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# **Improving Agricultural Extension Services through Knowledge Management Practices in the Delta Region of Egypt: An Applied Study of Knowledge Management Model**

**Heba Essam El-Dien Aly Salama<sup>1\*</sup>**

<sup>1</sup>*Department of Agricultural Extension Programs Research, Agricultural Extension and Rural Development Research Institute, Agriculture Research Center, Egypt.*

## **Author's contribution**

*The sole author designed, analysed, interpreted and prepared the manuscript.*

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## **ABSTRACT**

Knowledge management is considered as an essential factor for the sustainable development of enterprises in the agricultural context. A consecutive workshops were conducted for senior and junior agricultural extension workers (AEWs) of two Governorates of the Delta region namely: Beheira and Kafr-Elsheikh. A purposive sample of 11 senior AEWs and 20 junior AEWs was selected. The Wiig knowledge management model (KMM) of four stages was used to identify the knowledge management practices. Descriptive statistics (frequencies and percentages) were used for presenting interview responses and Chi Square Test was used to determine the differences between senior and junior AEWs regarding their responses. The most important results were: the respondents obtain explicit knowledge from the statistics department and pamphlets. Types of formulating and documenting knowledge were the periodical minutes and reports. The available knowledge was compatible with the farmers' problems. Remembering the explicit knowledge was facilitated by frequent use of the acquired knowledge. Explicit knowledge was kept on computer bases of the specialized departments. Aggregating and categorizing knowledge were rallying on

\*Corresponding author: E-mail: [heba2220@hotmail.com](mailto:heba2220@hotmail.com);

personal efforts. The practical knowledge was provided through awareness-raising meetings with farmers. Significant differences were found between senior and junior AEWs regarding their responses concerning: obtaining the tacit knowledge, compatibility of knowledge with farmers' problems, and retrieving knowledge. Among the most important recommendations were: conducting training programs on knowledge management concept and practices for AEWs and establishing knowledge management units at the central and the two Governorates level. Some suggested recommendations are: forming specialized team to organize and document the tacit knowledge, allocating storage units for knowledge including new tools and the required electronic devices, coordinating research institutions with agricultural extension organizations in transferring farmers' problems through formal procedures, and supporting the provision of AESs and developing the evaluation methods of the provided services. These predictors, however, need further work to validate reliability.

**Keywords:** *Knowledge management; knowledge management models; explicit knowledge; organization; agricultural extension services; knowledge management practices.*

## 1. INTRODUCTION

The vast amount of agricultural information creates a need for an appropriate mix of traditional and new approaches to use among target categories of rural people.

In Egypt, the farmers' move to produce agro-export products stimulates an increasing demand for distinctive Agricultural Extension Services (AESs) considering the ever-decreasing numbers of Agricultural Extension Workers (AEWs).

The human capital inside the agricultural extension organization is considered one of the most essential components of improving AESs. A considerable amount of knowledge and experiences are lost due to the retirement of senior extension workers [1]. The total number of AEWs is 2503. The number of AEWs in the age category which ranges from 31 to 40 years is 188 while their number is 266 in the age category which ranges from 51 to 60 years (Central Administration for Agricultural Extension, 2018). This problem is articulated by non-replacement. Knowledge management practices (KMPs) could facilitate the more effective provision of AESs to Egyptian farmers and producers.

According to Mohajan [2], Wiig knowledge management model (Wiig KMM), is one of the most preferable models that investigates knowledge management in the organization, is used in this study as a benchmark to achieve a better understanding of the current situation of (KMPs) inside the agricultural extension organization in two Governorates in the Delta of Egypt, namely: Kafr-Elsheikh and Beheira. Hence, the findings could be an eye-opener for the planners and public policymakers to the

situation of effective interventions that could be implemented to provide better AESs.

### 1.1 Literature Review

The concept of knowledge management (KM) appeared in the first decade of the 1990s as a necessity for dealing with larger amounts of data and the digitalization of information. Despite its simplicity, this definition encompasses the most important character of this concept: knowledge must be collated and put into a form that is comprehensible to all its users [3].

It can be argued that the most vital resource of today's enterprise is the collective knowledge residing in the minds of an organization's employees, customers, and vendors. Organizations are increasingly valued for their intellectual capital [4].

The most important criteria for a sustainable KM model in agriculture are the ability to provide the necessary information in the required time, organizational costs and level of user satisfaction [5]. To both increase farm income and improve rural livelihoods among the rural poor, it is necessary for most public extension organizations to transition its services toward small-scale men and women farmers, including the landless. At the same time, technology transfer and advisory services tend to be increasingly privatized [6].

In the last few years there has been a growing interest in knowledge as a key resource of the organization and it can be viewed in some instances as a commodity [7]. Knowledge refers to information that enables action and decisions or information with direction. Hence, knowledge

is intrinsically similar to information and data, although it is the richest and deepest of the three [4]. Data are raw and unprocessed facts resulting from observation, experimentation or calculation. Information is data that have been given a meaning and contexts. Knowledge is the practical and theoretical understanding of a subject. Finally, wisdom is the ability to think and act using knowledge [7].

Knowledge in organizations is often classified into two types which are explicit knowledge and tacit knowledge. The first one is explicit knowledge, which refers to knowledge that has been expressed into words and numbers. Such knowledge can be shared formally and systematically in the form of data, specifications, manuals, drawings, audio and videotapes, computer programs, patents, and the like. In contrast, tacit knowledge, which is difficult to express and formalize, therefore difficult to share. Tacit knowledge is more likely to be personal and based on individual experiences and activities [4].

In this context Cahyaningsih and et.al [8] reported that human capital is collection of individual knowledge, skill, abilities, ideas, and experiences as organizational intangible value to improve the organizational initiatives. In related references it was observed that the analysis of the consulting services offered by six consulting companies in the field of ergonomics in the United States revealed that KM system has a set of requirements that offered the best conditions for implementing ergonomics solutions. These conditions included: knowledge extends from workers experience to technical innovations and economic changes, knowledge becomes useless if workers are not encouraged to learn it and use it in their daily activities, the social context of knowledge transfer is highly important, employees should feel important, respected and motivated, and organizations should invest time and resources to implement KM [3].

Knowledge can be acquired in different ways and through different routes. Knowledge may be gained through observation and experience; this is referred to as experiential knowledge, and formal knowledge obtained from institutions and involves theories and formulae that are usually found in textbooks and handbooks.

The growing importance of knowledge has led to the concept of knowledge management [7]. Among the many definitions presented in the literatures, the most preferred is that knowledge

management is a process of creating and using knowledge to improve the effectiveness of the organization' activities, management of information, knowledge, and experience available in the organization.

KM helps identify, select, manage, share and disseminate information to improve the knowledge for problem-solving, strategic planning and enhance the organizational intellectual capital value [8].

That means; knowledge management is the process of using sequential steps to acquire, design, manage and share knowledge within an organization to achieve better performance through reduced costly rework, faster work and use of best practices [9].

However, the results offered by Madsen [10] in a study in Denmark found that the links between the different parts of the Danish AKIS were informal and had very few official document papers connecting them but in the same time, they were rather strong links.

Knowledge management model (KMM) is a combination of data or information into a reusable format for preserving, improving, sharing, aggregating and processing knowledge to stimulate intelligence. The Wiig's KMM is highly favored because it addresses the organization as a whole and includes business areas that are commonly found in most organizations. He proposed an organizational KM cycle of four consecutive stages as; building, holding, pooling, and using knowledge [2].

These stages could be simplified as follows:

- 1) **Building knowledge stage:** Which focuses on the various sources to acquire and build knowledge such as experts and advisers, training courses, procedures and instructions, research, books, media, inspections, and observations. It consists of a) obtaining knowledge; b) Analyzing knowledge indicates extract potential knowledge, c) Organizing Knowledge for specific uses. d) Reconstructing and synthesizing for coping knowledge with new and existing knowledge, and e) Codifying and modeling knowledge which includes assembling and documenting knowledge to post it to a knowledge repository.
- 2) **Holding knowledge stage:** Which empathize tacit knowledge and includes: a) Remembering which means that individual

has retained the item of knowledge, b) Accumulating is concerned with creating a computer knowledge base and encoding knowledge to facilitate its storage in organizational memory, and c) Embedding that comprises archiving knowledge and storing the content in another less costly or less bulky medium for easy and frequent future retrieval.

- 3) **Pooling knowledge stage:** Which aims to collect information about locating knowledge in the various sources. It consists of a) coordinating collaborative teams to create a 'who knows what' network, b) assembling to gather knowledge sources into a library or repository, and c) accessing and retrieving knowledge through consultation, obtaining a second opinion from an expert, or discussing a difficult case with a peer.
- 4) **Using knowledge stage:** As a way of using practical knowledge within an organization at various management levels. This includes routine tasks, production, and services to identify problems and the suitable knowledge for resolving these problems. Moreover, to explore the alternative solutions and implementing selected solutions.

The researchers have arrived at the conclusion that agricultural extension organizations should focus on interacting with farmers and knowledge generators more than just conveying knowledge to the farmers [11]. Extension agents primarily work as "knowledge brokers" in facilitating the teaching-learning process among all types of farmers. The field staff first works with different groups of farmers to first identify their specific needs and interests then the next step is to identify the best sources of expertise that can help these different groups to address specific issues and/or opportunities [6].

One of the examples of the role of target groups in applying the KM concept was an Italian case study demonstrated that the farmers were the main driving force for applying KM practices for improving the performance and competitiveness of their enterprises. The most preferable result of KM activity for interviewed farmer's information is depicted in the article. Therefore, the importance of using KMM and the necessity of extension services [5].

The agricultural sector in Egypt is considered as one of the most important economic sectors. The Delta and the narrow valley of the Nile comprise

5.5% of the area of Egypt, but have over 95% of its people and its agriculture. Populated Nile delta is seriously threatened by sea-level rise [12].

One of the most critical challenges makes matters worse and faced by the Egyptian Ministry of Agriculture and Land Reclamation (MALR) is the ever decreasing numbers of AEWs. The AESs are provided by a staff of only 2503 covering the 27 governorates all over the country [13]. Furthermore, due to the inverted pyramid of the staff's age structure a considerable part of them will leave within the next few years and very few will be replaced because of the hiring freeze in many sectors.

In this context, several consecutive workshops were conducted on the improvement of the KM system of the agricultural extension organization in the frame of collaboration between Water Management Reform Program of MALR and German Corporation for International Cooperation (GIZ) in two Governorates of the Delta namely: Beheira and Kafr El-Sheikh.

Participants of these workshops were the representatives of Central Administration for Agricultural Extension (CAAE), Agricultural Research Center (ARC), some organizations which are providing AESs such as Central Union of Cooperatives and related departments in the two Governorates.

The following lessons were learned from these workshops including: the volume of explicit knowledge and the number of databases were relatively limited in the extension organization, there were no agricultural documentation centers, knowledge mainly exists as tacit knowledge and comprehensive strategies, procedures or tools for the retention of it still have to be developed and implemented, facilities for the storage of knowledge in the extension service were extremely limited, absence of institutional memory directly affected the extension staff and their ability to disseminate Knowledge to rural target groups, media centers were losing the know-how network due to the retirement of experts, number of copies of booklets and other printed extension material was insufficient, and the impact of the media on the target groups was not sufficiently evaluated. [14].

In this context, Zahran [15] reported that imbalances in human resource management create a technological information gap between

the available knowledge in research and extension organizations and the available agricultural knowledge of farmers.

## 1.2 The Study Hypotheses

Based on the theoretical framework and review of literature, the following hypotheses were tested:

- 1- There are no significant differences between senior and junior AEWs regarding their responses concerning all items of the KMM stages.
- 2- There are no significant differences within senior AEWs regarding their responses concerning all items of the KMM stages.
- 3- There are no significant differences within junior AEWs regarding their responses concerning all items of the KMM stages.

## 2. MATERIALS AND METHODS

### 2.1 Methodology

#### 2.1.1 Description of the study area

The study was conducted at two Governorates that are considered the biggest agricultural Governorates of the Delta region namely: Beheira and Kafr-ElSheikh. Beheira Governorate consists of 14 districts and its total area is 9119.17 km<sup>2</sup>. It is considered as a one of the first Governorates in the production and exporting of fruits [16]. The population of the Governorate is 6.17 million people [17]. Kafr El-Sheikh Governorate consists of 10 districts and its total area is 3748 km<sup>2</sup>. It is the most popular Governorate in the production of rice, sugar beet, wheat and cotton [18]. The population of the Governorate is 3.36 million people [17].

#### 2.1.2 Sample technique

In the light of the uncertainty of the knowledge management practices should be taken in the extension organization, awareness workshops on the improvement of the knowledge management system were conducted for senior and junior AEWs in the frame of collaboration between Water Management Reform Program of MALR and German Corporation for International Cooperation (GIZ) in Beheira and Kafr El-Sheikh Governorates. The participants were better eyes to achieve the study' objectives. A purposive sample of 11 senior AEWs and 20 junior AEWs was selected. The age category was over 57 years for seniors AEWs and below 45 years for juniors AEWs.

#### 2.1.3 Data collection

The Wiig KMM [2] of four stages was used to identify the KMPs as a benchmark considering the local situation. Data were collected by using a questionnaire through personal interviews during July and August, 2018. Respondents were asked to provide answers towards some questions covering all items for each stage of the studied model. Respondents were asked an open question of each item of the KMM individually. The responses were recorded for each of the respondents and frequencies were calculated for all of them. The KMM stages were as follows:

The first stage is building knowledge, which focused on: a) obtaining knowledge, b) formulating knowledge, c) compatibility of knowledge with farmers' problems, and d) documenting knowledge.

The second stage is holding knowledge which assessed: a) remembering the acquired knowledge, b) creating computer knowledge bases, and C) establishing units for archiving and storing knowledge.

The third stage is pooling knowledge which focused on: a) aggregating information, b) categorizing sources of knowledge, and c) retrieving knowledge.

The fourth stage is using knowledge which identified provided agricultural services using the practical knowledge.

#### 2.1.4 Data analysis and presentation

Descriptive statistics (frequencies and percentages) were used for presenting interview responses of the respondents to identify the four stages of KMM importance level of their responses that handle in questionnaire. Four levels scale was utilized as follows: very important which ranged from 100% to 75%, important from 74% to 50%, fairly important from 49% to 25%, and not important from 24% and less 0% to 24%. Chi Square Test was used to determine the differences between senior and junior AEWs regarding their responses concerning all items of the KMM.

## 3. RESULTS AND DISCUSSION

As shown in Table 1, the current situation of AESs through KMPs could be presented as follows:

### 3.1 First Stage: Building Knowledge

The respondents mentioned eight methods used to obtain explicit knowledge in terms of the very important level of response. All of them referred to the statistics department, ARC pamphlets, the head of agricultural extension administration, Subject Matter Specialist (SMS) for field crop, and field crop specialist at districts level. The majority of them (96.8%) referred to the pest control specialist at district level. SMS for horticulture at Governorate level and the head of horticulture administration were identified by (93.5%) for each.

More than three-fourths of the respondents (87.1%) referred to their personal experiences as a very important level to obtain explicit knowledge. The majority (90.3%) of the respondents referred to the periodical minutes and reports as the types of formulating knowledge. More than three-quarters of the respondents (77.4%) mentioned that the available knowledge is highly compatible with the farmers facing problems in the area of horticultural crops.

The majority of the respondents as reported by (90.5%) and (90.3%) respectively regarding the very important level of response indicated two types of documenting knowledge; the periodical minutes and reports, crop records and seasonal statistics. Less than two-thirds of the respondents (64.5%) mentioned social media mediums as an important type for documenting knowledge.

The results revealed a relatively high misconception related to the sources of tacit knowledge and explicit knowledge among the respondents. However, the available knowledge contributes to solving the problems facing farmers. More than half of the respondents considered social media mediums as a type for documenting knowledge which indicated a need for developing the types of documenting.

The results thus obtained were compatible with the study of Muthuveloo et.al [19], which focused on the impact of tacit knowledge management on organizational performance in Malaysia and indicated that knowledge creation, sharing, and retention should be given priority. On the other hand, the study revealed that many of local and foreign companies located listed in the Federation of Malaysian Manufacturers directory operating in developing countries focus mainly

on hardware or skills needed instead of quality and knowledge management.

### 3.2 Second Stage: Holding Knowledge

The majority of the respondents (90.3%) mentioned that their frequent use of the acquired knowledge facilitate remembering the explicit knowledge regarding the very important level of response. However, only about quarter of the respondents (25.8%) reported that they review and check their knowledge by referring to its source. All the respondents reported that they keep knowledge and experience in their minds to remember tacit knowledge. Less than one-fifth of them (19.4%) indicated sharing knowledge and experience through www mediums as a way of remembering knowledge.

Creating computer bases for holding explicit knowledge was mentioned by all respondents of the specialized departments and IDSC at the Directorate level. Additionally, indicated the absence of computer bases for the tacit knowledge. Regarding archiving and storing knowledge there was a consensus among the respondents in three units available: the specialized departments at the Directorate level, agricultural extension administration, and library of the agricultural directorate.

The limited domains of extension work facilitate better remembering the knowledge by the respondents even though, this should be organized in the future considering the ever changing agricultural technologies.

About two-thirds of the respondents considered social media mediums as a type for documenting knowledge whereas, less than one-third of them share their knowledge and experience through these mediums. The absence of computer bases for the tacit knowledge was indicated by all respondents, which calls for speedy creation of computer bases.

These results consistent with a recent case study conducted at Dakahlia Governorate, Egypt by Mohamed [20] regarding knowledge management requirements of one of the new areas in agriculture which is the rural environmental awareness, the results indicated that determinants of the material and human resources of the entities working in awareness and coping with the risks were weak while, these determinants were reasonable regarding coordination, communication, evaluation, and future development of these entities.

**Table 1. Distribution of AEWs' responses according to the items of KMM stages that mentioned in used questionnaire form (N=31)**

<b>First Stage: Building Knowledge</b>	<b>F</b>	<b>%</b>	<b>Level of Importance</b>
<b>A- Obtaining knowledge</b>			
- <i>Explicit Knowledge</i>			
1- The statistics department and Information and Decision Support Center (IDSC) at directorate level	31	100	1 <sup>st</sup> level: V.I.
2- ARC pamphlets	31	100	
3- The head of agricultural extension administration	31	100	
4- Subject Matter Specialist (SMS) for field crop at Governorate level	31	100	
5- Field crop specialist at districts level	31	100	
6- Pest control specialist at districts level	30	96.8	
7- SMS for horticulture at Governorate level	29	93.5	
8- The head of horticulture administration	29	93.5	
9- Materials of training programs	22	71.0	2 <sup>nd</sup> level: I.
10- The official for recycling agricultural residues	11	35.5	3 <sup>rd</sup> Level :F.I.
11- World Wide Web	6	19.4	4 <sup>th</sup> level: N. I.
12- Publications of donor development projects	2	6.5	
- <i>Tacit Knowledge</i>			
1- Accumulation of the past personal experiences	27	87.1	1 <sup>st</sup> level: V. I.
2- Observing the administration head' behavior in managing discussions and solving problems	11	35.5	3 <sup>rd</sup> Level: F.I.
3- Accompanying the cotton crop specialist in the field visits	3	9.7	4 <sup>th</sup> level: N. I.
4- No method for obtaining knowledge (The seniors' experiences are insufficient to meet the juniors' needs of knowledge)	2	6.5	
5- Training by doing with the manager of the agricultural extension center (until his retirement then the communication was interrupted)	1	3.2	
<b>B- Formulating knowledge</b>			
1- The periodical minutes and reports	28	90.3	1 <sup>st</sup> level: V. I.
2- The activities of Farmer Field Schools' programs (FFS)	9	29.0	3 <sup>rd</sup> level: F.I.
3- Taking notes for using them later	9	29.0	
4- Preparing abstracts around the subject through browsing the internet	9	29.0	
5- Rural development activities	6	19.4	4 <sup>th</sup> level: N. I.
6- The new pamphlets of development projects	4	12.9	
<b>C- Compatibility of knowledge with farmers' problems</b>			
1- A highly knowledge compatibility for field and horticultural crops	24	77.4	1 <sup>st</sup> level: V. I.
2- Knowledge requires adding/updating in the field of livestock production	7	22.6	4 <sup>th</sup> level: N. I.
3- The knowledge incompatible with the requested tasks	5	12.9	
<b>D- Documenting knowledge</b>			
1- Crop records and seasonal statistics	29	93.5	1 <sup>st</sup> level: V. I.
2- The periodical reports (monthly/yearly)	28	90.3	
3- Social media mediums	20	64.5	2 <sup>nd</sup> level: I.



<b>Second Stage: Holding Knowledge</b>			
<b>A-Remembering the acquired knowledge</b>			
<i>- Explicit Knowledge</i>			
1- The frequent use of knowledge for successive seasons	29	93.5	1 <sup>st</sup> level: V. I.
2- Reviewing knowledge from its source	8	25.8	3 <sup>rd</sup> level: F.I.
<i>- Tacit Knowledge</i>			
1- Keeping knowledge and experience in their minds	31	100	1 <sup>st</sup> level: V. I.
2- Sharing information and experience by www mediums	6	19.4	4 <sup>th</sup> level: N. I.
<b>B- Creating computer knowledge bases</b>			
<i>- Explicit Knowledge</i>			
1- Keeping knowledge on computer bases of the specialized departments and IDSC at the Directorate level	31	100	1 <sup>st</sup> level: V. I.
<i>- Tacit Knowledge</i>			
1- Absence of computer bases	31	100	1 <sup>st</sup> level: V. I.
<b>C- Establishing units for archiving and storing knowledge</b>			
1- The specialized departments at the Directorate level (information and statistics)	31	100	1 <sup>st</sup> level: V. I.
2- Agricultural extension administration (periodical reports and posters)	31	100	
3- Library of the agricultural directorate (books- pamphlets – leaflets)	31	100	
<b>Third Stage: Pooling knowledge</b>			
<b>A- Aggregating information</b>			
1- Personal efforts	31	100	1 <sup>st</sup> level: V. I.
<b>B- Categorizing sources of knowledge</b>			
1- Personal efforts and social relations	31	100	1 <sup>st</sup> level: V. I.
<b>C- Retrieving knowledge</b>			
1- Reviewing the statistics and extension pamphlets	31	100	1 <sup>st</sup> level: V. I.
2- Consulting the current manager of the agricultural extension department	27	87.1	2 <sup>nd</sup> level: I.
3- There is no way for retrieving knowledge	4	12.9	4 <sup>th</sup> level: N. I.
4- Consulting the former manager of the department	3	9.7	
5- Consulting well experience colleague	1	3.2	
<b>Fourth Stage: Using knowledge</b>			
<b>A- Provided agricultural services</b>			
1- Raising farmers' awareness with recommendations of the prevalent crops through extension meetings	31	100	1st level: V.I.
2- Awareness farmers with rationalized irrigation practices in the frame of Water Users Associations activities	31	100	
3- Enhancing the potential of rural people through farmer field schools	10	32.3	3 <sup>rd</sup> level: F.I.
4- Training farmers of agricultural residue recycling practices	8	25.8	
5- Improving knowledge and skills of rural women	4	12.9	4 <sup>th</sup> level: N.I.

\* Multiple responses recorded (N=31), V. I. =Very important, I. Important, F. I. = Fairly Important, N. I. = Not Important

### 3.3 Third Stage: Pooling Knowledge

Considering the very important level category, the results revealed that all respondents counted on their efforts and good social relations with their colleagues and managers to aggregate and categorize knowledge. Furthermore, all of them review and check statistical and extension pamphlets.

Pooling knowledge is a very important element in KM system to organize various sources of knowledge and facilitate using them, despite this, all respondents had to leverage their social relations with colleagues and manager for keeping and organizing these sources. This emphasizes the pressing need to form a specialized team for establishing and organizing knowledge' sources.

These results in good agreement with the study of Zahran [15] on the challenges of agricultural knowledge management which were: the absence of ongoing and stable situation for agricultural knowledge utilizing, the prevalence of agricultural knowledge' gaps, the need of professional team for agricultural knowledge management, and cooperating with poorly equipped agricultural organizations.

### 3.4 Fourth Stage: Using Knowledge

All respondents mentioned that the main provided extension activities were awareness raising meetings to farmers conducted in the area of new recommendations of prevalent crops and rationalized irrigation practices in the frame of Water Users Associations activities. Considering the not important level category, it was only 12.9% of them referred to rural women activities.

These findings were confirmed by the study of Naba [21], which referred to the absence of the relationship between the parties of agricultural knowledge system at Dakahlia Governorate, Egypt because of the lack of coordination, lack of awareness of the tasks, absence of the specialization for each party, and the poor budgets.

As shown in Table 1 the extension activities and services were provided through few forms. Hence, improving KMPs could contribute to up-scaling the current extension activities and raising the quality of services in particular for women's development activities.

regarding their responses concerning all items of the Wiig KMM stages could be summarized as follows:

### 3.5 First Stage - Building Knowledge

Significant differences were found within each of senior AEWs and junior AEWs regarding their responses concerning the following items: obtaining both of the explicit knowledge and the tacit knowledge, formulating knowledge, and compatibility of knowledge with farmers' problems, while no significant differences were found within each of senior and junior AEWs regarding their responses concerning documenting knowledge.

Additionally, significant differences were found between senior AEWs and junior AEWs, regarding their responses concerning the obtaining the tacit knowledge and compatibility of knowledge with farmers' problems, while no significant differences were found concerning formulating knowledge and documenting knowledge.

The previous results could be interpreted by the nature of tasks managed by the high-top senior AEWs as high top officials and junior AEWs as executives. The different duties affected their ways for obtaining and formulating knowledge. Seniors tend to be concerned with the tacit knowledge related to applying the work regulations skillfully while juniors concentrated on field results rather than the methods used to achieve them.

For senior AEWs' obtaining knowledge was restricted with the limited domains of work while the juniors' perceptions tends to focus on the procedures for supplementing their field activities. Consequently, seniors view the knowledge as appropriate for solving farmers' problems, whereas juniors focus on knowledge related to different field areas of work. The results indicated that the concept of documenting knowledge was not clear enough for both of senior and junior AEWs.

### 3.6 Second Stage - Holding Knowledge

Significant differences were found within each of senior AEWs and junior AEWs regarding their responses concerning remembering the acquired knowledge, while no significant differences were found regarding their responses concerning creating computer knowledge bases, establishing units for archiving and storing knowledge.

Table 2. Results of Chi square for the items of KMM

<b>First Item: Obtaining knowledge</b>				
<b>A- Explicit Knowledge</b>				
<b>Hypotheses Tests</b>	<b>Chi square calculated</b>	<b>DF</b>	<b>Chi square tabular</b>	<b>Significant</b>
H <sub>1</sub> : Seniors & Juniors	9.645	11	19.675	Non
H <sub>2</sub> : Seniors workers	22.937*	11	19.675	0.05
H <sub>3</sub> : Juniors workers	39.770**	11	24.725	0.01
<b>B- Tacit Knowledge</b>				
H <sub>1</sub> : Seniors & Juniors	9.523*	4	9.488	0.05
H <sub>2</sub> : Seniors workers	40.000**	4	13.277	0.01
H <sub>3</sub> : Juniors workers	26.242**	4	13.277	0.01
<b>Second Item: Formulating knowledge</b>				
H <sub>1</sub> : Seniors & Juniors	8.174	5	11.070	Non
H <sub>2</sub> : Seniors workers	18.598**	5	15.086	0.01
H <sub>3</sub> : Juniors workers	23.235**	5	15.086	0.01
<b>Third Item: Compatibility of knowledge with farmers' problems</b>				
H <sub>1</sub> : Seniors & Juniors	10.702**	2	9.210	0.01
H <sub>2</sub> : Seniors workers	10.333**	2	9.210	0.01
H <sub>3</sub> : Juniors workers	8.000*	2	5.991	0.05
<b>Fourth Item: Documenting knowledge</b>				
H <sub>1</sub> : Seniors & Juniors	0.764	2	5.991	Non
H <sub>2</sub> : Seniors workers	2.000	2	5.991	Non
H <sub>3</sub> : Juniors workers	0.572	2	5.991	Non
<b>Second Stage – Holding Knowledge</b>				
<b>First Item: Remembering the acquired knowledge</b>				
<b>Hypotheses Test</b>	<b>Chi square calculated</b>	<b>DF</b>	<b>Chi square tabular</b>	<b>Significant</b>
H <sub>1</sub> : Seniors & Juniors	6.148	3	7.815	Non
H <sub>2</sub> : Seniors workers	11.320*	3	7.815	0.05
H <sub>3</sub> : Juniors workers	19.980**	3	11.341	0.01
<b>Second Item: Creating computer knowledge bases</b>				
H <sub>1</sub> : Seniors & Juniors	0.0	1	3.841	Non
H <sub>2</sub> : Seniors workers	0.0	1	3.841	Non
H <sub>3</sub> : Juniors workers	0.0	1	3.841	Non

<b>Third Item: Establishing units for archiving and storing knowledge</b>				
H <sub>1</sub> : Seniors & Juniors	0.0	1	3.841	Non
H <sub>2</sub> : Seniors workers	0.0	1	3.841	Non
H <sub>3</sub> : Juniors workers	0.0	1	3.841	Non
<b>Third Stage Pooling Knowledge</b>				
<b>First Item: Aggregating knowledge</b>				
<b>Hypotheses Test</b>	<b>Chi Square Calculated</b>	<b>DF</b>	<b>Chi Square Tabular</b>	<b>Significant</b>
H <sub>1</sub> : Seniors & Juniors	0.0	1	3.841	Non
H <sub>2</sub> : Seniors workers	0.0	1	3.841	Non
H <sub>3</sub> : Juniors workers	0.0	1	3.841	Non
<b>Second Item: Categorizing sources of knowledge</b>				
H <sub>1</sub> : Seniors & Juniors	0.0	1	3.841	Non
H <sub>2</sub> : Seniors workers	0.0	1	3.841	Non
H <sub>3</sub> : Juniors workers	0.0	1	3.841	Non
<b>Third Item: Retrieving knowledge</b>				
H <sub>1</sub> : Seniors & Juniors	10.731*	4	9.488	0.05
H <sub>2</sub> : Seniors workers	20.273**	4	13.277	0.01
H <sub>3</sub> : Juniors workers	48.045**	4	13.277	0.01
<b>Forth Stage – Using Knowledge</b>				
<b>First Item: Provided agricultural services</b>				
<b>Hypotheses Test</b>	<b>Chi Square Calculated</b>	<b>DF</b>	<b>Chi Square Tabular</b>	<b>Significant</b>
H <sub>1</sub> : Seniors & Juniors	2.920	4	9.488	Non
H <sub>2</sub> : Seniors workers	10.774*	4	9.488	0.05
H <sub>3</sub> : Juniors workers	30.885**	4	13.277	0.01

Moreover, no significant differences were found between senior and junior AEWs regarding their responses concerning all items of the stage.

These results could be explained for senior AEWs in the light of dealing with the concrete knowledge frequently and in accordance with their limited fields of work and for junior AEWs by their strong desire to remember knowledge and looking for new ideas to facilitate remembering knowledge. Respondents' views about creating computer knowledge bases and establishing units for archiving and storing knowledge weren't compatible with the concept of these two items.

### 3.7 Third Stage - Pooling Knowledge

Significant differences were found within each of senior AEWs and junior AEWs regarding their responses concerning retrieving knowledge. Significant differences were found between senior and junior AEWs regarding their responses concerning the same item.

No significant differences were found within each of senior AEWs and junior AEWs regarding their responses concerning aggregating knowledge and categorizing sources of knowledge. No significant differences were found between senior and junior AEWs regarding their responses concerning the previous two items.

This could be explained by senior AEWs tend to retrieve knowledge from the available sources whereas; junior AEWs prefer inter-personal communication to retrieve knowledge and take the advantage of www mediums to share the new knowledge with others. Additionally, the absence of the required procedures of aggregating knowledge and categorizing sources of knowledge.

### 3.8 Fourth Stage – Using Knowledge

Significant differences were found within each of senior AEWs and junior AEWs regarding their responses concerning the provided agricultural services, while no significant differences were found between senior and junior AEWs regarding their responses concerning the same item.

The previous results could be interpreted by the seniors' dependence on the traditional methods in providing extension service, while juniors are concerned with the most approaches and skills to achieve the field tasks.

As shown in Table (2), the most important results of the differences between senior and junior AEWs

## 4. CONCLUSION

In the recent years transforming farmers to the commercial farming has led to an increasing need for AESs. Improving AESs depends to a great extent on how knowledge is managed in the extension organization. AEWs should be involved as facilitators in managing knowledge to provide effective support to farmers. However, studies related to the knowledge management in agricultural extension organization in Egypt are still limiting.

A primary concern of this study was to investigate the existing situation of KM system in the extension organization. The Wiig KMM was used as a benchmark to identify the viewpoints of senior and junior AEWs in two Governorates of the Delta region namely, Beheira and Kafr El-Sheikh. Differences between senior and junior AEWs concerning their responses regarding all items of the KMM stages were assessed.

The results revealed some methods used by the respondents to obtain explicit knowledge include: the statistics department, ARC pamphlets, and the head of agricultural extension administration. About (87.1%) of the respondents referred to their personal experiences as way to obtain explicit knowledge and (90.3%) of them referred to the periodical minutes and reports as the types of formulating knowledge. Most of them viewed that the available knowledge is compatible with the farmers' problems.

The majority of the respondents indicated; the periodical minute and reports, crop records and seasonal statistics as types of documenting knowledge. Moreover, (90.3%) stressed on their frequent use of the acquired knowledge, which facilitate remembering the explicit knowledge. They hold explicit knowledge on computer bases of the specialized departments and IDSC at the Directorate level while these bases are not available for the tacit knowledge.

All respondents depend on their efforts and good social relations to aggregate and categorize knowledge. There was a consensus among the respondents that awareness raising meetings are the main provided activities to farmers.

Significant differences were found between senior AEWs and between junior AEWs regarding their responses concerning; obtaining both of the explicit knowledge and the tacit knowledge, formulating knowledge, compatibility of knowledge with farmers' problem, remembering the acquired knowledge, retrieving

knowledge, and the provided agricultural services. Significant differences were found between senior AEWs and junior AEWs regarding their responses concerning; obtaining the tacit knowledge, compatibility of knowledge with farmers' problems, and retrieving knowledge.

The current KM system in the agricultural extension organization is criticized for low effectiveness. This based on lack of specialized units for KM and the technological aids required for application of KMPs.

Additionally, KMPs were not clear enough in the respondents' minds. Misconception of some items of KMM among the respondents was revealed.

## 5. RECOMMENDATIONS

- Enhancing building knowledge stage through providing the AEWs with the required knowledge according to the operational surveys and field studies. Moreover, there is a need for conducting training programs for AEWs of diagnostic analysis tools such as participatory rural appraisal (PRA), SWOT analysis, social mapping, value chains. Media support centers need to be promoted to provide the required publications for the AEWs. Additionally, specialized teams need to be forming within extension organization to organize and document the tacit knowledge of the approaching retirement AEWs.
- Supporting holding knowledge stage through allocating storage units for knowledge including new tools and the required electronic devices to facilitate knowledge retrieval.
- Activating pooling knowledge stage through coordinating research institutions with agricultural extension organizations in transferring farmers' problems through formal procedures. This will facilitate keeping the dispersed knowledge.
- Improving using knowledge stage through supporting the provision of AESs through utilizing FFSs, self help groups, ICTs technologies, etc. Additionally, developing the evaluation methods of the provided services.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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