

## Do Farmers Do What they Know? Exploring Gender Differences in the Environmental Knowledge-Behavior Gap among Egyptian Farmers

<sup>1</sup>Ayman A. M. H. Ecresh, <sup>2</sup>Ali H. Abderazek and <sup>3</sup>Alaa Eldein A. Betah

<sup>1</sup>Associate prof. of Rural Sociology Fac. of Agriculture, Zagazig University, Egypt.

<sup>2</sup>Assistant prof. of Rural Sociology Fac. of Agriculture Alex. University, Egypt.

<sup>3</sup>Assistant prof. of Rural Sociology Fac. of Agriculture, Saba Basha, Alex. University, Egypt.

### ABSTRACT

The core idea of this paper is to explore the gap between male and female farmers' knowledge and behavior related to environmental protection. Data were collected via face to face structured interviews with a simple multi-stage cluster sample of 325 farmers in Sharkia governorate of Egypt. Data collection took place from the middle of March to middle April 2014. Findings indicated that what farmers know is not what they do. A negative significant correlation between farmers' knowledge-behavioral gap and some studied variables were shown, whereas there was a positive significant correlation with knowledge of environmental legislation was found. No significant gender differences were found for farmers' environmental knowledge and environmental attitudes, whereas significant pro-environmental behavior differences in favor of males existed and a knowledge-behavior gap in favor of females. Stepwise regression results showed that only nine variables (effectiveness of agricultural extension, effectiveness of public services, environmental attitude, socio-economic level, psychological comfort, knowledge of environmental legislation, belonging to the community, membership of NGO's, and rational consumption, respectively) had significant influences on farmers' knowledge-behavioral gap of environmental protection, these variables together explained 34.7% of total variance in farmers' knowledge-behavioral gap regarding environmental protection. Several recommendations were presented for improvement the knowledge and environmental attitudes for rural women.

**Key words:** Egypt, gender, farmers, environmental knowledge, attitudes, behavior.

### Introduction

Environmental protection (EP) is undoubtedly one of the most complex societal activities (Zovko and Butuci, 2009, p.658). Environmentalism emerged as a global phenomenon in the late 1960's and early 1970's (Buttel, 2002). Since then, EP has become an increasingly significant international issue (Batabyal, 1997, p.286). Currently, we are witnessing a growing concern regarding lifestyle and a raised awareness in relation to preserving the natural environment (Michel-Guillou, and Moser, 2006, p.227).

Scholars have recognized the fundamental importance of exploring how knowledge and attitudes influence human response to ecological degradation and pollution (Maloney, Ward, and Braucht, 1975). Researchers in the social sciences have sought to understand and map factors that lead people to move or to fail to move from environmental knowledge (EK) to pro-environmental behavior (PEB) (Courtenay-Hall and Rogers, 2002, p.283). Over the last few decades, numerous studies have investigated individual determinants of environmental behavior (EB) (Best and Kneip, 2011, p.917). In the past, environmental problems have been considered technical and economic problems. In recent decades, the social dimensions of environmental problems such as individuals' environmental have received attention from a variety of fields including sociology and psychology. Developing and developed countries during the last few decades continue to investigate public environmental attitudes (EA) and behavior as well as their environmental consequences (Kalantari *et al.* 2007, p.67). The quality of the environment strongly depends on psycho/social behaviour patterns of individuals. Thus, environmental quality strongly depends on human behaviour (Steg and Vlek, 2009, p.309).

Many people are quickly and carelessly consuming and or polluting water, soil, and other natural resources. Environmental destruction can impede economic growth. It also poses a threat to the health and well-being of local populations (Daniere and Takahashi 1999). This partly explains why different people become engaged in environmental issues and develop PEB patterns. If there are threatening and harmful consequences for egoistic, social-altruistic, or biospheric objects that they value (e.g., ones' own health, humankind, or animals and plants, etc.) a response is often influence by the significance of the problem. (Hansla, Gamble, and Garling, 2008,p.1).

It is commonly accepted that the environment is a commonly shared commodity. It is available to all, however ones individual's consumption of natural resources also affects others utilizing the same resource. Abstinence from consumption is often at one's own expense, but can improve the situation of others (Kaiser *et al.*,1999, p59). Accordingly, if a majority of individuals fail to limit, regulate, and monitor the consumption of natural resources they will become scarce.

Farming represents the main source of livelihood for individuals living in rural Egypt. For this group, agriculture is their main link to the environment. Nonetheless, people do not always do what they know they should do when it comes to protecting the environment (Rangan, Karim, and Sandberg, 1996). Specific factors that can keep this knowledge-behavior gap (KBG) from closing are often called determinants of behavior (e.g., awareness, attitude). To attain a certain level of improvement in preserving the environment, not only is technological change important, but also changes in the attitudes and behavior of those directly involved in agriculture (Wu and Mweemba, 2010, p.p.728-729). Preservation and prevention remain necessary but cannot be accomplished without changing the behavior of individuals and groups. Therefore, the present study attempted to address the following questions:

- Is there a gap between EK and PEB among rural farmers in Egypt? If so, what are the variables affecting this KBG?
- What are the variables related knowledge, attitudes and behavior related to EP?
- Do gender difference exist between farmers in terms of EK, EA, pro-environmental behavior, and KBG?

The planned objectives of the current study were to:

1. Determine the level of farmers' knowledge, attitudes, behavior, and KBG regarding EP.
2. Investigate the relationships between key variables with farmers' knowledge, attitudes, behavior, and knowledge-behavior gap regarding EP.
3. Test for significant gender differences regarding EK, EA, pro-environmental behavior, and knowledge-behavioral gap (KBG).
4. Identify variables affecting the KBG.

### ***Theoretical, Empirical framework and Studied hypotheses***

#### ***Environmental knowledge***

Fryxell and Lo (2003, p.48) defined EK as “knowledge of facts, concepts, and relationships concerning the natural environment and its major ecosystems”. Moreover, environmental knowledge means understanding the components of the environment, and their relationship to each other, and sense of the problems resulting from the breach of these relations in terms of causes and effects, and learn to exploit the resources available in the environment (Arnaout,1997).

According to Vogel (1996) farmers living under difficult conditions may possess more knowledge of environmental problems. Feng, and Reisner (2011) found that income was significantly and positively related to the level of EK.

#### ***Environmental attitude***

Allport (1935) defined attitude as “a mental and neural state of readiness, which exerts a directing, influence upon the individual’s response to all objects and situations with which it is related.” Contemporary theorists have come to the consensus that the main characteristic of an attitude is its evaluative nature, which becomes tangible in favorable or unfavorable reactions to an object, person, institution or event (Eagly and Chaiken, 1993). Furthermore, environmental attitude means a situation taken by the individual towards all quantitative or qualitative changes to the environment (Gad- Elnasr,1989).

According to Heslop *et al.* (1981) knowledge seems to have a strong positive relationship when dealing with attitudes towards EP. Arcury (1990) showed that EK is was consistently and positively related to EA, although the relationship was not especially strong. Kalantari *et al.* (2007) found a significant correlation between EA and environmental legislation and education. Sadati *et al.* (2010) showed positive correlations between literacy, off-farm income, farmers’ knowledge, extension contacts and a negative correlation between age and attitude toward sustainable agriculture.

#### ***Pro-environmental behavior***

##### ***Pro-environmental behavior Definition***

Kollmuss and Agyeman defined ‘pro-environmental behavior’ as “behavior that consciously seeks to minimize the negative impact of one’s actions on the natural and built world (e.g., minimize resource and energy consumption, use of non-toxic substances, reduce waste production)” (2000, pp. 240,258). They divided PEB into direct and indirect action: Indirect environmental actions include donating money, political activities, educational outreach, environmental writing, etc. These activities, although extremely important, do not have a direct impact on the environment. Direct environmental actions include recycling, driving less, buying organic food, etc. These actions have a direct, admittedly sometimes very small, impact on the environment.

This is a concise definition but it is not as uncontroversial as it may seem. This definition excludes all non-conscious behavior from what is to be recognized as pro-environmental behavior. As a result, behavior that should be counted as environmentally virtuous is rendered invisible by this exclusion, particularly behavior that is no longer consciously chosen each time it is performed because it is enacted out of habit (e.g., turning off lights), or behavior that is enacted out of deeply rooted values and inclinations rather than out of a conscious

choice to minimize negative environmental impacts (e.g., sharing equipment with neighbours, teaching neighbourhood children about plants and insects) (Courtenay-Hall and Rogers, 2002, p288). Ajzen and Fishbein, in their theory of reasoned action and theory of planned behavior have explained the relationship of belief, attitude, intention, subjective norms and behavior; and stated that people are rational and use the available information in a systematic way (1980). However, researchers have shown that additional factors influence these relationships. As a result, the decision-making process could almost be considered completely unpredictable. In other words, positive attitudes are not necessarily followed by positive intentions (Vermeir and Verbeke, 2006).

#### ***Linkage between environmental knowledge and Pro-environmental behavior***

Empirical findings regarding the relationship between EK and behavior are varied, some studies found no relationship between EK and environmental behaviour (Maloney *et al.*, 1975; Schahn and Holzer, 1990), while others suggest that the link from EK to PEB was somewhat tenuous (eg Kaiser and Gutscher, 2003)(Hassan,2004). However, other research findings found a moderately strong correlation between knowledge and EB (Hines, Hungerford, and Tomera, 1986/87; Duerden and Witt, 2010; Betah,2008).

#### ***Linkage between environmental behavior and Pro-environmental behavior***

Research focused on the relationship between EK and behavior is equally tenuous. Some findings reveal a moderate relationship between EA and ecological behaviour (Hines *et al.*, 1986/87; Axelrod and Lehman, 1993) whereas others show a weak relationship (Grob, 1995). However, other studies reported no such relationship (Lansana, 1992) and other studies yields a strong association between EA and behavior (e.g., Duerden and Witt, 2010).

#### ***Linkage between other variables and Pro-environmental behavior***

Feng, and Reisner (2011) found that gender is significantly related to household-level environmental behaviors. Mohai (1992) found that there is a weak tendency for women to be more environmentally concerned but environmentally less active than men. Whereas Hines *et al.* (1986/87) found no correlation between gender and behavior. Regarding age, Hallin (1995) found that age correlated positively with environmental behavior. Whereas Hines *et al.* (1986/87), Schultz, Oskamp, and Mainieri (1995), Dietz, Stern, and Guagnano (1998), and Abd El-Kader (2001) found no significant correlation between age and environmental behavior. In terms of education, Hines *et al.* (1986/87), Feng, and Reisner (2011) found that education is significantly and positive related to environmental behavior. Whereas, Abd El-Kader (2001) found no significant correlation between education and environmental behavior. Regarding family size Abd El-Kader (2001) found no significant correlation between family size and environmental behavior. While Betah (2008) found a strong correlation between family size and environmental behavior. Regarding income, Hines *et al.* (1986/87) Kalantari *et al.* (2007) and Betah (2008) found that income had a positive significant correlation with environmental behavior, whereas Feng, and Reisner (2011) found that income was not significantly related to environmental behavior. Hines *et al.* (1986/87) found that members in environmental organizations outperform the general public in terms of environmental concern and behavior. Regarding agricultural holding, El-ghannam and Elsabagh (2006) found negative correlation between agricultural holding and environmental behavior. Regarding environmental legislation, Kalantari *et al.* (2007) found that EB had significant correlation with environmental legislation and preparedness to act. In terms of farmers' pro-environmental behavior, the usual findings reveal significant correlation between farmers' attitudes and behaviors (Carr and Tait,1991; Daniere and Takahashi,1999), other researchers found a strong relationship between attitude and behavior among farmers (Lynne and Rola, 1988; Sullivan *et al.* 1996; Vogel, 1996). Tatlidil, Boz, and Tatlidil (2009) showed that the higher the socioeconomic status and the greater the access to information, the greater the perceived importance of sustainable agricultural practices. Wu and Mweemba (2010) revealed that more positive environmental behaviors are linked to greater farmers' awareness of the degradation of the environment.

#### ***Farmers' knowledge-Behavior Gap***

According to Zsoka (2008) a gap exists between EK and actual behaviour. Reviewed literature indicated that there is a clear lack of studies which address the issue of the knowledge-behavior gap in the field of rural EP.

#### ***Hypotheses Testing***

The main hypotheses of the current study were derived from the conceptual framework:

H1. There is a positive significant correlation between the following variables: age, educational level, environmental socialization, socio-economic level, effectiveness of governmental organizations, effectiveness of NGO's, effectiveness of public services, effectiveness of agricultural extension, amount of environmental stimuli, exposure to mass media, cultural openness, geographical openness, contact with change agents, degree of religiosity, tendency towards investment, degree of innovative, acceptance of

modern ideas, tendency towards modernization, planning for future, membership of NGO's, rational consumption, psychological comfort, belonging to community, Knowledge of environmental legislation with farmers' EK of EP.

H2. There is a positive significant correlation between each of the above variables, and farmers' attitudes toward EP.

H3. There is a significant correlation between each of the above variables and farmers' behavior related to EP.

H4. There is a negative significant correlation between each of the above variables and farmers' knowledge-behavior gap of EP.

H5. There is a significant difference between male and female farmers with regard to knowledge, attitudes, behavior, and knowledge-behavior gap regarding EP.

H6. The variable mentioned in the first hypothesis in addition to farmers' EA have a significant impact on knowledge-behavior gap regarding EP.

## **Methods**

### **Sampling Method**

The present study was based on a field survey. It was conducted in Sharkia governorate, one of the largest governorates in Egypt in terms of population. It ranks third among governorates after Cairo and Giza, and first among the governorates of Lower Egypt. Also Sharkia governorate is second in terms of cultivated area after Behera governorate (UNDP and INP, 2014). The districts of Sharkia governorate were selected by simple multi-stage cluster sampling technique. An index of population and availability of developmental organizations was established in the first stage, it consists of fifteen items (Bureau of Sharkia governorate, 2014) namely: total population, number of: local units, social units, schools, nurseries, healthy units, youth centers, mosques, churches, veterinary units, police stations, agricultural cooperatives, village banks, post offices, and community development associations. The raw data of this index was transformed to z-scores then to t-scores (where  $t\text{-score} = 10 \times z\text{-score} + 50$ ). The governorate's districts were arranged by t-scores and then divided into three categories namely high, middle and low. One district was selected from each category. Diyarb Nigm district was representative of high scores, Abu Hammad was the representative of middle scores, and Awlad Saqr was the representative of low scores.

In the second stage of the cluster sampling, villages within these three districts were arranged in a similar fashion and then one village was selected from each district (Alasaid village from Diyarb Nigm, El-Sheikh Jbeil from Abu Hammad and Jazerit El-Shafei from Awlad Saqr). In the third stage, a land tenure list, which was made available through cooperative associations with each village, was used as a framework for the final sampling. The total number of land holders across the three villages was 2130 (1263 farmers in the first village, 552 farmers in the second and 315 farmers in the third village).

### **Sample Size**

Cochran formula (1977) was used to determine the sample size of the present study. The result of this formula was 325 farmers. This size was distributed across the three villages mentioned in proportion to the number of holders of land tenure in each village. 193 farmers from Alasaid village, 84 from El-Sheikh Jbeil, and 48 from Jazerit El-Shafei were selected by simple random sample.

### **Participants**

The data for this study were collected from farmers.

### **Data Collection**

Data was collected with questionnaire administered through face-to-face interviews at each farmers' home or field. Data was collected from middle March to middle April, 2014. Each questionnaire took about 30 minutes on average to complete.

### **Variables and measurements**

The definitions and measurements of the study's variables are as follows:

Gender was a dummy variable (1= male, 0= female). Education level was measured by the number of years exceeding compulsory education. Environmental socialization was measured using fifty six items representing four socialization agents, fourteen items for each, reflecting the influence of family, peers, school and media on in farmers during their childhood related to environmental practices (4=always, 3=much, 2=sometimes, 1=rarely, 0=No).

Socio-economic level was measured using an index constructed from responses to six questions concerning monthly household income (per Egyptian pound), number of sources of income, social level of the neighbors (3=high, 2=middle and 1=low), possession of equipment and home electrical devices (amount of equipments  $\times$  its costs), size of the possession of cattle, sheep and poultry (number of possession  $\times$  its cost) and size of possession of agricultural land (feddan of land  $\times$  its cost/feddan), total t-scores of these six questions were used to calculated this index.

Effectiveness of governmental organizations was calculated by totaling t-scores for degree of farmers' satisfaction of fifteen governmental organizations in the rural community. Effectiveness of NGO's was calculated by totaling t-scores for degree of farmers' satisfaction of five nongovernmental organizations. Effectiveness of public services was a composed variable of total t-scores for degree of farmers' satisfaction across thirty five items representing eight services including social, health, cultural, veterinary, political, religious, entertainment, and environmental services. The response format for the above three variables was (5=extremely satisfied, 4=very satisfied, 3= somewhat satisfied, 2=very dissatisfied, 1=extremely dissatisfied and not fund=0).

Effectiveness of agricultural extension was calculated by total degrees of farmers' response to a scale consisting of ten statements reflecting the effectiveness of the agricultural extension agency in the village, the response format for this scale was a 5-point Likert scale (5=strongly agree, 4=agree, neutral=3, 2=disagree and 1=strongly disagree). Negatively formulated items were reversed.

The amount of environmental stimuli was calculated by a total of seven items related to respondents' attitudes towards fumes of factories and cars, hurricane news and environmental diseases news. Exposure to mass media was calculated by total of five items related to listening to radio, watching TV and reading newspapers. Cultural openness was calculated by a total of five items related to computer and internet usage, and attending cultural seminars and public conferences. Geographical openness was calculated by five items related to the frequency of visiting other villages, cities and countries. Contact with change agents was calculated by ten items related to the degree of contact with managers of organizations in the village. Degree of religiosity was calculated by total of seven items related to prayer, worship, attending seminars and discussions of religion. Tendency towards investment was calculated by sixteen items related to degree farmers invested their income into useful things. Degree of innovative was calculated by five items related to farmers' innovation of some practices and home activities which brought them gain. Acceptance of modern ideas was calculated by a seven items related to the adoption of new farm practices. The response format for the above nine variables was (4=always, 3=much, 2=sometimes, 1=rarely, 0=No).

Tendency towards modernization was calculated by farmers' responses to an eleven item scale regarding their attitudes toward new machines, the internet, the mobile education of girls, family planning, and equality between males and females. Planning for the future was calculated by farmers' responses to a scale consisting of nine statements regarding their attitude towards planning for their future careers and life style. The response format for the above two variables was a 5-point Likert scale (5=strongly agree, 4=agree, neutral=3, 2=disagree and 1=strongly disagree). Negatively formulated items were reversed. Membership of NGO's was calculated by total t-scores for degree of farmers' membership in ten non-governmental organizations, the response has taken the following scores (6=President of board director, 5=secretary of board director, 4=member of board director, 3=Chairman of committee, 2= member of committee, 1=common member, 0=not member). Rational consumption was calculated by total degrees of ten items of farmers responses related to rational consumption of clothing, energy and food (4=always, 3= much, 2=sometimes, 1=rarely, 0=No). Psychological comfort was calculated by farmers' responses to a scale consisting of ten statements reflecting their feeling of calm and optimism for their livelihood and their lives. Belonging to community was calculated by farmers' response to a scale consisting of ten statements reflecting their pride, sacrifice, jealousy toward their community. The response format for the above three variables was a 5-point Likert scale (5=strongly agree to 1=strongly disagree). Negatively formulated items were reversed.

Knowledge of environmental legislation was calculated by total farmers' knowledge degrees of twelve items related to legislation that compel them to protect the environment regarding soil, air or water. The response was taken (3=high knowledge, 2= middle knowledge, 1=low knowledge, 0= I don't know). Farmers' EK - Respondents were asked about their knowledge level of the impact of a set of human actions and practices on the environment regarding soil (11 practices), air (11 practices) and water (11 practices). Farmers' EA- Respondents were asked about their tendencies toward some ecological practices related to EP regarding soil (9 practices), air (9 practices) and water (9 practices). Farmers' pro-environment behavior was measured by asking respondents about a set of actions and practices that they have taken or intended to take to protect the soil (11 practices), air (11 practices) and water (11 practices) found in their community. The response format for Farmers' Environmental knowledge, attitudes and behavior was a 5-point Likert scale (5= strongly agree to 1= strongly disagree). Negatively formulated items were reversed. Farmers' knowledge-behavior gap was calculated by subtracting PEB scores from total EK scores.

### ***Statistical analysis***

Descriptive Statistics were used to describe the sample. Cronbach's alpha's were calculated to test the reliability of measures used in this study. Three principal methods of analysis were used to test the hypotheses namely, pearson correlation coefficient, Mann-Whitney U test, multiple regression analysis (stepwise). The calculations were carried out using the "Statistical Package for the Social Sciences" (SPSS16).

### Reliability Test

Cronbach's alpha tests showed (see Table 1) that the internal consistency levels of measures ranged from .614 to .917, meaning that all these measures were considered reliable (alpha value greater than .60). Some items were removed in order to improve reliability scores.

**Table 1.** Reliability analysis (Cronbach's Alpha)

Scale Name	No. of items in the scale	Total no. of items in the scale	Alpha coefficients
Effectiveness of agricultural extension	10	10	0.804
Amount of environmental stimuli	7	7	0.695
Exposure to mass media	5	5	0.794
Cultural openness	5	5	0.838
Geographical openness	5	5	0.788
Contact with change agents	10	10	0.917
Tendency towards modernization	11	11	0.811
Planning for future	9	9	0.781
Psychological comfort	10	10	0.640
Belonging to community	10	10	0.781
EK		33	0.843
Soil	11		0.885
Air	11		0.863
Water	11		0.907
EA		27	0.790
Soil	9		0.614
Air	9		0.725
Water	9		0.606
PEB		33	0.743
Soil	11		0.816
Air	11		0.762
Water	11		0.858

### Characteristics of sample

The sample was 79.7% male and 20.3% female. Respondents' ages ranged from 16 to 80 with a mean age of 46.81 (SD=13.45). The majority (54.5%) of respondent were 37-58 years old. The mode educational level was secondary (24%), Most (86.2%) of the farmers were married. The majority (97.2%) of farmers had low levels of environmental socialization. The socioeconomic level of most (64.3%) of the farmers was in the middle category. Most governmental agencies (64.4%) were perceived to have moderate levels of effectiveness as were the majority (60%) of the NGO's. The majority public services (80.6%) agricultural extension offices (56.6%) were also in the middle (see Table 2).

Also, Table 2 shows that all farmers had low membership of NGO's and majority (43.7%) of farmers had low cultural openness but all farmers had high geographical openness. The level of environmental stimuli of most (77.2%) farmers was high. Majority (87.7%), (68.9%), (66.8%), (65.8%), (65.2%), (61.8%), (57.8%), (57.2%) and (44.6%) of farmers had middle tendency towards investment, psychological comfort, planning for future, Knowledge of environmental legislation, degree of innovative, tendency towards modernization, exposure to mass media, rational consumption and contact with change agents, respectively. Majority (80%) and (73.2%) of farmers had high belonging to community and degree of religiosity, respectively. Majority (47.7%) and (47.1) of farmers had middle and high acceptance of modern ideas, respectively.

### Results

#### Level of farmers' knowledge, attitude, behavior, and knowledge-behavior gap related to EP.

Table 3 depicts that the majority (69.8%) of farmers had high (35.1%) and very high (34.7%) levels of EP knowledge. (see Fig.1). The majority (63.1%) of farmers had high and none had very low or low attitudes toward EP (see Fig.2). The majority (49%) and (48%) of farmers had high/very high and middle levels of behavior related to EP (see Fig.3). The majority of farmers (76.9%) had a gap between EK and pro-environmental behavior, (31.4%) of farmers had very low KBG of EP (see Fig.4).

#### Correlation analysis

To test Hypotheses 1-4, pearson correlation analyses were used. Table 4 demonstrates the results in this respect.

#### Farmers' environmental knowledge

Table 4 shows that there was a positive significant correlation between effectiveness of agricultural extension, Knowledge of environmental legislation, rational consumption, belonging to community, tendency towards investment, planning for future, psychological comfort, socio-economic level, effectiveness of public services, acceptance of modern ideas, amount of environmental stimuli, environmental socialization,

effectiveness of governmental organizations, geographical openness, contact with change agents, tendency towards modernization, degree of innovative, membership of NGO's, age, effectiveness of NGO's, and degree of religiosity with farmers' environmental knowledge, respectively. Other variables did not show any significant correlation. Therefore, Hypothesis 1 was not fully supported.

**Table 2.** Descriptive statistics

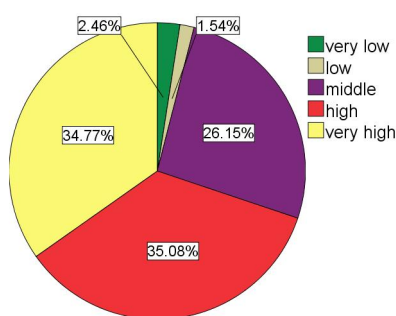
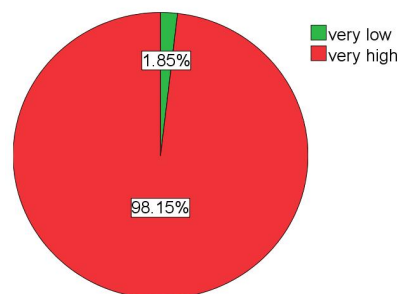
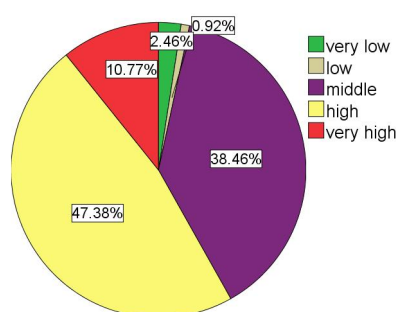
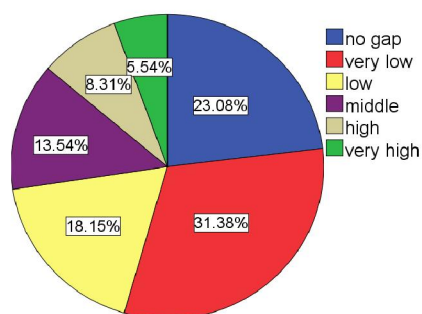
Total of each category	Frequency (n)	(%)	Total of each category	Frequency (n)	(%)
Gender			Geographical openness		
Male	259	79.7	low (<7)	Nil	Nil
Female	66	20.3	middle (7-14)	Nil	Nil
			high (14-20)	325	100
Age			Contact with change agents		
16-37	75	23.0	low (<13)	80	24.6
37-58	177	54.5	middle (13-26)	145	44.6
58-80	73	22.5	high (26-40)	100	30.8
Educational level			Degree of religiosity		
Illiterate	57	17.6	low (<9)	17	9.2
Reads and writes	64	19.6	middle (9-18)	70	21.5
Primary	19	5.8	high (18-28)	238	73.2
Preparatory	26	8.0			
Secondary	78	24.0			
Institute	19	5.9			
University	62	19.1			
Marital status			Tendency towards investment		
Never married	30	9.2	low (<21)	7	2.1
Engaged	4	1.2	middle (21-42)	285	87.7
Married	280	86.2	high (42-64)	33	10.2
Widowed	4	2.8			
Divorced	5	.6			
Environmental socialization			Degree of innovative		
low (<74)	316	97.2	low (<7)	46	14.2
middle (74-148)	9	2.8	middle (7-14)	212	65.2
high(148-224)	Nil	Nil	high (14-20)	67	20.6
Socio-economic level			Acceptance of modern ideas		
low (1551-1780)	60	18.5	low (< 9)	17	5.2
middle (1780-2220)	509	64.3	middle (9-18)	155	47.7
high (2220-2600)	56	17.2	high (18-28)	153	47.1
Effectiveness of govern. Org.			Tendency towards modernization		
low (63-334)	58	17.8	low (11-26)	12	3.7
middle (334-605)	209	64.4	middle (26-41)	201	61.8
high (605-876)	58	17.8	high (41-55)	112	34.5
Effectiveness of NGO's			planning for future		
low (189-236)	70	21.5	low (9-21)	13	4.0
middle (236-205)	195	60.0	middle (21-33)	217	66.8
high (282-328)	60	18.5	high (33-45)	95	29.2
Effectiveness of public services			Membership of NGO's		
low (101-233)	38	11.7	low (<20)	325	100
middle (233-364)	262	80.6	middle (20-40)	Nil	Nil
high (364-495)	25	7.7	high (40-60)	Nil	Nil
Effectiveness of agric. extension			Rational consumption		
low (10-23)	7	2.2	low (0-13)	14	4.3
middle (23-36)	184	56.6	middle (13-26)	187	57.5
high (36-50)	134	41.2	high (26-40)	124	38.2
Amount of environmental stimuli			Psychological comfort		
low (< 9)	15	4.6	)10-23 (low	Nil	Nil
middle (9-18)	59	18.2	middle (23-36)	224	68.9
high (18-28)	251	77.2	high (36-50)	101	31.1
Exposure to mass media			Belonging to community		
low (< 7)	52	16.0	low (10-23)	Nil	Nil
middle (7-14)	188	57.8	middle (23-36)	65	20.0
high (14-20)	85	26.2	high (36-50)	260	80.0
Cultural openness			Knowledge of environmental legislation		
low(< 7)	142	43.7	low (<12)	7	2.2
middle (7-14)	125	38.5	middle (12-24)	214	65.8
high (14-20)	58	17.8	high (24-36)	104	32.0

### **Farmers' environmental attitude**

Table 4 depicts that there was positive significant correlation between belonging to community, effectiveness of agricultural extension, amount of environmental stimuli, environmental knowledge, Knowledge of environmental legislation, acceptance of modern ideas, psychological comfort, tendency towards modernization, planning for future, effectiveness of governmental organizations, effectiveness of public services, environmental socialization, degree of religiosity, geographical openness, tendency towards investment, rational consumption, exposure to mass media, membership of NGO's, and socio-economic level with farmers' EA, respectively. Other variables did not show any significant correlation. Thus, Hypothesis 2 was not fully supported.

**Table 3.** Descriptive of farmers' environmental knowledge, environmental attitudes, pro-environmental behavior, and knowledge-behavior gap

Total of each category	Frequency (n)	(%)	Total of each category	Frequency (n)	(%)
EK			PEB		
very low (< 34)	8	2.5	very low (< 34)	8	2.5
low (34-67)	5	1.5	low (34-67)	3	.9
middle (67-100)	85	26.2	middle (67-100)	154	47.4
high (100-133)	114	35.1	high (100-133)	125	38.5
very high (133-165)	113	34.7	very high (133-165)	35	10.8
EA			KBG		
very low (< 28)	Nil	Nil	no gap ( $\leq 0$ )	75	23.1
low (28-54)	Nil	Nil	very low (1-10)	102	31.4
middle (54-81)	61	18.8	low (10-19)	95	18.2
high (81-108)	205	63.1	middle (19-28)	44	13.5
very high (108-135)	59	18.2	high (28-37)	27	8.3
			very high (37-45)	18	5.5

**Fig.1.** Environmental knowledge**Fig.2.** Environmental attitude**Fig.3.** Pro-environmental attitude**Fig.4.** Knowledge-behavioral gap

### Farmers' pro-environmental behavior

Table 4 illustrates that there was a positive significant correlation between environmental knowledge, Knowledge of environmental legislation, acceptance of modern ideas, tendency towards investment, EA, rational consumption, belonging to community, age, planning for future, effectiveness of agricultural extension, effectiveness of governmental organizations, socio-economic level, psychological comfort, effectiveness of public services, amount of environmental stimuli, geographical openness, degree of innovative, environmental socialization, effectiveness of NGO's and contact with change agents with farmers' pro-environmental behavior. Other variables did not show any significant correlation. Thus, Hypothesis 3 was not fully supported.

### Farmers' knowledge-behavioral Gap

Table 4 depicts that Hypothesis 4 cannot be rejected fully. Where there was negative significant correlation between effectiveness of agricultural extension, EA, psychological comfort, belonging to community, Effectiveness of public services, rational consumption, socio-economic level, planning for future, tendency towards investment, effectiveness of governmental organizations, tendency towards modernization,



membership of NGO's, amount of environmental stimuli, contact with change agents, geographical openness, degree of religiosity, environmental socialization, acceptance of modern ideas and degree of innovative with farmers' KBG. Whereas there was positive significant relationship with Knowledge of environmental legislation. Other variables did not show any significant correlation

**Table 4.** Correlation among different variables

Variables	EK	EA	PEB	KBG
Age	.186**	.005	.206**	-.034
Educational level	-.025	.121*	-.065	-.044
Environmental socialization	.290**	.222**	.244**	-.155**
Socio-economic level	.324**	.131*	.169**	-.311**
Effectiveness of governmental organizations	.288**	.249**	.175**	-.244**
Effectiveness of NGO's	.176**	-.018	.137*	-.108
Effectiveness of public services	.320**	.246**	.163**	-.313**
Effectiveness of agricultural extension	.400**	.422**	.180**	-.423**
Amount of environmental stimuli	.253**	.340**	.160**	-.206**
Exposure to mass media	.094	.154**	.077	-.054
Cultural openness	-.021	.104	.005	.042
Geographical openness	.236**	.209**	.146**	-.197**
Contact with change agents	.211**	.087	.110*	-.202**
Degree of religiosity	.169**	.212**	.086	-.164**
Tendency towards investment	.351**	.198**	.254**	-.244**
Degree of innovative	.188**	.094	.142*	-.122*
Acceptance of modern ideas	.310**	.283**	.288**	-.131*
Tendency towards modernization	.205**	.268**	.078	-.236**
Planning for future	.340**	.252**	.202**	-.294**
Membership of NGO's	.188**	.146**	.068	-.212**
Rational consumption	.361**	.172**	.214**	-.312**
Psychological comfort	.326**	.279**	.168**	-.317**
Belonging to community	.360**	.473**	.210**	-.316**
Knowledge of environmental legislation	.390**	.303**	.415**	.204**
EK		.338**	.795**	
EA			.138*	-.375**

\*  $p$ -value  $\leq 0.05$  \*\*  $p$ -value  $\leq 0.01$

### Differences Analysis

The fifth Hypothesis addressed potential gender difference of pertaining to knowledge, attitudes, behavior, and knowledge-behavior gap related to EP. To test this hypothesis, a Mann-Whitney U Test was used. The results of this test are presented in Table 5.

No significant differences between males and females in each of EK and EA were found. However, there were significant differences between male (mean rank=169.6) and female (mean rank=137.2) in PEB scores in favor of the males. Also, there were significant differences between males (mean rank=141.1) and females (mean rank=168.6) in terms of the knowledge-behavior gap in favor of females. Therefore, the data supported Hypothesis 5 that significant differences would exist between males and females on the study's variables.

### Regression analysis

The sixth hypothesis of the current study dealt with the influence of variables mentioned in the first hypothesis and farmers' environmental KBG. To test this hypothesis, stepwise regression analysis was used. The results of this test are presented in Table 6.

Table 6 indicates that only nine among twenty variables entered the regression model had significant influence on farmers' KBG. These nine variables together explained 34.7% of total variance in farmers' KBG of EP in the region selected for the study. Effectiveness of agricultural extension considered alone explained 17.9%. Effectiveness of public services explained 4.9%. EA alone explained 3.3%. Socio-economic level alone explained 2.4%. Psychological comfort alone explained 2.3%. Knowledge of environmental legislation alone explained 1.2%. Belonging to community alone explained 1%. Membership of NGO's' alone explained .9%. Rational consumption alone explained .8%. Thus, Hypothesis 6 was not fully supported.

**Table 5.** Results of Mann-Whitney U Test

Variables	Grouping Variable: Gender				Mann-Whitney U value	Z value	Asymp. Sig.
	Male (n=259)		Female (n=66)				
	Mean Rank	Sum of Ranks	Mean Rank	Sum of Ranks			
EK	165.56	42880.0	152.9	10095.0	7884.0	-.973	.330
EA	163.6	42385.0	160.5	10590.0	8379.0	-.247	.805
PEB	169.6	43919.5	137.2	9055.5	6844.5	-2.499	.012
KBG	141.1	9310.0	168.6	43665.0	7099.0	-2.126	.033

**Table 6.** Results of stepwise regression analysis

Source of variation	Sum of squares	Degree of freedom	Mean square	F-ratio	p-value		
Regression	21350.07	9	2372.23	18.62	0.000		
Residual	40121.24	315	127.36				
Total	61471.31	324					
Variables in the equation							
Variables	R <sup>2</sup> cumulative	R <sup>2</sup> Change	F Change	P Change	β	t-value	Sig.t
Constant	-	-	-	-	68.85	8.247	.000
Effectiveness of agricultural extension	.179	.179	70.37	.000	-.254	-2.01	.044
Effectiveness of public services	.228	.049	47.68	.000	-.036	-3.15	.002
EA	.261	.033	37.87	.000	-.080	-3.34	.001
Socio-economic level	.285	.024	31.69	.000	-.105	-3.27	.001
Psychological comfort	.308	.023	28.43	.000	-.381	-2.70	.007
Knowledge of environmental legislation	.320	.012	24.99	.000	.480	3.39	.001
Belonging to community	.330	.01	22.34	.000	-.280	-1.92	.055
Membership of NGO's	.339	.009	20.23	.000	-.683	-2.32	.021
Rational consumption	.347	.008	18.62	.000	-.226	-2.03	.042

## Discussion and Conclusion

The main objective of this paper was to try answer the question “do farmers what they know they should?” the results of the present study revealed that farmers in the sample had higher levels of EK and attitude in comparison to their levels of environmental behavior. The results also showed a gap between respondents' EK and pro-environmental behavior. These results confirm that farmers do not always do what they know they should when it comes to environmental behavior.

Correlation analysis results indicated farmers' environmental knowledge, attitudes and behavior related to EP are linked to other rural community variables like effectiveness of agricultural extension agency, effectiveness of public services, effectiveness of governmental organizations and farmers' personal variables such as degree of belonging to the community, knowledge of environmental legislation, degree of acceptance of modern ideas, positive tendency towards investment, degree of planning for future, degree of feeling of psychological comfort, degree of environmental socialization in childhood, amount of environmental stimuli, degree of rational consumption, socio-economic level, degree of geographical openness, and NGO memberships.

Also, correlation analysis results showed that rural community variables such as the effectiveness of agricultural extension agency, effectiveness of public services, effectiveness of governmental organizations, and higher of farmers' personal variables like positive EA, degree of psychological comfort, degree of belonging to community, degree of rational consumption, socio-economic level, degree of planning for future, positive tendency towards investment, positive tendency towards modernization, membership of NGO's, amount of environmental stimuli, degree of contact with change agents, degree of geographical openness, degree of religiosity, degree of environmental socialization in childhood, acceptance of modern ideas, and degree of innovative, resulted in decreases in farmers' KBG.

Stepwise regression analysis results that, only nine variables had significant influence on farmers' KBG of EP. These variables together explained 34.7% of total variance in farmers' KBG of EP in the region selected for the study. Effectiveness of agricultural extension was the strongest predictor, followed by effectiveness of public services, then EA, then socio-economic level, then psychological comfort, then knowledge of environmental legislation, then belonging to community, then membership of NGO's, and finally

rational consumption. All of above variables had negative influence on total variance of farmers' KBG except the variable of environmental legislation which had positive influence. This positive influence might be due to the lack of government control on farmers' behavior with respect to practices in the field of EP in the air, soil and water, and due to the weakness of environmental socialization

Differences analysis results indicated that there were no significant gender differences among farmers in terms of EK and attitudes. There were significant differences between males and females in terms of PEB in favor of males. Also there were significant differences between males and females in knowledge-behavior gap in favor of females. These results indicate farmers' male exhibit more PEB than females and that the knowledge-behavior gap is smaller for males than females.

Finally, from this study and given the seriousness of environmental problems in Egypt, it is suggested that environmental education needs to incorporate learning objectives associated with elevating both EK and PEB among present and future farmers. In addition, the government needs to increase its control over wrongful practices that are detrimental to the protection of the environment and enforce laws related to environmental legislation.

Furthermore, this study recommends increasing community women participation with men in order to achieve a comprehensive and sustainable development and to reduce the gender gap, through applying environmental policy adopting the philosophy of sustainable development, which requires taking environmental, social and economic sides into consideration, without neglecting to deal with the immediate environmental problems.

### **Limitations**

The study was conducted in one governorate in Egypt and does not allow for any generalization about Egyptian farmers. Another limitation of the study is related to the translation process of the interviews that were conducted in Arabic. According to Temple and Young (2004), the "domestication" of research into English language can cut the ties between language and culture and leads to the disadvantage of non-English speakers.

### **Suggestions for future research and applications**

This study explored the gap between male and female farmer' knowledge and behavior related to EP, and investigated the variables affect farmers' KBG. However, it is important to design a study that investigates the variables that affect the gap between male and female farmer' knowledge and behavior related to EP.

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