



Full Length Research Paper

Knowledge Management Approach for Managing Indigenous Knowledge of Crop Production

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Submission Date: November 25/2019

Acceptance Date: January 10/2020

Abstract

*Indigenous knowledge refers to a complete body of knowledge, know-how and practices maintained and developed by peoples through generations in rural areas. However, the usage of this knowledge is decreasing at alarming rates. Thus, the aim of the study was to identify indigenous knowledge of crop production in Southwest Shewa Zone. Purposive sampling technique was used for the study. Focus group discussion as well as questionnaire were the used for data collection. The finding of the study indicated that women have a great role to store and protect crops as well as for seed selection. To protect crops from weevils, the grain stored in a locally made storage known as dogoogoo/gumbii. Moreover, it is mixed with powder of leaves of *Croton macrostachyus*. To improve crop production in indigenous system, farmers used methods like crop rotation, using animal manure, fallowing and sowing quality seed. The farmers acquired this knowledge by seeing and doing, sharing or transferring through oral and folklores and preserve it in their memory. However, there are numbers of barriers of managing this knowledge, among others modernization, oral transfer, lack of interest to receive it by younger generation, lack of recognition, records and trust. Therefore, the researchers recommended that all responsible bodies engage in formal documentation, sharing and transferring of this knowledge. To this end, the researchers proposed knowledge management framework that helps on how indigenous knowledge should be managed.*

Key Terms: *Agriculture, Crop production, indigenous knowledge, knowledge management, Sustainable agricultural development*

Axareeraa

Beekumsa Ganamaa jechuun qaamaafi ka'umsa beekumsa hundaa, oggummaa baadiyyaa keessatti ummaatootan kalqamanii raawwatamaaniifi guddaataa dhaloota dhalootatti darbaa jiranidha. Haata'u malee, itti fayyadamni beekumsa kanaa haala saffisaa ta'een hir'ataa jira. Kanaaf, kaayyoon goroo qorannoo kanaa, Godian Kibbaa Lixxaa Shawwaa keessatti haalatti Beekumsa Ganamaatiin midhaan oomishan qorachuu ture. Walitti qabiinsa raga qorannoo kanaaf idatteessuu kayyeeffataatti (Purposive sampling) dhimma baa'ameera. Ragaa waliit qabuuf meeshaalee bargaaffiifi marii garee xiyyeeffannootti dhimma bahameera. Argannoowwan qorannoo kanaas, dubartoonni midhaan kuusuufi ol kaa'uu, akkasumas sanyii ol kaa'uu irratti ga'ee guddaa akka qaban mul'isa. Haaluma kanaan, sanyii haala gaariin ol kaa'uuf wantoota naannoo isaanitti hojjeetaman irraa kan Gumbii jedhamutti fayyadamu. Kunis, midhaan ol kaa'an sanatti daakuu baalaa bakkannisaa (Croton macrostachyus) itti naquuni. Oomisha midhaanii foyyessuuf qote bulaan sanyii marsaan facaasuu, ciicata/dikee (xaa'oo bu'aa beelladaa) fayyadamuufi sanyii qulqullina qabu facaasuun Beekumsa Ganamaa hawaasa bakka qorannoo sanaati. Qonnaan bultoonni Beekumsa Ganamaa kana kan argatan bifa ilaaluuniifi (shaakaluun) hojjechuun, kan waliif dabarsan afaaniin bifa Fooklooriitiin sammuu isaanii kessatti qabachuuni. Haata'u malee, ammayyummaan, afaaniin dadarbuun, darggaggoonni fedha dhabuun, beekamtii dhabuu, warabamuufi itti amanannu dhabuun Beekumsa Ganamaa kun akka gufatu godhaa jira. Kanaaf, qaamni ilaallatu marti waarabamuu isaafi dhaloota dhalootatti daddabarsuuf hojiiwwan fuulduratti hojjetamuu qabanidha. Dhuma irratti, qoratoonni kunneen "knowledge management framework", haala saayinsaawaa taheen akkaataatti Beekumsa Ganamaa kun ittiin hogganamu qabu beeksisuuf yaada dhiyeessuudhaaf yaalleerra.

***Jechoota Ijoo:** Beekumsa Hogganuu, Beekumsa Ganamaa, Midhaan Oomishuu, Qonna, Guddina itti fufiinsa qabu.*

1. Introduction

Indigenous knowledge (IK) refers to a complete body of knowledge, know-how and practices maintained and developed by peoples through generations, generally in rural areas (Lodhi and Mikulecky, 2010). IK is thus a type of knowledge which is generated mostly at local area by indigenous people and mostly practiced by its holders.

Even though IK is broad; this study focuses on IK of agricultural practices of crop production (CP) which is the economic base and the backbone of the developing country, like Ethiopia. CP is the process of growing and harvesting of the crops for own consumption and/or sale (Federal Democratic Republic of Ethiopia, 2008). The farmers are familiar with how and when to sow seeds, how to store and protect grains, how to prepare and manage land for planting, harvest the crops and to cope up with rainfall variability by using IK of crop production. Even if most of CP and other agricultural practices in developing countries are performing using IK, factors like globalization or modernity of local community affect it. However, the accessibility of the latest technology of agriculture is high prices relate to return (Cavatassi *et al.*, 2006). So far, the recent agricultural practices around the world reveals that using of the latest technological advancements in agricultural sector will not be as appropriate method as indigenous practices in order to realize the target of sustainable agricultural development (Kazmi *et al.*, 2014).

However, a lot of IK have been lost through the deaths of elderly people since there is no recorded and filed document (Akullo *et al.*, 2007). Consequently, the future generation will be enforced to lose the IK of their environment that had retained in the minds of their ancestors. As a result, knowledge about that community and management of natural resources like land, water, plant, animal, health protection, weather forecasts and agricultural practices will disappeared.

Therefore, in this knowledge based economy, the erosion of IK can be reduced through appropriate investigation and formal documentation of it. Due to its compatibility with the preservation of the local environment and sustained development of the concerned community, the preservation of IK has become important (Anwar, 2016). Besides, this knowledge is used to provide the empirical data, methods and concepts for modern science regarding crop domestication, crop rotation and plant breeding as well as management, principles and practices of agro-ecology, agro-forestry, pest, soil, natural forest and biodiversity and other agricultural activities (International Council for Science, 2002). These indicate that the role of IK is not only ensuring sustainable agricultural development, but also it is the base for modern crop production.

However, many scholars assured that the effort of working towards management of IK is less in developing countries (Mosia and Ngulube, 2005). In order to increase the management of IK, it is necessary to explore before it becomes extinct all over the world. Now a day, some researchers explain that the Knowledge Management (KM) approach will be functional in rural communities if it is really practiced. KM encompasses the processes and practices concerned with the creation, acquisition, sharing and use of knowledge, skills and expertise and follow a circular flow and a nonstop process that continually updates itself (Cong *et al.*, 2007).

For several decades, different studies link KM approach only with formal enterprise. Today, some scholars are assessing and indicating KM approach to the informal structure like rural communities. Hence, this study was initiated with the following objectives.

1.1 Objectives of the Study

- To identify how crop production is practiced by using IK with respect to selecting, storing and protecting crops, improve the productivity of crops and cope up with rainfall variability in the study area,
- To investigate the mechanisms used to acquire, share, preserve and use IK of crop production in the case of Southwest Showa Zone, Oromia,
- To determine the barriers of managing IK of crop production in rural communities in Southwest Shewa Zone (SWSZ),
- To develop a framework of KM approach for managing IK of crop production practices.

2. Methodology

For this study the cross-sectional survey research method was used.

2.1 Population of the Study

In Ethiopia, the adoption of agricultural technologies like fertilizers and agricultural chemicals was started since 1987 by Derg regime (Asmeromand Abler, 1994). This means that in Ethiopia, an expansion of an exogenous agricultural knowledge had been before 31 years ago. Also, in context of developing countries, old age occurred at the ages of 45 (Kowal and Dowd, 2001). Based on these points of view, the participants of Focus Group Discussion (FGD) of this research were farmers whose ages were ≥ 45 years in the four selected Kebeles. Besides, questionnaires were distributed to agricultural extension workers of the four selected Kebeles, and agricultural officers of the SWSZ and of both selected Woredas. The total population of the study was 364.

2.2 Sampling Technique and Sample Size

By using purposive sampling technique, two Woredas were selected from SWSZ based on the information obtained from the manager of zonal agricultural office. And he informed the researchers that Woliso and Bacho Weredas were the foremost in using IK for crop production in the zone. Based on the information gained from the manager four Kebeles were selected for this study. From 279 elderly farmers whose age is ≥ 45 , 58 farmers have participated in FGD.

Moreover, all of the eight (8) agricultural extension workers of four Kebeles and 21 participants were purposively selected based on their specialization, namely plant science and/or agronomy from a total of 77 agricultural offices of SWSZ to fill out the questionnaire. Therefore, the total sample of this study participants were 87 excluding key informants.

2.3 Instruments of Data Collection

In order to collect the appropriate information, the researchers used FGD, questionnaire and observation. Accordingly, two FGDs were conducted from each selected Kebeles of both Weredas. In this study, FGDs were categorized into 8 groups and the participants in one Kebele were 6 to 9. And the total numbers of participants in FGD were 58. And the researchers translated the checklist prepared in English into the respondents' language, Afaan Oromoo so that they understand the questions well and respond.

In order to find out the view of both workers of agricultural extension and agricultural officers regarding IK of crop production, questionnaire was devised as a second data collection tool. The questionnaire contained both close ended and open items. Thus, the questionnaire was distributed in English and Afaan Oromoo based on the respondent's preferences. Besides, the researchers observed without actively participating in the actual activities that related to IK crop production practices at that specified time in the study area. For this purpose, the researchers went to the farmers' house and the farming land and observed what is really going on through IK of crop production.

2.5 Data Analysis and Interpretation

The research method used for this study was both qualitative and quantitative research. The researchers have mixed both research methods by using sequential transformative strategy. The data obtained through observation and FGD were analyzed qualitatively, whereas the data gained via questionnaire were analyzed quantitatively using tabular method and frequency, mean (X) and Standard Deviation (SD). The frequency of the Likert's scale was tabulated descriptively using the number of frequencies of the responds by statistical package social science software (SPSS) version 23. To analyze the results, the researchers considered the percentage corresponding to the X and the SD of the scale for analysis. According to Alston and Miller (2002) and Mohammad *et al.* (2014), the results from five Likert's scales is interpreted based on X value as 1.0-1.49 Strongly Disagree (SDA), 1.5-2.49 Disagree (DA), 2.5-3.49, Undecided (UN), 3.5-4.49 Agree (A) and 4.5-5 Strongly Agree (SA).

3. Results

3.1 Indigenous Knowledge for Seed selection

On the technique of seed selection, the participants of FGD stated that they use IK as follows. Since the grain that is well ripe and not well ripe are harvested together by using sickles, it will be separated during winnowing by air. The grain that is well ripe has weight and dropped at the back, whereas the unripe one thrown in the middle or fall to the front with the straw/chaff. Thus, the grain that has weight, the well ripe and dried will be preserved for seed and it is viable to germinate for 4 to 6 years. Related to this, though both husband and wife can select seed, most of respondents explained that the wife has more responsibility to select and protect the seed.

3.2 Harvesting Crops by using Indigenous Knowledge

According to the data obtained by FGD, since it will contribute to the lost of the grain, the crops should be harvested earlier or before it become dried too much. Starting from harvesting till threshing, farmers prefer being in group to help each other which is known as *daaboo* (cooperation) in the study area so that the matured crops is harvested within short time than staying on the farmland for extended time and exposed to loss. In that community harvesting process is known as *haamaa*.

Respondents in FGD said that the uses of folklore (*afoola*) as a mechanism to encourage each other during the processes of crop production as well as for sharing or transferring this knowledge. These common folklores were heroic tale (*geerarsa*), proverb (*mammaaksa*), poem (*walaloo*), song (*sirba*), work song (*weedduu hojii*) and customary law of Oromo (*tumaa Oromoo*).

A common poem for the harvesting time as stated during the FGD was:

*“Hamilee haamtuu beeka,
Goomattuu ollaa beeka,
Maasiin eebba qaba,
Warri farsoo qaba”.*

When translated:

"The harvester knows about harvesting,

The neighbor knows someone who envy,
 The land has a bless,
 The owners have a traditional beer".

The first message of this poem was, there is one who is jealous in the neighborhood. Also, another point regarding to the poem was the land consists blesses for farmer because he sew and harvested it as well as they drink and enjoy by the traditional beer of crops which is harvested from the land.

As stated in FGD, the folklore that is used by the farmers during their crop production was customer law known as *Tumaa*. Before commanding this law, the harvesters sing song to express their feeling of hungry/thirsty and informing the owner of the work that the lunch and drink should come on time. However, when the time for lunch approach, but the person who should bring the lunch is not coming and the workers start to make the customary law (*tumaatumatu*). The owner of the work will be punished by tying his hand to back with a rope. Then, the owner of the work Abbaa Daboo will call his first guarantee (*wabii*) for lunch (*laaqana*). Following that, they start to punish that owner for lunch two bread (*daabboo lama*), four jars of local bear (*farsoo*) and four liters of local alcohol (*araqee*) should come to lunch. If the time of the lunch passed, the guaranteed person will also be punished by putting a thorn of *Silybummarianum* (*qorattii sokorruu*) in his hand by bending in to back until the lunch come.

Additionally, if the workers are not satisfied by lunch provided, the owner will be punished again in a similar manner as before. Then the Abbaa Daboo will call another guarantee for dinner. And they open their second phase of making their customary law by saying "*tumaantumaa Oromooti*". Means this custom law is the Oromos' custom to make stronger their custom law and it should be executed. Then after that they start to punish for evening dinner by making double and the water prepared for their hands should be warmed. If this owner does not prepare as ordered, workers will bit by a tree branch (simple sticks) at an evening dinner. Then the owner's wife (*haadha warraa*) says the following poem for them by shouting:

*Maaloo Abbaa Manaa koo hin hidhinaa
 Waan hanqate hundaanuu nan guutaa.*

To mean

OK, ok do not arrest my husband, please,
 I will full fill what remains.

And they will shout as 'Uuuu', then after, all things will come as needed. After they satisfied by what they ate and drunk, they start to enjoy by singing for what they have eaten and its message was thanks for the food and drink of the crops which was produced by their own hand. Moreover, they also sing the song which entitled as "*haadha farsoo naqteef weddisu*" for the woman who made the local/traditional bear and the message is inspiring her to provide more of it for them.

3.3 Indigenous Knowledge of Crops Storage and Protection

The responds obtained in all FGD reveals that the IK based crops storage is the most effective to protect the crops from damage and it is known as *dogogoo or gumbii* (figure 3.1). Respondents in FGD said that the wise wife prepares *gumbii* by mixing soil, water and teff straw by hand and store the grain in. One *gumbii* will be allowed to store only one type of crop at once.

In order to protect the crops from damage like, to prevent it from being eaten by *daana'oo* (weevils), the selected crops will be added into the *gumbii* at night because it is a cold time and should be closed by the prepared cover and it should be put in dry place. Otherwise the crops will be damaged and will not germinate if used as a seed for next season. Thus, the wife has to check it and protect strictly. Additionally, on protection of IK based crop storage from insects, responds from FGD noted that the leaves of the *Croton macrostachyus* tree (*bakkanniisa*) can be used. The respondents said that the leaves of this tree are dried, grounded (crashed) into mortar and then mixed with the crops and no insects can harm the crops. As the data gained via observation, the IK based crop's storage that available in the rural communities of the study area was shown in figure 3.1.



Figure 3.1: IK based crop storage known as *dogogoo/gumbii*

3.4 IK Strategy that the Farmers Plan to cope up with Rainfall Variability for Crop Production

As participants in FGD explained, they are familiar in predicting whether rain season (*Arfaasaa*) is approaching or not as well as to coping up rain variability by using their IK for crop production. Following this, those respondents said that as a pointer for the rain is coming soon, the leaves of (*laaftoo*) *Acacia abyssinici* trees start to become green which were dried for a long time. Also, participant in FGD1 of Gurura Baka Kebele said "*coqorsai* (*Cynodondactylon*) start to grow over the land and cover the lands. Similarly, respondents in FGD said that to indicate that the rain is soon to come, *Albizia gumifera* or *Albizia schimperiana* trees (*Mukarbaa*) to get rid of its earlier leaves and start to develop new leaves. Also, other respondents of FGD said that the false banana (*Warqee*) leaves which were wilted in the winter season will start to re-grow up and this is also an indicator of rain prediction. This shows that most of farmers are familiar with IK based rainfall prediction to be ready for their crop production.

As stated in FGD, in order to control excess rain from harming the sowed seed by using IK, the farmers will make *bo'oo* (ditch) so that the rain water passes around the land without washing away the seed. On the other hand, the participants rose about coping up insufficient rain linking

by using IK of crop production practices as follows. While insufficient rain causes the disease on the sowed seed which known as *waraantuu* (rust fungi) which harm the crops during the drying seasons, the farmers overcome this problem by replacing the damaged crops by another type of crops that can be sown later if there is a possibility to farm another crops on that land. If no option to replace, the land would be left in that year and exposed the societies for food crisis. In order to overcome this food insecure, they will sell livestock like sheep, goat and so on to buy grain for consumption.

3.5 Techniques of Improving Crop Productivity Using Indigenous Knowledge

1. Crop Rotation

According to the response in the FGD, most of the farmers prefer mono cropping and each crop is planted in its own term because it is not comfortable for weeding, harvesting, threshing and storing dissimilar crops together. Also, in order to fertilize the soil and to improve the yield, the crops should be produced by rotating, what they call *midhaan jijjiirani* *facaasuu*. Additionally, respondents explained that all crops do not grow well on all parcel of land. For instance, the land of teff, wheat and of maize is not the same but based on the type of the soil. Also, the flowers, stem, root and leaf of the crops which fall on the land help to fertilize soil for the crops that will be planted in the next year. Moreover, the crops like beans, peas, chickpeas, lentils, *etc* has the capacity which helps to fertilize the soil. The results reveals that the main purpose of crop rotation (*midhaan jijjiirani* *facaasuu*) is to fertilize the land, it is easy for weeding, harvesting and threshing, different types of crops will adapt to different soil as well as not all crops have same capacity to fertilize the soil. Hence, farming the lands without rotating crops can deplete the fertility of the soil and as a result the land cannot give enough production.

2. Using Compost

As stated by respondents in FGD, the manure of domestic animals like cows/oxen, donkeys, horses, goats, sheep is one source of soil fertilization. This can be done in two ways. As they stated, one method is by standing home animals like cows on the farmland, it decomposes and then fertilize the soil. Another method is by collecting animal manure from the barn, where the animals stay overnight and disperse the farm land.

3. Fallowing the land for a Season

The participants in FGD said that by leaving the land without farming for a specified time in order to recover natural fertility, that farm land can be fertilized by itself. This activity is known as *lafa lafa baasuu*. Related to this, they stated that the grasses and weeds grown on land will be dried by sun and then broken down on by animals' legs, decomposes and fertilize the soil.

3.6 The mechanisms used to acquire, share and preserve Indigenous Knowledge of crop production

3.6.1 Acquisition of Indigenous Knowledge of crop production

As both the responds gained via FGD and open ended questions reveals, almost all of the respondents experienced with any actions related to IK of crop production starting from their

childhood because his/her family were farmers. This shows that farmer acquired IK of crop production by seeing and doing as well as taking instruction from his/her parents. However, as said in FGD, the younger generations have no interest to learn this knowledge from their parents. This indicates that since youth were unwilling to acquire IK of crop production from family, their awareness towards the benefits of this knowledge is low. As a consequence, the indigenous mechanism of acquiring this knowledge is missed its effectiveness in this globalization age.

3.6.2 Sharing and transferring of Indigenous Knowledge of crop production

The responds from FGD reveals that the parents transfer the IK of crop production to their children via practice, advice or mentoring them on each activities of crop production. Moreover, farmers were using their folklore to transfer and share their IK of crop production among their families or partners. For instance, *geerarsa* is effective to transfer the message that the farmers should be ready and start to farm land always in spring (*arfaasaa*) season. Therefore, the result shows that the farmers share and transfer their IK of crop production for each other or for their children starting at childhood by doing and orally in the form of advice or orientation and folklores.

3.6.3 Preserving Indigenous Knowledge of crop production

On the preserving IK of crop production, respondents in FGD said that parents have responsibility in order to teach their children not to forget how to farm, weed and so on. Additionally, one respondent in FGD expressed his feeling how he preserved the farming knowledge by saying "*Anaaf qonni dhiiga koo keessa jira*". To mean that for me, farming is there in my blood. This indicates that he is personalized, stored and preserved IK in his memories as an inerasable storage medium. Also, on effectiveness of IK preserving mechanisms, the participants in FGD said that there is no any tangible way of preserving it. This shows that the orally transmitting and preserving IK of crop production in practice and memory of farmers is not effective to preserve this knowledge.

Hence, the better methods of preserving IK of crop production, the responds of FGD were stated as follows. It is better to use the combinations of IK and modern knowledge by comparing their good experiences. This reveals that integrating of IK to the modern knowledge can help to preserve IK of crop production as well as ensures sustainable agricultural development with high yield crop production. So, respondents in FGD said the farmers should be asked to identify both good and bad experiences of IK of crop production and also the professionals should have to evaluate the effectiveness of the technology based crop production as well as advice and support how both knowledge can be integrated. This reveals that IK of crop production should not be discouraged as it is and it needs to carefully identify its bad and good experience.

Additionally, in FGD it was stated that it is better to document and transmit from generation to generation; also it should be supported by education. Moreover, the responds in open ended questions confirmed that in order to manage IK, it should be organized, recorded in the form of videos, documented in the form of manuscripts, transferred to farmers' children as well as the good experience of IK should be shared. Thus, the results reveal that in order to manage IK of crop production in a proper manner, it should be the acquired, used, shared and preserved.

3.7 Barriers of Managing of IK of crop production

The data collected through questionnaire and FGD indicates that although the IK of crop production has much significance, there were several barriers of managing it (table 3.1).

✓ **Table 3.1: Significance and limitation of indigenous knowledge of crop production**

NO.	Items	Respondents' frequency of satisfaction (%)					Central Tendency		Decision for X
		SA	A	UD	DA	SDA	X	SD	
1	Farmers more rely on IK for their crop production practices for:								
A	accessibility	56.5	26.1	13	4.3	0.0	4.35	0.88	A
B	Effectiveness (good for health and quality)	47.8	30.4	8.7	13.0	0.0	4.13	1.05	
C	save time	0.0	0.0	0.0	26.1	73.9	1.26	0.44	SD
D	save labor	0.0	0.0	0.0	26.1	73.9	1.26	0.44	
E	save cost	43.5	47.8	4.3	0.0	4.3	4.26	0.91	A
F	high yield production	4.3	13.0	26.1	39.1	17.4	2.48	1.082	DA
2	IK of crop production contributes for SAD	39.1	34.8	8.7	17.4	0.0	3.96	1.107	A
3	IK contributes for exogenous knowledge	69.6	26.1	0.0	4.3	0.0	4.61	0.722	SA

As can be seen in table 3.1, the respondents put their scale of satisfaction for the reasons why farmers more rely on IK for their crop production practices as agreed on the accessibility of this knowledge, due to it save cost and the effectiveness (good for health and quality) of crops produced by this knowledge at mean of 4.35, 4.26 and 4.13, by variation of 0.885, 0.915 and 1.058 from average respectively. Since, the response variation of 0.885 smaller than others, farmers were relying on IK of crop production for the accessibility of the knowledge at most. In contrast, as it is seen from table 3.1, they strongly disagreed on the statement said that IK of crop production can save time and labor at mean of 1.26 for both by variation of 0.449 from average. Similarly, the respondents disagreed on the crops produced by using IK offers high yield production at mean 2.48 with a little over 1 point (1.082) away from the mean. Related to this, most of responds in open ended question indicates that agricultural professionals discourages the usage of this knowledge because it did not provide high yield production. To strengthen this, then responds in FGD also reflects that the farmers did not gain high yield from IK of crop production.

Thus, the results reveal that farmers were relied more on IK of crop production for the accessibility of this knowledge at most and followed by saving cost which expended in usage of

this knowledge and effectiveness of the crops produced through IK for health with quality respectively; not for it save time and labor and provide high yield of crops.

Additionally, the results shown in table 3.1 indicate the respondents were agreed and strongly agreed with statements said IK of crop production contributes for sustainable agricultural development and of exogenous knowledge at variation of 1.107 and 0.722 from mean of 3.96 and 4.61 respectively. Besides this, the responds from both FGD and open ended questions reveals that the IK of crop production has a great role for ensuring sustainable agricultural development as well as it is fundamental for the development of modern agricultural knowledge correspondingly. To confirm this, one respondent from FGD explained as IK of crop production contributes sustainable agricultural development, especially technology based weeding can kill living organisms which helps for land fertilization by nature and for the environment, though the IK based does not harm. This demonstrates that IK based weeding system keeps land fertilization sustainably. Generally, this assured that IK based crop production does not harm the continuousness of agriculture, although it kills time and asks much energy.

Moreover, in responds to open ended questions, most of the participants said that IK is the base for the innovation of modern/exogenous knowledge and thus the agricultural professionals believe that IK contributes to the development of exogenous knowledge. Therefore, it is essential to determine the major barriers of managing this knowledge in the area of crop production, which are presented in table 3.2.

✓ **Table 3.2 Barriers of managing indigenous knowledge of crop production in the rural community (Values in bracket indicate standard deviation)**

NO.	Items	Respondents' Frequency of ' Satisfaction (%)					Central Tendency
		SA	A	UD	DA	SDA	X
A	Poor knowledge sharing culture	47.8	21.7	17.4	13.0	0.0	4.04 (1.107)
B	Poor recognition of IK	21.7	52.2	8.7	17.4	0.0	3.78 (0.998)
C	Lack of IK records	56.5	21.7	13.0	8.7	0.0	4.26 (1.010)
D	Lack of trust	26.1	39.1	17.4	17.4	0.0	3.74 (1.054)
E	No interest to receive IK by younger generation	30.4	47.8	8.7	13.0	0.0	3.96 (0.976)
F	Oral transfer of IK	56.5	34.8	4.3	4.3	0.0	4.13 (0.968)
G	Change of life style	56.5	34.8	4.3	4.3	0.0	4.43 (0.788)

Where SA = strongly agree, A = Agree, UD = undecided, DA = Disagree, SDA = strongly disagree, SD = Standard deviation, X = mean

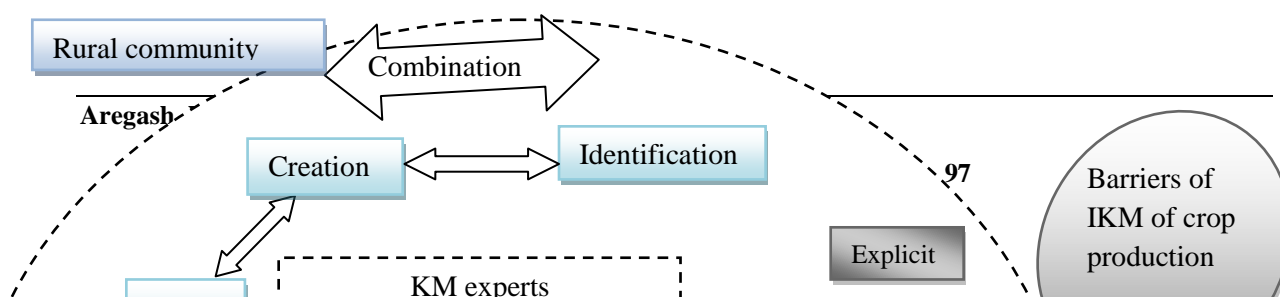
As presented in table 3.2, the respondents' level of satisfaction on different items considered as barriers of managing IK in the rural community, namely for change of life style, oral transfer of IK, interest to receive IK by younger generations, poor recognition of IK, lack of IK records, poor knowledge sharing culture and lack of trust by variation was respectively 4.43(0.788), 4.13(0.968), 3.96 (0.976), 3.78(0.998) 4.26 (1.010), 3.74 (1.054) and 4.04 (1.107) respectively. From the finding it can be seen that change of life style is the top barrier of IK of crop production.

As stated in FGD, in order to enhance the yield of their crop production as well as to be harmless from the limitation of IK, they had started to use technology for crop production. Thus, the use of IK in the community is declining. For instance, in earlier times, to thresh a small amount of crops, oxen were used, but today those who have not financial problem are threshing crops by machine in a simple way. This helps farmers to save their time. This shows that the use of IK of crop production is declining due to the technology based crop production in rural areas as well as its practice consumes time and much labor.

Additionally, participants of FGD said that today's youth is saying to them what you benefited from farming because your living standard is the same as your grandparents. Thus, in collaboration with data obtained from FGD and questionnaire, ever since farmers acquired IK of crop production from his/her parents; the use of this knowledge is decreasing at alarming rate. This is because of barriers such as limitation of IK crop production, like time and labor consummation, failure to solve some problem at hand and low yield, its discouragement from agricultural professionals, modernization (change of life style), oral transfer of IK, no interest to receive IK by younger generation, poor recognition to IK, lack of IK records, lack of trust and poor knowledge sharing culture respectively.

3.8 Framework for Knowledge Management Approach in Managing Indigenous Knowledge of Crop Production

According to Kok (2005), the KM approach for IK is cultural approach. Because, this approach takes into account the context, culture and people in which knowledge is created and used (Pienaar, 2009). Hence, the researchers incorporated the five main entities of the proposed framework. And these include the rural community, the major barriers of managing IK of crop production, the responsible bodies to play the role of indigenous knowledge management, KM key attributes including knowledge conversion and exogenous knowledge system. The KM attribute thus include knowledge creation, identification, acquisition, store, share/transfer via knowledge conversion model (socialization, externalization, combination and internalization), promotion/mentor, preservation, evaluation, selection and usage.



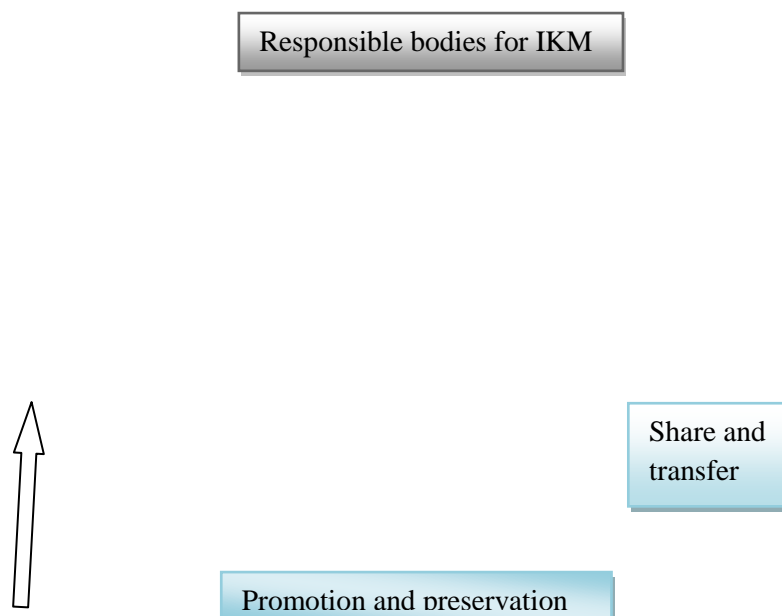


Figure 3.2: The proposed framework of Indigenous knowledge management of crop production

- ✓ This framework depicted in figure 3.2 was developed based on the results of the present study and the concepts adopted from literature about KM and IKM framework proposed by another researcher, like Lwoga (2011). The rural community was not well organization, but they are ready to interact with external community or other individuals, the researchers had represented the rural community by dashed circular. As noted by Cong *et al.* (2007), KM follows a circular flow and a nonstop process that continually updates itself. Thus, the researchers represented the IKM of crop production by solid circular. In order to show the cooperation and contribution of the responsible bodies for strong IKM of crop production, KM is placed at the center.

Therefore, the following responsible bodies were identified to be included in the development of the framework.

- ✓ KM professionals should have identified, capture and document IK of crop production.
- ✓ Through including this knowledge in education program, other and agricultural students should have good awareness about it.
- ✓ Farmers should enhance trust between themselves to improve their knowledge sharing culture. Also, they should use good experience of IK side by side with exogenous knowledge of crop production.
- ✓ Young generation should improve their interest to adopt this knowledge.

- ✓ Agricultural professionals should support farmers in using this knowledge and good experience of modern knowledge of agriculture.
- ✓ Additionally, the flowchart arrow down from the top is to show the sources of barriers of IKM of crop production were from both external and internal of the rural community. And, the dashed line of this arrow was used to show it is simple to be solved by the collaboration of those responsible bodies. Also, the up-down arrow at the bottom is used to indicate the important of accessibility of agricultural technology to solve some limitations of IK of crop production and the contribution of this knowledge for exogenous knowledge.
- ✓ In general, as indicated on the framework, the barriers to IK crop production hinder the management of this knowledge in the rural community. Hence, the concerned bodies of IKM of crop production with their capable of managing this knowledge through the application of KM. Finally, the framework was evaluated through in face to face (direct communication) by the agricultural experts of the two selected Weredas. Then the researchers gave it to the agricultural experts and some of KM professionals to give comments it on. Finally, those participants confirmed the applicability of this framework to play its role in management of IK of crop production.

4. Discussion

According to the findings of this study, the farmers can forecast the rainy season by observing changes to floras like noticing of sprouting of the *coqorsa* (cynodondactylon), trees like *laaftoo* (acacia abyssinicia), *mukarbaa* (albiziagumifera or albiziaschimperiana) and indigenous crop like false babana (*warqee* or enset). This prediction helps farmers to get ready by preparing seeds, materials, lands, and so on. To strengthen this, Risiro *et al.* (2012) supported that one type of biological indicators that elderly farmers used IK for weather forecasting plants in addition to animal behavior, birds, insects and human ailments determine their activities particularly preparation of land, planting and harvesting. However, the type and name of plants used for predicting weather prediction were not identified or reported by (Risiro *et al.*, 2012)

In IK system, women are experiencing that the well ripe grain is quality seed to be planted next season and they separate and preserve it during the process of harvesting. To verify this, the study of Matsa & Mukoni (2013) confirmed that the IK of seed selection was made by elderly women based on seed size, color, texture and resistance to diseases and pest attacks. The findings of Matsa & Mukoni (2013) and the present study on how elderly women select the seed by using IK are similar. Moreover, the finding shows that women have a responsibility to prepare grain storage and its protection from weevils in IK crop production, because it is believed that women are wiser than men on it. According to Federal Ministry for Economic (2013), that the variety of women tasks in rural area are important bearers of knowledge related to seed management, the sustainable use of natural resources.

In the study area, the winnowed crops were stored in IK based crop storage known as *dogogoo/gumbii* (figure 3.1). Related to this, Matsa & Mukoni (2013) demonstrated that in IK system, the crops stored in clay-pots, calabashes and closed granaries. The finding also indicates that to protect the crops that stored in traditional storage to protect from damaging it. There are

Aregash, Worku & Chala, Knowledge Management Approach

three methods in IK of crop production. First, it should be stored and closed or locked in that IK based crops storage at cold night. Second, they used the powder of the dried leaves of the Croton macrostachyus tree (*bakkanniisa*) after grinding it into mortar (*moonyee*) and mix to the grains to protect the damage of weevils and the third method is: farmers used the cat as rodenticide to protect the crops from the harms of rodents or rats. As a result, the stored grain can be kept safe for long season. Also, the study of Waithaka (2011) supported the use of IK for insecticidal plants to control pests and the use of cat for rodents. As respondents in FGD confirmed, though the second method is the most effective, however its usage was rare in that rural community today. This indicates that this knowledge of crop protection method is in danger to be lost.

As the results shows, IK based improvement of crop production is done in order to enhance the yield of crops. To achieve this, farmers used two main IK based methods. First, using soil fertilization mechanisms, like crop rotation, animal manure and fallowing the land for one year. Similarly, the findings of Otwoma (2004), Akullo *et al.* (2007) and Rankona (2017) support this idea by saying crop rotation was the traditional knowledge that farmers used by gift and it is a fruitful mechanism. However, the current findings reveal that not all types of crops can be rotated in any soil. Thus, through IK farmers understand the advantages and limitations of different soil types (Otwoma, 2004). This mean, there are the types of crops compatible with specific types of soil. Therefore, indigenous farmers are enforced to use another soil fertilization method.

Also, animals' manure is an important source to improve soil fertility in traditional farming system. The insufficiency of animal manure was the common problem in the rural community to address a large farm land, although it consumes time and maximizes the weeds in the crops. The use of animal manure has been restricted mainly due to the unavailability of this source to farmers in large enough quantities (Otwoma, 2004). This shows that the limitation of using animal manure for soil fertilization may include scarcity of its source, time consuming and increasing weeds.

As a result, the farmers may turn to choose another method of soil fertilization. To fertilize the land by fallowing for one year, and in this case the grasses and weeds grown on land would be dried by the sun and then broken down by the animals' legs helps to fertilize the soil. Likewise, the study of Rankona (2017) confirmed that during fallowing the land for 2 to 5 years, the cattle, sheep and goats are driven into the fields to browse course grass and that their droppings should regain soil fertility.

The second method of improving crop production by IK was the farmers used IK in seed selection. This means the quality seed used to enhance the crop production. Similarly, the finding indicates that the delayed matured and matured crops were harvested together. To confirm this, the farmers select healthy crops in terms of maturity period, height, color, and size (Rankona, 2017).

Additionally, any activity in IK of crop production does not harm the soil, human and environment. This assured that, IK of crop production contributed a lot for SAD and food security in the rural areas. Several related studies support the linkage of IK and sustainable agriculture (World Bank, 1998; Bonny and Vijayaragavan, 2001 and Maragelo, 2008).In short,

the IK based crop production improvement method is natural and useful to keep soil healthy and to ensure sustainable agriculture. In contrast, the modern method used to improve crop production was inorganic fertilizer; it can improve for a short time and harm soil. Thus, this provides unsustainable agriculture. Also the study of Otwoma (2004), agreed with this point of view that it spoils/destroys the soil and it is also expensive.

Additionally, the findings confirmed that folklore is used as an important mechanism in practicing of IK of crop production. It helps to give value for their culture, share and transfer IK of crop production from generation to generation. These folklores are used for enjoyment, strengthen and disciplined each other by using our heroic tales (*geerarsa*), proverbs (*mammaaksa*), poems (*walaloo*), songs (*sirba*), work songs (*weedduuhojii*) and customary law of Oromo (*tumaa Oromoo*). Likewise, Yonatan (2018) stated all the listed, except one type of folklore which is known as *tumaa Oromoo*. This investigation identified that the usability of folklore depending on the contexts and tasks existed at hand.

The younger generation should acquire IK of crop production at childhood from their parents, neighbors and other concerned bodies by seeing, observing and doing. To confirm this point, the study of Ramata *et al.* (2017) has briefly stated it. And this knowledge transferred and shared through embedded in practice and oral communication with each other's and mostly preserved this knowledge in mind Waithaka (2011) and Oboko *et al.*, (2016). For instance, as noted by Oboko *et al.* (2016), traditional crop farmers tended to know more about their local agro-ecosystems and this kind of knowledge, usually preserved by adults and transfer to younger generations by word of mouth, practice and informal educational system originating from social interaction systems.

However, the findings of this study demonstrated that due to various barriers in managing IK of crop production, its usages were declining. Those barriers includes limitation of IK crop production like time and labor consummation and giving low yield, its discouragement from agricultural professionals, modernization (change of life style), oral transfer of IK, no interest to receive IK by younger generation, poor recognition to IK, lack of IK records, lack of trust and poor knowledge sharing culture respectively. According to Ramata *et al.* (2017), the major barriers of IK of agriculture were the same with the current findings. However, the current study identified the extra barriers of IK of crop production, which was the limitation of this knowledge and its discouragement from agricultural professionals. Due to the identified and explained barriers mentioned above, the IK of crop production is endangered. Therefore, identifying, acquiring, recording, organizing, documenting IK and using the good experience of both indigenous and exogenous knowledge side by side would help for reservation of IK as well as ensuring sustainable agricultural development.

5. Conclusion and Recommendation

The findings of the present study show that the resource and knowledge used in the IK of crop production is an easy and cost efficient. IK based seed storage is an effective to keep the seed viable for 4 to 6 years. Although IK based weeding consumes much time and energy, it is good to remove weeds from its roots and protect the health of soil. On the other hand, the preparation

of compost from animal manure in modernized method is totally advanced from the way it prepared in IK system. Additionally, the crop production improvement techniques are valuable in keeping soil fertility without any hurt and providing quality seeds. Similarly, like the modern based crop production, IK does not convey any harm on environment, animals and humans. This realizes that indigenous knowledge's benefit is higher than its demerit. The knowledge constructed and proved over a long period of experience and its sources are organic and local made resources. Hence, most of these practices can consume time and labor; IK of crop production is appropriate in ensuring the target of sustainable agricultural development. On the other hand, the finding indicated that the women's role is higher than male's role in relation to seed selection and also it is considered as women are wiser than male in order to identify best seed for better crop production.

The younger generation should acquire knowledge informally from their parents and neighbors. Related to this, using folklore is an important mechanism throughout IK of crop production to transfer/share this knowledge, to enjoy and to support each other although there is no recognition in modern mechanism. And the major barriers of indigenous knowledge management of crop production are limitation of this knowledge, modernization (change of life style), oral transfer of IK, no interest to receive IK by younger generation, poor recognition to IK, lack of IK records, lack of trust and poor knowledge sharing culture respectively. Finally, based on the findings, the researchers proposed a framework that helps to direct how the KM approach is applied in rural community in order to make effective management of IK of crop production. Through careful application of the proposed framework, it is hoped that it will help to manage IK of crop production.

Acknowledgment:

The authors acknowledge Jimma University for providing us the fund and the necessary letter to conduct this research. Moreover, we are grateful for the study participants as well as Woredas and Kebeles Officers who assisted in conducting this study.

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