

Article

The Attitudes of Agricultural Extension Workers towards the Use of E-Extension for Ensuring Sustainability in the Kingdom of Saudi Arabia

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Abstract: E-extension as a modern mode of communication can be used to improve the effectiveness and efficiency of extension services for agricultural sustainability. E-extension is the delivery of extension services using the Internet and the latest information communication technologies (ICTs), which allow networking, online sharing, and collaboration. Extension workers are a key factor in conducting an effective agricultural extension work plan; therefore, understanding extension workers' attitudes towards the use of E-extension is important. It has been noted in some studies that, before implementing ICTs, positive attitudes from extension workers is required. This study analyzed the attitudes of extension workers towards the use of E-extension in the Kingdom of Saudi Arabia (KSA). A survey questionnaire was developed comprising statements regarding E-extension and then distributed through the post to all 230 extension workers in the Kingdom with the help of the Ministry of Agriculture. The findings show that extension workers generally had a positive attitude towards the use of E-extension. Significant relationships were found between the overall means of extension workers' attitudes towards E-extension and their age, years of service, and computer experience. In the light of the results, recommendations drawn are as follows: encouraging extension workers, especially those who are older, to use the E-extension system through exclusive training programs and refresher courses; and incorporating combined workshops for extension workers with few and more years of service to eliminate the generation gap and instigating a better understanding of the E-extension system.

Keywords: attitudes; agriculture; extension workers; E-extension; information communication tools (ICT)

1. Introduction

Extension methods are devices implemented to set up situations in which new information and knowledge can pass freely between extension workers and their intended audiences [1]. Mass extension methods such as television, radio, circular letters, newspapers, banners, magazines, and brochures were successfully used in several countries to carry out extension educational programs [2]. Modern communication tools play a key role in improving the availability of market information and farmer assistance in developing countries [3]. There is a dire need to utilize information technology to access the most recent information at a reduced cost relative to the existing system, which is plentiful with human imperfections and affectations [4].

E-extension is the delivery of extension service using web tools, which allow online sharing, collaboration, and networking [5]. Examples of these web tools include websites, networking

software, online sharing tools such as emails, blogs, and surveys, video conferencing, instant messaging, community-based telecenters, and mobile phones. E-extension could also be termed as a network of institutions that provides a more efficient alternative to the traditional extension system of agriculture [6]. E-extension as a modern mode of communication can be used to improve the effectiveness and efficiency of extension services [7]. It is a collaboratively built Internet-based environment to enhance face-to-face and paper-based transactions, which can also be used as an electronic tool delivering sound and the latest information on agriculture [8]. In addition, ICTs are also very useful for sharing the market prices of commodities and taking proper marketing decisions [9]. ICTs can be defined as consisting of the hardware, software, networks, and media for the collection, storage, processing, transmission, and presentation of information (voice, data, text, images), as well as related services [10].

The Kingdom of Saudi Arabia has seen a vital strategy shift in recent years by aiming to favor sustainable production while abandoning conventional production techniques. A major component of this strategy has been the promotion of modern water saving techniques, especially drip irrigation. In addition, farmers are advised to grow higher economic value crops such as vegetables and fruits to take better advantage of scarce water resources [11]. The Kingdom is endeavoring to achieve food security by implementing its newly devised water and environment-friendly Agricultural Strategy (2010–2030) [12]. The Agriculture Strategy (AS) also includes promoting Saudi agricultural investments in collaboration with countries with high agricultural potential. This policy is mainly concerned with producing food, but also aims at saving 8.5 billion cubic meters of irrigation water by 2030 [13]. The Kingdom's population is estimated to be approximately 31 million and growing at 1.49% annually. This increasing rate of growth causes an amplifying demand on agricultural produce and raises significant challenges to the agricultural sector in the Kingdom [14,15].

Realizing the positive role of agricultural extension in the development of agricultural production, the Ministry of Agriculture offers free-of-charge supporting services in the Kingdom of Saudi Arabia. For this purpose, The Ministry of Agriculture in Saudi Arabia, with support from the Government, conducted several awareness programs for farmers through television, radio, newspapers, booklets, and brochures to furnish them with up-to-date information regarding the cultivation of important crops [16]. The Kingdom of Saudi Arabia lacks an integrated and accurate agricultural information system, which is a serious obstacle to agricultural sustainability. The recent developments in agricultural information systems have made it particularly important to deliver needed information in due time for farmers, engineers, and public and private officials [14].

Implementing a more vibrant support and advisory system in a timely fashion is necessary to make the Kingdom strive through the challenges faced by its agriculture sector. Before initiating any extension system, it is extremely important to evaluate the current attitudes of the extension workers towards the particular concept that needs to be promoted [17]. According to Kerlinger [18], attitude is an organized predisposition to think, feel, perceive, and responding to a psychological object or idea. The direction and outcome of a social action is determined more than anything else by the person's set of beliefs and disbeliefs [19,20]. Specifically, it can be stated that the relative success of an extension system can be determined by assessing, in part, the attitude that extension workers hold towards their work [21]. Attitude is a "psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" [22]. Davis [23] presented the Technology Acceptance Model (TAM), which helps to not only predict a respondent's attitude towards information systems or information technology and strongly predict responses, but also introduce technological change [24]. TAM postulates attitude on the basis of two factors: perceived usefulness (PU) and perceived ease of use (PEU). The attitude of Saudi extension workers towards E-extension had not been studied before. Therefore, this study was carried out to determine their attitude towards implementing E-extension for agricultural sustainability in the Kingdom of Saudi Arabia.

2. Research Objectives

This research was carried out to achieve the following objectives:

- (1) to determine the attitude of extension workers towards the use of E-extension in the Kingdom of Saudi Arabia; and
- (2) to determine the relationship between the characteristics of extension workers and their attitude towards the use of E-extension in the Kingdom of Saudi Arabia.

3. Methods and Procedures

The study was carried out with all 230 extension workers in different directorates all over the Kingdom of Saudi Arabia under the Ministry of Agriculture in Saudi Arabia. The questionnaire was constructed with the help of professors, examined by the experts in the Department of Agricultural Extension and Rural Society, College of Food and Agriculture Sciences, King Saud University Riyadh. The questionnaire was pretested by involving 30 extension workers from the Ministry of Agriculture office in Riyadh who were later excluded from the sampling population. The reliability of the summated values from section two (attitudes of extension workers towards the use of E-extension) from the pretested data was verified by calculating the Cronbach's alpha. The Cronbach's alpha coefficient calculated for the scale was 0.80.

The questionnaires were then given to the Directorate of Agricultural Extension in the Saudi Ministry of Agriculture. The Director of Agricultural Extension dispatched a cover letter to each Agricultural Directorate in the Kingdom along with the questionnaires. The letter was comprised of the instructions for the respective Heads to distribute the questionnaires to all extension workers of the concerned Directorates and Agricultural Branches. The response rate was about 65%, comprising 149 questionnaires. This is a more than acceptable response rate according to Richardson [25], who cited Babbie [26] and Kidder [27] when stating that 50% is an acceptable response rate in social research postal surveys. Ninety-five responses were received in February 2014, and the remaining 54 were received in March 2014. The first 95 questionnaires were regarded as the "early response" and the remaining 54 were categorized as the "late response". An independent *t*-test was used for comparing early and late respondents to generalize non-respondents as late respondents [28]. No significant differences between early and late respondents were found ($t = 0.253$; $p = 0.801$).

Frequency, percentages, and mean tests were used to analyze the demographics and Likert-scale data. Spearman rank correlation was used to analyze the relationship between the extension workers' attitudes by their age, education, years of service, and current job status. Cramer's V test was used to analyze the relationship between the extension workers' attitudes in relation to their current residence, computer experience, computer training, and area of specialization.

4. Findings

4.1. Demographic Characteristics

The age of the respondents ranged from 23 to 60 years. The mean age of the respondents was 40.4 years ($SD = 7.5$; $N = 149$). Results of previous studies conducted in different regions [29,30] had shown that the extension workers' age ranged within 31–40 years of age. About 83% of the respondents declared their current residence as urban, and the rest of them (16.8%) said that they belonged to a rural area. Most of the respondents (54%) hold a Bachelor's degree. About 38% of the respondents had a diploma in agriculture, only 6% were having Master's degree, and only 1.3%, including respondents with higher secondary education stated their level of education as "other". Less than one-third of the respondents (28%) were associated with agricultural extension. Specialization in plant protection was declared by 23% of the respondents. About 22% of the respondents declared their specialization in plant production and 29% of respondents were from "other" disciplines, including food production, agricultural engineering, and water management. Agriculture economics and animal

production were revealed as area of specialization by 3.4% and 2.7% of the respondents, respectively. The respondents' years of experience ranged from 1 to 35 years. The mean of the years of experience was 13.3 (SD = 8.8; $N = 149$). More than one-third (40.3%) of the respondents' job status was grade 7. About 26% were in grade 8, and 12% of the respondents' revealed grade 6 as their current job status. About 11% of the respondents were in grade 9. Grade 10 was stated by 7.4%, and grade 5, grade 12, and grade 11 were declared by 6%, 1.3% and 0.7%, respectively. Most of the respondents (89.3%) stated that they had computer experience, and only 10.7% denied having such expertise. Slightly more than two-thirds (67.8%) of the respondents had computer training, and 32.2% of them denied having any.

4.2. Agricultural Extension Workers' Attitude towards the Use of E-Extension

The respondents marked their response through a five-point Likert type scale: 1 = strongly disagree to 5 = strongly agree with 3 = neutral. The mean value of the overall (summed across the 14 items) attitude of the respondents towards the use of E-extension was 3.8; SD = 0.89. This overall mean value indicates that the respondents generally had a positive attitude towards the use of E-extension in the Kingdom of Saudi Arabia. This corresponds to similar studies analyzing attitudes of extension workers towards the use of ICTs with identical results conducted in different countries [31–34]. Most of the respondents (90.6%) agreed with the statement, "Contacting farmers through mobile and SMS is effective", with the highest mean value of 4.31; (SD = 0.73), and 88% of the respondents with the second highest mean value of 4.21; (SD = 0.78) agreed with the statement, "Mobiles are effective in disseminating agricultural information" (Table 1). Whether it is a developed country or a developing country, mobile phones have become a regular part of daily life. Mobile phones have made our daily communication very easy and cheap between distant locations. They are also an important part of E-extension services; farmers and extension workers can communicate with each other easily without the hindrance of scheduling face-to-face or group meetings.

Table 1. Agricultural extension workers' attitudes towards the use of E-extension.

Attitude towards E-Extension	Mean	SD
Contacting farmers through mobile and SMS is effective.	4.31	0.73
Mobiles are effective in disseminating agricultural information.	4.21	0.78
Dissemination of agricultural information through internet is effective.	4.03	0.78
The efficiency of extension workers will increase with the use of E-extension.	4.00	0.89
By using E-extension methods, the workload of the extension worker will be minimized.	3.90	0.92
Communication through the Internet is essential to make agricultural extension activities effective.	3.90	0.85
Cost and time for reaching farmers could be saved by using E-extension.	3.90	0.82
Spreading agriculture information through websites is helpful for farmers to get information.	3.83	0.89
By implementing E-extension services, extension department could achieve its goals easily.	3.79	0.87
Using social websites (Facebook & Twitter) between extension workers and farmers is helpful for establishing better communication.	3.77	0.96
The responsibility of extension workers will increase with the use of E-extension.	3.73	0.98
Using E-extension methods could improve rural livelihood.	3.54	0.98
E-extension, in comparison to a traditional extension system, is a better method.	3.36	1.12
Research blogs and research papers on the Internet are providing sufficient agricultural information.	3.32	0.95

Note: 1 = strongly disagree to 5 = strongly agree with 3 = neutral.

About 80.8% of the respondents agreed with the statement, "Dissemination of agricultural information through internet is effective", with the third highest mean value of 4.03; (SD = 0.78). Agricultural information may include weather forecasts, market information, and precautions related to certain crops. Sometimes farmers in remote areas are unable to acquire such information in time; in this case, the Internet could act as an astute source of timely information. The benefits for Australian

farmers using the Internet for timely information include cost reduction, time saving in bookkeeping, potential gains to production, and improved marketing opportunities [35]. The lowest mean value of 3.32; (SD = 0.95) was attained by the statement, “Research blogs and research papers on the Internet are providing sufficient agricultural information”, and was agreed with by about 52.9% of the respondents. A knowledge service system for the domain of agriculture is a need of the time; these service systems may include aggregate knowledge from the Internet, digital archives, and experts [36]. To get information from research blogs and research papers, scientific education and some sort of scientific approach is required, which may act as a hindrance to farmers. Accessing information and knowledge and then presenting it in a perspicuous way to farmers are two of the main functions of an E-extension system. Incorporating some official web pages or informative sites in local language and encouraging extension workers and farmers to access them could strengthen this knowledge service system.

4.3. The Relationship between Extension Workers’ Attitudes towards E-Extension in Relation to Their Age, Education, Years of Service, and Current Job Status

The findings show a significant relationship at the 0.05 level between age and overall extension workers’ attitudes towards E-extension ($p = 0.028$; $r_s = -0.180$). The negative value indicates that, as the age of the respondents increases, their attitude towards E-extension becomes negative, conversely indicating a positive attitude from young respondents. Young people can adopt new technologies and techniques more swiftly and show more energetic behavior to overcome challenges, as compared with older adults. The use of computers and other digital devices was found by older adults to be difficult; moreover, older people hold a less favorable attitude towards these tools, as compared with younger adults [37]. Results from demographic data reveal that most of the respondents were not too old, with a mean age of 40 years. Combining these two aspects, it can be stated that most of the respondents who were young advocated the use of E-extension services in the Kingdom of Saudi Arabia.

Years of service resulted in a high significant relationship at the 0.01 level with the attitudes ($p = 0.001$; $r_s = -0.266$). Again, the negative value indicates positive attitudes from the respondents with fewer years of service (Table 2). This may be because the younger generations are more exposed to the latest communication tools such as mobile phones and computers. Extension workers with fewer service years’ with positive attitudes towards the use of information technology were also documented in the research conducted by Mohammadi [38] and Pezeshki et al. [39]. Negative attitudes from the respondents with more years of service could be turned into positive by arranging some training programs regarding the use of the latest communication tools. Results could be related to the fact that most of the respondents were not too old, depicting a mean age of 40 years according to demographic data, with a mean value resulting 13 years of service. Consequently, we can assume that the majority of them were in favor of using E-extension services and its components. Incorporating E-extension knowledge-based workshops could help instigate a better understanding among extension workers.

Table 2. Spearman correlation of means for extension workers’ overall attitudes towards E-extension by their age, education, years of service, and current job status.

Factor	r_s	p
Age	−0.180 *	0.028
Education	0.094	0.255
Years of service	−0.266 **	0.001
Current job status	−0.153	0.062

* Significant at 0.05 (2-tailed); ** Significant at 0.01 (2-tailed).

4.4. The Relationship between Extension Workers' Attitudes towards E-Extension in Relation to Their Current Residence, Computer Experience, Computer Training, and Area of Specialization

The results in Table 3 reveal that current residence has no significant relationship with the attitudes of extension workers towards the use of E-extension. Results are not similar to the study conducted by Albirini [32], revealing more positive attitudes from urban residents towards the latest communication technologies, as compared with rural residents. However, extension workers' overall attitude and their experience of using computer showed a significant relationship ($p = 0.019$) at the 0.05 level (Table 3). Eighty-nine percent of respondents had experience with computers; 11% of respondents did not. This clearly reveals that the respondents with computer experience had a more positive attitude towards the use of E-extension. Use of a computer and its relevant accessories is one of the main components of an E-extension system. It could be concluded from the results that, to establish an E-extension system, computer literacy in extension workers is inevitable. Individuals with computer experience are well informed about the useful applications and benefits of computers, as compared with those with no experience. It could be assumed from the results that computer experience is ineluctable for extension workers to develop a perceived importance and agreement towards the use of E-extension. Keeping in view the less positive attitude towards E-extension from aged extension workers with more years of experience, encouraging and motivating them to immerse themselves in a computer-based environment could improve their understanding for E-extension. The relationship between attitudes towards new information technology and computer experience has also been investigated in studies conducted by Winter et al. [11], Kubiak, and Halakova [40], the results of which are in accord with our results.

Table 3. Cramer's V test for extension workers' overall attitudes towards E-extension by their current residence, computer experience, computer training, and area of specialization.

Factor	ϕ_c	p
Current residence	0.440	0.628
Computer experience	0.584	0.019 *
Computer training	0.480	0.359
Area of specialization	0.440	0.809

* Significant at 0.05 (2-tailed).

4.5. The Relationship between Extension Workers' Attitudes and Individual E-Extension Statements by Their Characteristics

4.5.1. Age

Age had a significant relationship ($r_s = -0.178$; $p = 0.030$) at a 0.05 significant level with the statement, "Mobiles are effective in disseminating agricultural information". A negative r_s value indicates young age respondents agreed more with this statement, as compared with older respondents.

Another statement, "By implementing E-extension services, extension department could achieve its goals easily", was identified as having a significant relationship with age ($r_s = -0.207$; $p = 0.011$), again with a negative value clearly indicating that young respondents agreed on this statement and that agreement level decreases with the increase in age.

4.5.2. Years of Service

Years of service showed a significant relationship ($p = 0.037$; $r_s = -0.171$) at a 0.05 significant level with the statement, "Mobiles are effective in disseminating agricultural information", with a negative r_s value indicating that respondents with few years of service were of the view that mobile phones are effective in communicating and spreading agricultural information. Years of service were also significant ($p = 0.041$; $r_s = -0.168$) with the statement, "The efficiency of the extension workers will increase with the use of E-extension". The statement, "Communication through the Internet is essential

to make agricultural extension activities effective”, was agreed with by respondents with few years of service, with a significance value of $p = 0.016$ ($r_s = -0.057$). A significant relationship ($p = 0.001$; $r_s = -0.266$) was also found with the statement, “By implementing E-extension services, extension department could achieve its goals easily”. The statement, “Using social websites (Facebook and Twitter) between extension workers and farmers is helpful for establishing a better communication”, was found to have a highly significant relationship ($p = 0.009$; $r_s = -0.213$) with years of service. “E-extension, in comparison to a traditional extension system, is a better method” was also agreed with by respondents with few years of service as compared with more experienced personnel, with a significance value of $p = 0.017$ ($r_s = -0.195$).

4.5.3. Current Job Status

Current job status was found to have a significant relationship ($p = 0.016$; $r_s = -0.197$) with the statement, “Mobiles are effective in disseminating agricultural information”. This result clearly reflects that, as job status increases, respondents’ viewpoint for this statement becomes negative. Respondents with a low job grade also agreed with the statement, “By implementing E-extension services, extension department could achieve its goals easily”, with a significance level of 0.025 ($r_s = -0.183$).

4.6. The Relationship between Extension Workers’ Attitudes towards Individual E-Extension Statements in Relation to Their Current Residence, Computer Experience, Computer Training, and Area of Specialization

4.6.1. Current Residence

The results show a significant relationship $\phi_c = 0.266$ ($p = 0.032$) between respondents’ current residence (rural and urban) and the statement, “Using E-extension methods could improve rural livelihood”. Extension workers residing in urban areas agreed at a significantly higher level (41.6%) as compared with the extension workers from rural areas (13.4%).

4.6.2. Computer Experience

Respondents with computer experience (79.9%) agreed with the statement, “Mobiles are effective in disseminating agricultural information”, at a significantly higher level ($\phi_c = 0.249$; $p = 0.027$) compared with the respondents who had no computer experience (8.1%).

The statement, “The efficiency of extension workers will increase with the use of E-extension”, was agreed with at a significantly higher level $\phi_c = 0.365$ ($p = 0.001$) by the computer-experienced respondents (72.5%) compared with non-computer experienced respondents (4.7%).

The respondents who had computer experience (68.4%) also agreed with the statement, “By using E-extension methods, the work load of the extension workers will be minimized”, at a significantly higher level compared with non-experienced computer users (3.3%) ($\phi_c = 0.328$; $p = 0.003$).

4.6.3. Computer Training

The respondents with computer training (55%) agreed with the statement, “Cost and time for reaching farmers could be saved by using E-extension”, at a significantly higher level compared with the individuals with no training (18.8%) ($\phi_c = 0.262$; $p = 0.002$). “Using E-extension methods could improve rural livelihood” was agreed with at a significantly higher level ($\phi_c = 0.255$; $p = 0.045$) by the respondents with computer training (39.6%) compared with those with no training (15.4%).

4.6.4. Area of Specialization

The respondents who declared their area of specialization as “plant protection” agreed with the statement, “Spreading agriculture information through websites is helpful for farmers to get information”, at a significantly higher level (16.2%) compared with other disciplines such as those classified as “other” (16.1%), agricultural extension (15.4%), plant production (14.8%), agriculture

economics (3.4%), and animal production (2.7%) ($\phi_c = 0.234$; $p = 0.037$). “Other” disciplines included food production, agricultural engineering, or water management.

5. Conclusions

Results revealed that most of the respondents were from urban areas, had a Bachelor’s degree, and agricultural extension as their specialization. Computer experience and computer training, for most of the respondents, clearly impacts their more positive attitude towards E-extension implementation in the Kingdom. Only the factors of age, years of service, and computer experience showed a significant relationship with extension workers’ attitudes towards E-extension. Extension workers generally had a positive attitude towards the use of E-extension in the Kingdom of Saudi Arabia. Young extension workers revealed more positive attitudes towards the use of E-extension compared with older ones. Extension workers with fewer years of service showed more positive attitudes towards the use of E-extension compared with those having more years of service. Extension workers with computer experience resulted in a more positive attitude towards the use of E-extension compared with non-experienced users. These results could help in designing and maintaining an effective E-extension infrastructure within the Kingdom. Incorporating this infrastructure reinforced with latest communication tools could help the Kingdom to achieve agricultural sustainability.

6. Recommendations

On the basis of this study, the following recommendations may be enforced to help establish the E-extension system in the Kingdom: encouraging extension workers, especially those who are older, to use the E-extension system through exclusive training programs and refresher courses; introducing the E-extension system on a pilot basis and evaluating farmers’ views to get a clear scenario regarding its incorporation impacts; and arranging combined workshops emphasizing computer literacy, including all extension workers regardless of years of service to eliminate the generation gap and instigating a better understanding of the E-extension system.

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References

1. Obibuaku, L.O. *Agricultural Extension as a Strategy for Agricultural Transformation*; University of Nigeria Press: Nsukka, Nigeria, 1983.
2. Qamar, M.K. *Modernizing National Agricultural Extension Systems: A Practical Guide for Policy Makers of Developing Countries*. 2016. Available online: <ftp://ftp.fao.org/docrep/fao/008/a0219e/a0219e00.pdf> (accessed on 14 September 2016).
3. InfoDev. *ICTs for Sustainable Food Production and Agriculture: Technology and Information for the Next Green Revolution*. 2009. Available online: <http://unpan1.un.org/intradoc/groups/public/documents/unpan/unpan037354.pdf> (accessed on 14 September 2016).
4. Adekoya, A.E. Cyber extension communication: A strategic model for agricultural and rural transformation in Nigeria. *J. Food Agric. Environ.* **2007**, *5*, 366–368.
5. Renwick, S. Potential for Use of Information Communication Technologies (ICT) in Agricultural Extension. 2009. Available online: <http://uwispace.sta.uwi.edu/dspace/bitstream/handle/2139/12632/icts%20and%20extension%20final%20paper.pdf?sequence=1> (accessed on 10 July 2016).
6. Philippine e-Extension Portal. e-Extension. *Electronic Extension in Philippine Agriculture and Fisheries*. Available online: <http://e-extension.gov.ph/> (accessed on 10 June 2012).

7. Hemmati, A.; Sefidian, E. e-Learning and investigation on its application in on-the job training for the staff of AREO. In Proceedings of the Iranian Agricultural Education Seminar, Tarbiat Modares University, Tehran, Iran, 1–2 November 2006; pp. 221–232.
8. Kramer-Leblanc, C.; Greg, C. Capacity Building of Farmers through an e-Extension Model: Challenges and Opportunities. In *Multi Stakeholder Dialogue on Implementing Sustainable Development*; USDA: Washington, DC, USA, 2010.
9. Mukhebi, A.W.; Kundu, J.; Okolla, A.; Wambua, M.; Ochieng, W.; Fwamba, G. Linking farmers to markets through modern information and communication technologies in Kenya. In Proceedings of the 2nd International AAAE Conference, Accra, Ghana, 20–22 August 2007.
10. The World Bank. Information and Communications for Development: Extending Reach and Increasing Impact. 2009. Available online: <http://issuu.com/world.bank.publications/docs/9780821376058> (accessed on 5 July 2016).
11. Winter, S.J.; Chudoba, K.; Gutek, B.A. Attitudes toward computers: When do they predict computer use? *Inf. Manag.* **1998**, *34*, 275–284. [[CrossRef](#)]
12. Ministry of Agriculture (Ministry of Agriculture Kingdom of Saudi Arabia). *Agricultural Statistics Year Book*; MOA: Riyadh, Saudi Arabia, 2009; Volume 23.
13. Darfaoui, E.M.; Al Assiri, A. *Response to Climate Change in the Kingdom of Saudi Arabia*; Internal Working Paper; FAO RNE: Cairo, Egypt, 2011.
14. Ministry of Economy and Planning. Kingdom of Saudi Arabia. Strategic Priorities for Agricultural Technologies. 2010. Available online: http://nstip.kacst.edu.sa/NSTIPWCPortal/faces/NSTIPPolicyReferencesDetailPage?title=Agriculture%20Technology&_afLoop=415041618207882&_afWindowMode=0&_afWindowId=wmbkxwjig_6#%40%3F_afWindowId%3Dwmbkxwjig_6%26_afLoop%3D415041618207882%26title%3DAgriculture%2BTechnology%26_afWindowMode%3D0%26_adf.ctrl-state%3Dwmbkxwjig_18 (accessed on 15 January 2015). (In Arabic)
15. General Authority for Statistics Kingdom of Saudi Arabia. 2015. Available online: <http://www.cdsi.gov.sa/en/4068> (accessed on 20 September 2016).
16. Ministry of Agriculture. A Glance on Agricultural Development in the Kingdom of Saudi Arabia. 2005. Available online: <http://www.MOA.gov.sa> (accessed on 12 June 2016).
17. Al-Subaiee, F.S.; Yoder, E.P.; Thomson, J.S. Extension agents' perceptions of sustainable agriculture in the Riyadh Region of Saudi Arabia. *J. Int. Agric. Ext. Educ.* **2005**, *12*, 5–14. [[CrossRef](#)]
18. Kerlinger, F.N. *Foundations of Behavioral Research*; Holt, Rinehart and Wiston, Inc.: London, UK, 1973.
19. Reeder, W.W. *Beliefs, Disbeliefs and Social Actions: A Theoretical Frame of Reference for Interpersonal and Organizational Behavior*; New York State College of Agriculture and Life Sciences: Ithaca, NY, USA, 1972.
20. Rogers, E.M. Social structure and social change. *Am. Behav. Sci.* **1971**, *14*, 767–782. [[CrossRef](#)]
21. Ilevbaaje, I.E. Attitude of extension personnel to training and visit extension system in Benue and plateau states, Nigeria. *J. Agric. Soc. Res.* **2004**, *4*, 1–12. [[CrossRef](#)]
22. Eagly, A.H.; Chaiken, S. *The Psychology of Attitudes*; Harcourt Brace Jovanovich College Publishers: San Diego, CA, USA, 1993.
23. Davis, F.D.; Bagozzi, R.P.; Warshaw, P.R. User acceptance of computer Technology: A Comparison of two Theoretical Models. *Manag. Sci.* **1989**, *35*, 982–1003. [[CrossRef](#)]
24. Morris, M.G.; Dillon, A. How user perceptions influence software use. *IEEE Softw.* **1997**, *14*, 58–65. [[CrossRef](#)]
25. Richardson, J.T. Instruments for obtaining student feedback: A review of the literature. *Assess. Eval. High. Educ.* **2005**, *30*, 387–415. [[CrossRef](#)]
26. Babbie, E.R. *Survey Research Methods*; Wadsworth Pub. Co.: Belmont, CA, USA, 1990.
27. Kidder, L.H.; Fine, M. Qualitative and quantitative methods: When stories converge. *New Dir. Program Eval.* **1987**, *1987*, 57–75. [[CrossRef](#)]
28. Miller, L.E.; Smith, K. Handling non-response issues. *J. Ext.* **1983**, *21*, 45–50.
29. Celik Ates, H.; Gokce Cakal, Z. Views of Extension Personnel on Extension Methods and Transition to Private Extension: The Case of Isparta Province. *J. Agric. Sci. Technol.* **2014**, *16*, 1529–1541.
30. Kizilaslan, N. Attitudes and Behaviors of the Farmers towards Agricultural Extension (Tokat Province Research Yesilyurt County). *TUBAV Sci. J.* **2009**, *2*, 439–445.
31. Adekunle, P.A.; Omoba, R.O.; Tella, A. Attitudes of librarians in selected Nigerian universities toward the use of ICT. *Libr. Philos. Pract.* **2007**, *9*, 53.

32. Albirini, A. An Exploration of the Factors Associated with the Attitudes of High School EFL Teachers in Syria toward Information and Communication Technology. Ph.D. Thesis, The Ohio State University, Columbus, OH, USA, 2004.
33. Hakkarainen, K.; Ilomäki, L.; Lipponen, L.; Muukkonen, H.; Rahikainen, M.; Tuominen, T.; Lakkala, M.; Lehtinen, E. Students' skills and practices of using ICT: Results of a national assessment in Finland. *Comput. Educ.* **2000**, *34*, 103–117. [[CrossRef](#)]
34. Sandercock, G.; Shaw, G. Learners' performance and evaluation of attitude towards web course tools in the delivery of an applied sports science module. *J. Asynchronous Learn.* **2000**, *3*, 1–10.
35. Rolfe, J.; Gregor, S.; Menzies, D. Reasons why farmers in Australia adopt the Internet. *Electron. Commer. Res. Appl.* **2003**, *2*, 27–41. [[CrossRef](#)]
36. Kawtrakul, A. Ontology engineering and knowledge services for agriculture domain. *J. Integr. Agric.* **2012**, *11*, 741–751. [[CrossRef](#)]
37. Baack, S.A.; Brown, T.S.; Brown, J.T. Attitudes toward computers: Views of older adults compared with those of young adults. *J. Res. Comput. Educ.* **1991**, *23*, 422–433. [[CrossRef](#)]
38. Mohammadi, D. Investigating Factors Affecting Information Seeking Behavior and Information Dissemination of Extension Staff in Zanzan Province. Master's Thesis, University of Tehran, Tehran, Iran, 2002.
39. Pezeshki-Raad, G.; Zamani, N.; Radhakrishna, R. An exploration of information seeking-behavior of extension managers and specialists in Iran. In Proceedings of the 20th Annual AIAEE Conference Education and Extension for Multi-Functional Agriculture, Dublin, Ireland, 23 May 2004; pp. 626–638.
40. Kubiato, M.; Haláková, Z. Slovak high school students' attitudes to ICT using in biology lesson. *Comput. Hum. Behav.* **2009**, *25*, 743–748. [[CrossRef](#)]



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