

Constraints in Teaching Secondary School Agriculture for Food Security: A Case of Secondary Schools in Embu County, Kenya

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Abstract: This paper investigates the various constraints experienced by agriculture teachers and the students in the teaching and learning process which have an implication on food security. The study employed descriptive survey design. Data was collected using an Agriculture Teachers' Interview Schedule and a Students' Focus Group Discussion Guide. Data was analyzed using both descriptive and inferential statistics. The research findings show that there are major constraints in the teaching and learning of secondary school agriculture that negatively impact on food security. The paper concludes by highlighting the implications of these constraints to education policy and recommendations for further action.

Key words: Community-school linkage, Constraints, Food security, Secondary school agriculture, Skills development.

Date of Submission: 29-04-2019

Date of acceptance: 13-05-2019

I. INTRODUCTION

Food security is now a global concern. In its report on population dynamics and hunger, Food and Agricultural Organization [1] indicated that the world produces enough food to feed everyone, yet nearly 1 billion people remain hungry in all continents, in both developed and developing countries and in urban and rural areas. The international freedom from hunger campaigns and the World Food Security (WFS) summits have currently made enough effort to keep the hunger issue constantly high on international agenda. The current report by [2] however has indicated that the number of hungry people in the world has risen for a third consecutive year to 821 million (or one in every nine people on the planet) in 2017, as compared to 804 million people in 2016. According to [2] this is a return to levels not seen in almost a decade ago. This reversal in progress sends a clear warning that more must be done and urgently if the Sustainable Development Goal of Zero Hunger (SDG2) is to be achieved by 2030 [2]. The current report by [2] confirms its fears outlined in its 2010 report that the world food security remains an uncertain prospect even as it focuses to feed the world by 2050 [1].

In many developing countries where food systems face severe difficulties in enabling access to sufficient, safe and nutritious food for all, skills development in agriculture and its application is either absent or inadequate [3]. Different scholars have associated various obstacles to poor skills acquisition and their application in securing food among learners. Kenya in particular is one of the countries endowed with vast agricultural land which is 587,000 km² of which 576,076 km² is arable land [4]. However, her agricultural production has not kept pace with population growth rate hence food security is becoming a concern. Food and nutrition security is a national mandate. The country's future depends on a healthy population and an economy that is resilient to the effects of climate, global swings in staple food prices, and the effects of threats like the fall armyworm. Such risks threaten the welfare and livelihoods of many Kenyans and destabilize the economy [5].

According to the global food security index of 2017, Kenya is food insecure and was ranked position 86 out of 113 countries, International Food Policy Research Institute [6]. The survey was based on affordability, availability, quality and safety of food [6]. At the same time every Kenyan individual has 'right to food' [7]. However, a snap review of Kenya's food balance sheet shows that Kenya imports most of the basic food commodities including wheat, maize, rice, beans, potatoes, sugar and milk [8]. The persistent meager harvest in many parts of the country has further escalated the problem of food shortage. If ignored or not sustainably resolved, this problem is likely to call for more resources to handle the escalating rollback problems such as unemployment, insecurity, drug and substance abuse and other violent activities among the youth. The

government will also continue missing out on critical development issues which have an implication on the economic trend.

Food security is one of the big four agenda that the Kenyan government wishes to tackle in its 2018-2022 vision plans. The Big Four Agenda is streamlined very well within the global, continental and national development contexts. At the global level, the Big Four Agenda is effectively aligned to the 2030 Agenda for Sustainable Development, upon which the seventeen Sustainable Development Goals (SDGs) are anchored. The 2018 World Food Programme report on Kenya's Country Strategic Plan (2018-2023) indicate that at the continental level, the Big Four Agenda aligns well with Africa's Agenda 2063 themed "The Africa We Want" which sets out Africa's aspirations for development by 2063. In the national context, the Big Four are rightly pegged on the Kenya Vision 2030 and well-mainstreamed in the third-Medium Term Plan of the Vision [9]. The Big Four Agenda is also a major step in the realization of the country's Constitutional obligations.

Agricultural education should be in a position to develop skills among secondary school students that promote avenues for food security. This can help to meet the United Nations (UN) initiative [10] which outlines the first Millennium Development Goal (MDG) of eradicating extreme poverty and hunger. Secondary school agriculture can greatly contribute to food security if the Kenyan government can enact policies to teaching of agriculture with food security agenda in mind. For instance making Young Farmers Clubs (YFC) compulsory in schools, enforcing practical agriculture and be well outlined in the school timetables as a double lesson which is currently missing. At the same time, all idle land in schools can be used for farming to instill the spirit of self-reliance. At the same time, encouraging urban farming would be an avenue for production of more food crops in schools that have limited farming fields. The skills can however be effectively developed if the constraints that face teachers and students in the teaching and learning process can be identified and appropriate solutions put into place.

Since the integrated nature of the Big Four Agenda calls for inclusive and integrated approaches to its implementation and reporting. Identifying and alleviating the constraints faced by both the teachers and learners in the process of teaching and learning secondary school agriculture may help the government meet the food security agenda especially on improved self-reliance and reduced imports. It is also important to note that the teaching of agriculture in the anticipated Competence Based Curriculum (CBC) cannot run smoothly if the current constraints are not first dealt with.

The study aimed at establishing the constraints faced in teaching secondary school agriculture for food security. In order to achieve this, agriculture teachers' views and those of the students within secondary schools in Embu County were sought in interviews and Focus Group discussions respectively. The study was guided by one question: What constraints are faced in teaching secondary school agriculture for food security in Kenya? The specific objective for the study was to establish the constraints faced in teaching secondary school agriculture for food security.

II. METHODOLOGY

2.1 Location of Study

The study was carried out in Embu County representing the forty seven counties in Kenya in regard to resource endowment, climatic conditions, rural versus urban areas, private versus public schools as well as diversity in population distribution. Such differences have an influence on the varied constraints faced in the teaching and learning process as well as their varied solutions.

2.2 Research Design

The study adopted descriptive survey design where both qualitative and quantitative data was collected. The study adopted the design because only opinions of the respondents on the constraints faced in teaching agriculture in secondary schools for food security was being investigated. No treatment on subjects or testing of any hypothesis was done.

2.3 Sampling Procedures and Sample Size

The study applied mixed sampling methods where both random and non-random sampling designs were used. Embu County was purposively selected. Stratified random sampling was administered to obtain the number of schools required in the public and private school categories. Systematic random sampling was further applied to get the specific schools, as well as the agriculture teachers. Simple random sampling was carried out on the students in the selected schools. The researcher achieved this by obtaining the number of students specializing in agriculture in Form Three and Four from their subject teachers. However, the class registers from the class teachers in Form One and Two were used to determine the students present. This was with the assumption that they would not have selected their subject options by the end of Form Two. The researcher then assigned random numbers to all the students to sample those who would take part in the study. The sample population is presented as Table 1.0.

Table 1.0: Population Sample

Subject category	Target population	Expected sample	Actual sample	Percentage sample
Public schools	186	132	60	41.67
Private schools	12	12	8	0.06
Agriculture teachers	235	148	111	75.00
Students	46,340	381	350	91.8

Sources: Target Population -Embu County Headquarters Statistics Office
Actual Sample - Field Data

2.4 Research Instruments

An Agriculture Teachers' Interview Schedule (ATIS) containing 18 questions was developed. These were distributed into seven open ended questions, six closed ended questions and five in likert scales. A Students' Focus Group Discussion Guide (SFGDG) was also prepared with a set of fourteen open-ended questions which allowed students to speak freely and provide as much information as they knew. It is from these items that the question on the constraints faced in teaching and learning secondary school agriculture for food security was answered.

2.5 Pretesting the Research Instruments

The interview schedule and the focus group discussion guide were subjected to pre-testing. A pretest sample of 1% and 10% depends on the sample size, which is 1% for a large sample and 10% for a small sample [11]. The researcher used 10% of the research participants to give a total of fourteen schools, two focus group discussion and fourteen interview schedules in the selected schools to participate in the pilot study. The randomly selected schools for piloting were not included in the actual study. The pilot data was used to compute the reliability coefficient of the instruments using the internal consistency approach.

2.6 Data Collection Procedures

A letter of introduction from the University of Embu helped the researcher obtain a research permit from the National Commission for Science, Technology and Innovation (NACOSTI). The researcher also obtained a consent letter from the county director of Education before contacting the school principals to prepare for data collection. The research instruments were administered over a span of three months where the interviews with the agriculture teachers were conducted. Within these months, the researcher also met the students in their focus group discussions. Two field assistants were involved recording the interviews and the discussions.

2.7 Data Analysis

The edited data was coded and fed into the computer for analysis using the Statistical Package for Social Sciences (SPSS) version twenty four for windows. The researcher transcribed the audio data from face-to-face interviews and the focus group discussions. The students' and the agriculture teachers' responses were read and re-read for proper interpretation. Content analysis was used to categorize the various responses into themes. Correlation analysis was applied to establish the direction and strength of the association between the constraints faced in teaching and learning agriculture and food security. The regression equation of Y on X was used. That is: $\hat{Y}=a+bX$ (equation 1) where, \hat{Y} is the dependent variable which is food security and X is the constraints faced in developing the relevant skills for food security while a and b are the constants.

III. RESULTS AND DISCUSSION

3.1 Constraints Teachers Faced in Teaching Agriculture for Food Security

The research question sought to find out the constraints faced by the agriculture teachers in the process of teaching the subject in Embu County. The researcher distributed the responses based on three themes: agriculture teaching facilities, agriculture teaching and learning activities and the services available.

3.1.1 Constraints Based on the Agriculture Teaching Facilities

The agriculture teachers' responses on the constraints based on the school facilities were presented on a 3-point likert scale from disagree to agree as shown in Table 2.0.

Table 2.0: Teachers’ Views on the Constraints Based on the Agriculture Teaching Facilities

Facility Characteristic	Disagree		Neutral		Agree	
	n	%	n	%	n	%
There is an agriculture laboratory	93	86.1%	8	7.4%	7	6.5%
There is an agriculture laboratory assistant	95	87.2%	7	6.4%	7	6.4%
There is a school workshop	82	74.5%	11	10.0%	17	15.5%
The workshop is well equipped	75	72.1%	23	22.1%	6	5.8%
The school has a demonstration farm	28	25.5%	22	20.0%	60	54.5%

Source: Field Data

A total of 93(86.1%) agriculture teachers mentioned that there were no agriculture laboratory in the school, 95(87.2%) said there were no agriculture laboratory assistants, 82(74.5%) mentioned that there were no school workshops, another 75(72.1%) disagreed that the few workshops that were there were well equipped. This implies that most schools concentrated on theory and did very little on practical activities. Government funding for school based projects such as construction of agriculture laboratories in schools lacking them, Information Communication Technology (ICT) integration in teaching agriculture as well as building storage facilities and agricultural workshops could further improve the practical aspect and development of skills among the learners for food security.

A total of 60(54.5%) agriculture teachers positively felt that their schools had demonstration farms. However, in in reference to table 3.0, 68(64.2 %) of the teachers were neutral about practical work being applied weekly to illustrate the concepts that had been introduced. This could be associated with the limited time on the school timetable to carryout agriculture projects leading to most of the work being, taught theoretically than being practical in nature.

3.1.2: Constraints Based on the Agriculture Teaching and Learning Activities

The agriculture teachers’ responses on the constraints based on the agriculture teaching and learning activities were presented on a 5-point likert scale from strongly agree to strongly disagree as presented on Table 3.0.

Table 3.0: Teachers’ Views in Relation to the Teaching and Learning Activities

Teaching and learning Activity	Strongly agree		Agree		Neutral		Disagree		Strongly Disagree	
	N	%	n	%	n	%	N	%	n	%
Practical work was applied to illustrate the concepts that had been introduced	20	18.9%	1	17.0%	68	64.2%	0	0.0%	0	0.0%
Students did hands-on practical work every week	6	5.6%	2	22.4%	61	57.0%	1	11.2%	4	3.7%
Students were taken for field work or a technical institute after every agriculture topic	4	3.8%	9	8.5%	56	52.8%	3	28.3%	7	6.6%
Agriculture teachers were recognized and worked hand in hand with the surrounding community	13	12.1%	1	15.0%	34	31.8%	3	34.6%	7	6.5%

Source: Field Data

It was observed that a total of 68(64.2%) agriculture teachers were neutral about the fact that practical work was applied to illustrate the concepts that had been introduced. At the same time 61(57.0%) were also neutral about the fact that students did hands-on practical work every week. Another 56(52.8%) of the agriculture teachers were also neutral about the fact that students were being taken for field work or a technical institute after every agriculture topic. This has the implication that practical activities, hands-on-training and field work could have probably been carried out during class demonstration and class projects or hardly present. These two teaching approaches were not allocated adequate time which could be detrimental to developing skills for food security.

A total of 37(34.6%) of the agriculture teachers had the opinion that they were neither recognized nor worked hand in hand with the surrounding community as they taught the subject. Lack of recognition by the community could be associated with the lack of school-community based projects around the schools. For instance a school could have a project which is supported by the community whose members are also invited to learn some skills such as grafting, budding and breaking seed dormancy which are all attributed to food security. Neighbouring farms could also be set aside for demonstration and field visit where the school does not have adequate space. This would end up linking the school to the community through such projects and imparting them with the relevant knowledge and skills for food security.

3.1.3 Constraints Based on the Agriculture Services Available

The agriculture teachers' responses on the constraints based on the agriculture services available were presented on a 5-point likert scale from strongly agree to strongly disagree as shown on Table 4.0.

A total of 48(45.3%) agriculture teachers were neutral while another 48(45.3%) disagreed that technical experts were invited to the school to teach agriculture lessons. Inviting technical experts lies on the hands of the agriculture teachers themselves through the school administration. The minimal invitation could be attributed to time factor to organize for longer teaching spells outside the normal school timetable or even lack of knowledge by some teachers with the conviction that they were experts in their own fields. Inviting technical experts can help blend ideas on better ways of teaching for food security.

A total of 52(49.1%) of the agriculture teachers were neutral about the fact that they had sufficient opportunity to attend seminars and workshops to improve on the teaching of the subject. This could be linked to the time needed for practical training such as soil sampling and testing. This may require two continuous days to achieve the results. Facilitation and travelling to soil laboratories may have been the hindering block as many schools lacked agriculture laboratories as mentioned by most teachers.

Table 4.0: Teachers' Views on Constraints Based on the Agriculture Services Available

Agriculture Service	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	N	%	N	%	n	%	n	%	N	%
	Technical experts were invited to the school to teach some agriculture lessons	0	0.0%	3	2.8%	48	45.3%	48	45.3%	7
Teachers had sufficient opportunity to attend seminars and workshops to improve on the teaching	10	9.4%	22	20.8%	52	49.1%	18	17.0%	4	3.8%
The agriculture syllabus was focused on preparing students for food security	22	20.6%	36	33.6%	29	27.1%	10	9.3%	10	9.3%
Agriculture teachers had sound content knowledge	55	51.4%	40	37.4%	9	8.4%	1	.9%	2	1.9%
Agriculture teachers were supported by the school administration	24	22.4%	35	32.7%	43	40.2%	2	1.9%	3	2.8%
There was sufficient time to explain each topic in depth	16	15.1%	22	20.8%	40	37.7%	27	25.5%	1	0.9%

Source: Field Data

The study found out that a total of 36(33.6%) agriculture teachers agreed that the agriculture syllabus was most of the time focused on preparing students for food security. This implies that the government through the Kenya Institute of Curriculum Development (KICD) had set guidelines for teaching agriculture for food security. The implementation lied on the hands of the schools to see to it that the same areas were objectively taught for food security. However, the practical aspects in such areas might have been overtime taught theoretically through lectures due to the constraints based on the teaching and learning facilities which an individual school cannot handle failing to meet the food security agenda.

The statistics further indicated that 55(51.4%) of the agriculture teachers strongly agreed that they had sound content knowledge of the subject hence could deliver it at ease but much work was covered theoretically to cover the syllabus. However, a number of the agriculture teachers 40 (37.7%) were neutral about the fact that there was sufficient time to explain each topic in depth. This could be linked to time needed to explain the practical aspects leaving majority of the work covered theoretically in lectures and students making notes.

A total of 43(40.2%) agriculture teachers were neutral about the fact that they were supported by the school administration. The support given could be attributed to the few agriculture seminars, workshops and field trips carried out by teachers in the course of teaching the subject. More support could probably be made if class projects were continuously done in schools such as nursery practices, livestock farming and crop production all of which not only develop skills but also make schools food secure. The same skills could be transferred by the students to their homes which represent the school community.

3.2 Constraints Experienced by Students in Learning Agriculture for Food Security

The study was further interested in finding out the constraints experienced by students in learning agriculture for food security. The information was audio recorded and then transcribed for analysis. Some more information was recorded by the students in handouts A and B issued by the researcher. The researcher introduced by first defining the term food security and asked the students to grade their schools on the job they had done in preparing them for food security.

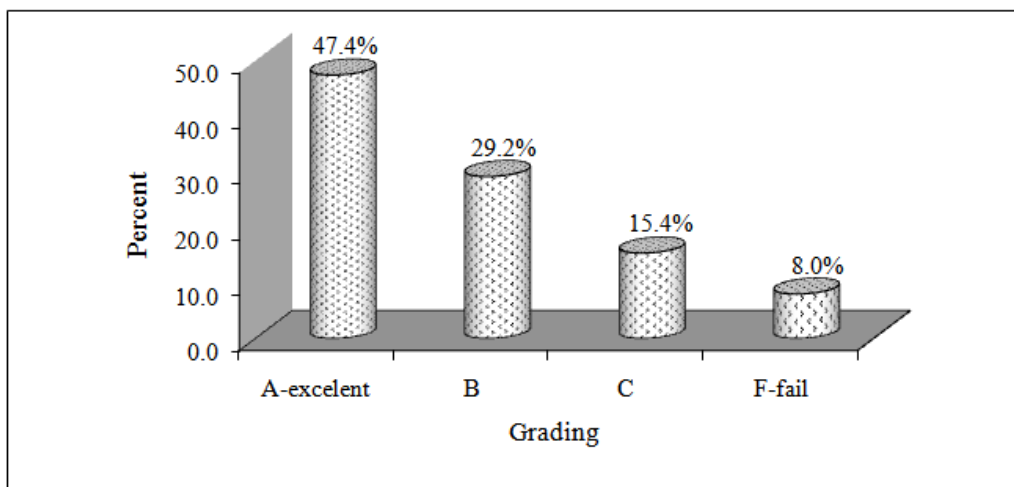


Fig 1.0: students grading their schools on the job they had done in preparing them for food security.

Slightly below half (47.4%) of students assigned a grade A-excellent to their schools on the job it had done in preparing them for food security, 29.2% gave their schools grade B whereas 15.4% gave their school grade C. This implies that a good number of schools were trying to impart students with the correct knowledge they needed to ensure there is food security in their homes and in the country at large. However, eight percent of the students assigned their schools grade F-indicating that their schools had failed in preparing students for food security. Those who assigned their schools low grades reported that it was due to the constraints they experienced in the learning process.

When asked to mention such constraints, some students reported that their schools had established projects such as rearing fish, cattle, pigs and poultry. However, they had limited time to practice animal husbandry on the same projects leaving all the work to the school grounds men to manage the enterprises. This left little opportunity for developing the relevant skills needed for food security. Students also listed in a hand out that the instructional sessions were not adequate enough to carry out practical activities. In agreement with the teachers' views is also the opinion that more time was needed for practical sessions and in-depth learning. Majority of the work covered theoretically in lectures and giving notes would hence translate into problem solving and class projects paving way for more skills development for food security in secondary schools.

A number of students in their groups reported that their schools had inadequate resources to carry out practical agriculture. These included land, tools and equipment and inadequate water to carry irrigation in their demonstration plots. A number of the students reported that technical experts were rarely or never seen in their schools. The students' responses agree with the agriculture teachers' views that technical experts were either sometimes or never invited to the schools to teach agriculture lessons. They further felt that greater commitment in involving technical experts from agricultural institutions was necessary as this would in turn add more and new skills to the students.

Some students mentioned that they were poorly linked to the community around the schools. In this case, starting school-community based projects would expose them to the actual field and its agricultural activities. At the same time, involving extension officers in the projects would help them develop the relevant skills as early as at the secondary school level. Students further said that the agriculture syllabus content was too wide encouraging use of lecture method of teaching by their teachers and students spending a lot of time in making notes. In addition a number of students had the feeling that lack of agriculture in the primary school curriculum was a major factor in the lack of motivation on the side of the students to develop the basic concepts and apply them even at home.

Some students reported that there was minimal career guidance or even none during subject selection. This might have resulted into lack of role models in the agricultural sector hence many students drop the subject or even choose it without any informed decision on the right path to follow later in life. Quite a large number of students stated that they had little access to agricultural reference materials. This resulted into the agriculture teachers leaving handouts for the students to make notes. There was therefore a lot of sacrifice on the side of the students leaving very little time for personal revision.

A large proportion of the students mentioned that attendance of shows and field trips was not common in their schools. If common, they would give learners the required exposure and experience of the real world. This would not only prepare them for jobs in future but also help them continually develop skills for food security while in school.

Lastly, students complained that the distribution of marks in Examination was not at all motivating. There are two agriculture papers, paper 1 covering 21 topics entailing areas on crop production, soil science and agricultural economics. Paper 2 covers 12 topics entailing areas on livestock production and agricultural engineering. Each of the papers has three sections: A, B and C. section A has 30 marks distributed in half marks covering a very wide content. Such an area could be reorganized in terms of marks allocation. More to that, a number of students pointed out that much of the topics in book four were on agricultural economics. This required a lot of mathematical skills which challenged quite a number of students. Reorganizing the topics so that they are covered earlier in book two or three would give students humble time to revise the same areas. This would also open students to more career paths related to agricultural economics.

3.3 Correlation analysis on the relationship between the constraints of teaching and learning agriculture on food security.

The researcher conducted a correlation analysis in order to ascertain the direction and the strength of the association between the constraints of teaching and learning agriculture and food security. The findings are presented in Table 5.0.

Table 5.0: Correlation Analysis on the Relationship between the Constraints of Teaching and Learning Agriculture and Food Security

		Food Security
Constraints of teaching Agriculture	Pearson's Correlation	-0.652
	Sig. (2-tailed)	0.05
	N	131

**Correlation is significant at the 0.05 level (2-tailed).

The results in table 5.0 shows that there was a negative significant linear relationship between the constraints of teaching agriculture and food security ($r = -0.652$, $p < 0.01$). This implies that an increase in constraints of teaching agriculture leads to a decline in food security.

Table 6.0: Regression Analysis Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.581 ^a	.338	.324	5.90703

a. Predictors (constant): constraints in teaching and learning agriculture

b. Dependent variable: food security

Table 6.0 presents a correlation coefficient of 0.581 and determination coefficients of 0.338. This depicts a moderately strong relationship between constraints in teaching and learning agriculture and food security. Thus, constraints in teaching and learning agriculture in secondary schools contribute to about 33.8% of the variations in food security.

Analysis of Variance was used to test the significance of relationship that exists between variables; thus, model's significance. The results are presented in Table 7.0.

Table 7.0: Analysis of Variance (ANOVA)

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	836.031	1	836.031	23.960	.000 ^b
Residual	1639.969	169	34.893		
Total	2476.000	170			

- a. Dependent Variable: Food Security
- b. Predictors (Constant) : Constraints In Teaching And Learning Agriculture

The results in Table 7.0 revealed that the regression model has a margin of error of $p < .001$. This indicates that the model has a probability of less than 0.1 thus, it is therefore, statistically significant.

Table 8.0: Regression Coefficients

Model	Unstandardized Coefficients			T	Sig.
	B	Std. Error	Beta		
1 (Constant)	44.370	6.980		6.357	.000
Constraints in teaching and learning agriculture	1.828	.374	.581	4.895	.000

In reference to equation 1, where \hat{Y} is food security, 'a' is constant at 44.370 and X is a unit increase in constraints which is 1.828, therefore, the equation for this study will be $\hat{Y}=44.370+1.828b$ where 'b' is all other factors held constant.

The study established that holding all other possible factors that influence food security constant, a unit increase in constraints in teaching and learning agriculture would lead to a 1.828 decrease in food security. The study concludes that the constraints in teaching and learning agriculture in secondary schools had a negative impact on food security. This argument is in agreement with findings of a study by [12] that inadequate teaching and learning resources, poorly organized teaching and learning activities as well as limited services constrain the teaching and learning process. These ultimately negatively impact on skills development especially those geared towards food security. Similar studies [13; 14; 15; 16] emphasize that it is the financial constraints that have reduced the expansion of facilities leading into specific problems in practical agriculture.

IV. CONCLUSION

As the country moves towards achievement of the big four agenda and in particular to food security, there are some constraints faced by the students and agriculture teachers in secondary schools that need to be tackled. These are based on the teaching and learning facilities, teaching and learning activities as well as the agricultural services available. The low integration of practical agriculture in the teaching and learning process due to the aforementioned constraints derail adequate skills acquisition and their application for food security.

V. RECOMMENDATIONS

The researcher recommends integration of the following recommendations in teaching of secondary school agriculture for food security in the country.

- a) Review of the agriculture syllabus by the Kenya Institute of Curriculum Development (KICD) in order to reorganize chapters, summarize and allocate double lessons for practical sessions which lacks in the current school time tables.
- b) The government should put a greater effort in establishing well equipped agriculture laboratories and workshops in schools that are lacking them. This will promote more practical learning than theory for better skills development.

ACKNOWLEDGEMENT

The author wishes to acknowledge the immense support from the two supervisors and other experts from University of Embu. She also acknowledges the Office of the County Director of Education, Embu County and those of the Principals in secondary schools in the county for allowing for data collection. Further the author acknowledges the agriculture teachers and the students who participated in the interviews and the focus group discussions respectively.

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IOSR Journal Of Humanities And Social Science (IOSR-JHSS) is UGC approved Journal with Sl. No. 5070, Journal no. 49323.

Njura, Hellen Joseph. "Constraints in Teaching Secondary School Agriculture for Food Security: A Case of Secondary Schools in Embu County, Kenya." *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*. vol. 24 no. 05, 2019, pp. 22-30.