previous studies also reported a moderate level of EA's perception regarding dimensions of organic agriculture namely; social responsibility; economic viability; production efficiency, and environmental sustainability [54–56].

The majority of extension agents surveyed were unsure of the role of ES in organic agriculture. This could be attributed to extension agents having an insufficient knowledge of organic farming—indeed, according to Alotaibi et al. [25], most extension agents in Saudi Arabia have expressed an urgent need for training in this field. Consequently, direct contact between farmers and extension agents is ineffective for encouraging the adoption of organic practices, which may also explain the weak effect of ES on farmers' motivation to comply with organic certification. Although financial resources are available for ES in Saudi Arabia, these services face various challenges, including centralization, a limited number of extension agents, a lack of responsiveness to farmers' needs, and a focus on the technology transfer approach instead of participatory approaches [57,58]. Considering the lack of trust among the extension agents surveyed regarding their effectiveness in supporting conversion to organic farming, attention should be paid to three issues: developing professional training for extension agents in the field of organic farming; establishing partnerships with the private sector for knowledge sharing and co-organizing learning activities; and disseminating information about organic practices through communication technologies such as applications and social networking tools [59,60]. Other studies have reported that access to various types of agricultural advisory services plays a significant role in promoting organic farming by improving farmers' knowledge and skills and enhancing their ability to deal with institutional and legal procedures that are applicable to the organic farming sector [61–65]. These findings reflect the urgent need to support and activate the agricultural knowledge and innovation system (AKIS) in Saudi Arabia. As noted by Oksanen and Hautamäki [66], AKIS plays a key role in the transfer of knowledge regarding eco-innovation activities by creating synergistic relationships between people, knowledge, and resources. These relationships facilitate the co-creation of value, solving production and marketing problems, supporting the role of ES as a broker among actors in agricultural value chain, and strengthening networking between organic producers and other actors [67,68].

Understanding people and the flow of ideas as a basis of innovation activities challenges traditional innovation policy, and requires a systemic approach and deep institutional cooperation and interaction [69–71]. This approach requires sustainable and inclusive innovation policy in which all innovation activities are considered in terms of how they contribute to quality of life and to solving wicked problems.

Younger extension agents tended to be more satisfied that their qualifications meet the educational needs of organic farmers than older extension agents. This may be because younger people are more willing to embrace innovations and accept change than older people, who often do not like to change the way they work and consequently show

resistance to change. Similarly, Declaro-Ruedas [52] also found that age is a significant factor affecting EA's attitudes toward organic farming. The present study also showed that extension agents with more agricultural experience tended to consider organic farming as being more important and had more interest in training than those with less agricultural experience—indeed, extension agents with little experience lacked knowledge of the contemporary organic agriculture context and consequently had a lower interest in acquiring new knowledge and skills. This result is inconsistent with the findings of Yadav et al. [44], Declaro-Ruedas [52], and Neda, et al. [72], who reported that agricultural experience is not a major determinant of EA's perceptions of organic farming. The present study also showed that extension agents with higher levels of education tended to place more importance on developing their knowledge and skills regarding organic farming than those with lower levels of education. In particular, extension agents with higher levels of education had a greater awareness of the importance of farmers complying with organic standards and their role in environmental protection and increasing the annual income of farmers, resulting in these extension agents considering information and awareness barriers when deciding to develop their technical expertise. According to Kucińska et al. [73], conversion to organic farming requires highly educated extension agents with backgrounds in various fields, such as ecology, agribusiness, economy, marketing, livestock husbandry and agronomy, to assist farmers in preparing and conducting the conversion. These findings are in line with the results of Declaro-Ruedas [52] and Oladele and Tekena [74] but contrast with the results of Yadav et al. [44] and Neda, et al. [72], who found no significant relationship between EA's levels of education and attitudes toward organic farming.

5. Conclusions

Several conclusions can be drawn from the findings of the present study. First, it is clear that the extension agents surveyed in Riyadh Region had a slightly positive perception of organic farming and it is more likely that those extension agents who did not respond felt more negatively toward organic farming and chose not to respond for that reason. However, it is also evident that these extension agents were uncertain about their opinion of the role of extension services in organic agriculture, although they still appeared to support the transformation to organic production. In addition, the extension agents surveyed tended to consider that there are currently no good ES in Riyadh Region that provide adequate information on organic farming. More detailed examination of the differences in EA's perceptions showed that there were no significant differences in the summated scores for EA's perceptions regarding the role of ES in organic agriculture when examined by their backgrounds. However, providing additional training and placing a stronger emphasis on organic farming could help motivate them, increase their skills, and add to their knowledge base. Therefore, more scientific studies on organic farming are required to obtain research-based facts in this field.

The present research in Riyadh Region was not intended to be generalized to organic farming in other parts of Saudi Arabia, but its results may help guide initial efforts to expand organic farming in the country. If organic programs are to be included as a component of a large extension program's efforts to increase organic farming, it will be important to examine the EA's knowledge, as well as their skills, perceptions, attitudes, and confidence in developing programs. Examining farmers' perceptions toward organic farming may also provide useful insights into the barriers they face when adopting organic practices. Since organic agriculture programs in Saudi Arabia are conducted by extension agents, it is imperative that their perception of organic agriculture is first improved, following which their skills and knowledge should be increased through sound training programs to enable them to transfer the wealth of knowledge they have more efficiently and effectively.

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