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Understanding the Perceptions of Secondary School Youth toward Agricultural Careers in Democratic Republic ofCongo, Kenya and Nigeria

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Abstract

Youth are critical participants in the modernization of African agriculture but often their perception of farming is negative. A baseline survey of 1264 students from eight secondary schools in Democratic Republic(DR)ofCongo, Kenya and Nigeria was conducted to assess their attitudes toward career pathways to agriculture and agribusiness. KoboToolBox was used to collect data online before compilation and inspection for errors in Microsoft Excel and exportation into STATA for analysis. Findings were presented as summary statistics, frequencies and multiple linear regression. A large majority (86%) of the students attended agricultural courses and 54% identified agriculture as having a place in their future, but often not as their highest career ambition. Livestock, field cropping, small animal production, and horticulture were the most viable enterprises for the youngsters. Nearly half (46%) that were averse to agriculture as a career path based their decision upon excessive labor requirements (30%), difficulties in securing land (25%), and low returns to effort (20%). Disparities from a country, area and gender perspective were recorded. Perceptions and career plans among the sexes differed; with females having less experience with machinery, and were more drawn to horticulture and agro-processing. Despite unfavorable attitudes toward agriculture, the study established that youth from these countries recognize that opportunity exists from adopting modern farming methods and commercial agricultural enterprises. The results of this study suggest several avenues for future Start Them Early Program activities intended to strengthen career pathways toward agriculture in African secondary schools

Keywords

Africa, agricultural education, career pathways, Start The m Early Program, youth

Funding Source

This study was conducted as a component of the Start Then Early Program(STEP)of the International Institute of Tropical Agriculture(IITA), an activity originally envisaged by its Director-General, Dr. Nteranya Sanginga,and supported by grants obtained from the International Development Research Center (Canada) and the Technical Centre for Agricultural and Rural Cooperation (CTA). The instructors and administrators in eight secondary schools helped with consensual clearance among the minors and assisted in the implementation of this survey as well. The authors of this report appreciatively acknowledge the contributions of all these individuals, STEP personnel, IITA Scientists,and partners

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Introduction

The Start Them Early Program (STEP) is a youth empowerment intervention of the International Institute of Tropical Agriculture (IITA) that is based on the principle that agriculture is the necessary engine of future economic growth across Africa (Harsch, 2004; Rodin, 2016) and a next generation of modern farmers is needed to achieve that success. Agricultural education at the secondary school level is a means to develop enthusiasm and skill sets needed by young farmers (Okiror et al., 2011). At the same time, the program recognizes the lack of appeal to careers in agriculture among youth who associate it with poverty and drudgery (IITA, 2019; Yaboah et al., 2020). As a result, many youth do not prepare themselves to become modern farmers and agribusiness persons as they aspire for jobs in professional fields, government and business (White, 2012; Mukembo et al., 2014). Greater opportunities are perceived to exist in urban areas, sparking migration that deprives rural areas of their brightest and most ambitious youth (AGRA, 2015).

To better understand the perceptions and attraction of youth to career paths in agriculture, and the differences among gender groups and socio-economic settings, STEP conducted studies in DR Congo, Kenya and Nigeria. The objectives of the study were to form a baseline describing school and student characteristics and to determine students' participation in agricultural courses, their career pathway plans and how they relate to their agricultural studies including participation in extracurricular young farmer clubs. This paper describes a baseline study conducted in eight secondary schools in these three countries between October and November 2019 and forms a basis for comparison as the STEP Program conducts its agricultural education backstopping activities into the future (Adefioye et al., 2019).

Literature Review

A diverse set of economic and socio-cultural factors influence youths' aspirations toward engagement in agriculture and agribusiness (Betcherman & Khan, 2015). The economic factors include low level of agricultural productivity and earnings, causing the youth to form negative perceptions about agriculture as a career (Barratt et al., 2012; Sumberg & Okali, 2013; Daum & Birner, 2017). These perceptions are also influenced by household responsibilities; expectations of family members, friends, communities; and exposure to both conventional and social media (Flynn & Sumberg, 2017). At the same time, a large number of young people residing in the rural areas of Africa are and will inevitably be employed in small-scale farming and related family-based livelihood activities that are subject to low returns and poor marketing systems (Chianu et al., 2008; Onakuse, 2012; D'Alessandro et al., 2015). This results in a contradiction among rural youth seeking to escape agriculture as a lifestyle and the likelihood that they will depend upon it in the future. The challenge is to alter these negative perceptions of the potential for agricultural livelihoods in a manner that influences career path decisions by school-age rural youth (Mukembo et al., 2014), and then to see this potential realized through the transformation of agriculture and its increased productivity and profitability.

Career development is continuously shaped by various elements that strongly impact upon life choices and can be influenced and evolve over time. Career choices among school-age youth are particularly exploratory and influenced through extracurricular engagement but tend to stabilize as young adults enter the workforce (Super et al., 1996). Within the context of young Africans and their engagement with agriculture, career choices may be positively reinforced through membership in young farmer clubs (Adebo, 2009; Mukembo et al., 2015), a factor that warrants consideration in the design of agricultural curricula on secondary schools.

In a study of the perceptions of members of Young Farmers Clubs concerning their intent to pursue agriculture-related careers after graduating from two Ugandan secondary schools, Mukembo et al (2015) found that a high percentage (71%) were interested in agriculture-related fields. This proportion is considerably greater than in an earlier study among the general student population where animal and crop production were ranked as the 12th and 13th career interests (Mukembo et al., 2014) with far more students expressing interest in medical, engineering and business fields. In Nigeria, young farmers clubs were shown to encourage youth to learn about better farming techniques under the guidance of the agricultural mentors and through learning-by-doing (Adebo, 2009). In Uganda, it was established that students engaged in supervised agricultural programs pass useful information on to their families and communities (Okiror et al., 2011). Clearly, an important element to modernizing agriculture in Africa rests with directing youth toward profitable career pathways in farming and agribusiness, but at the same time requires that their skill sets be raised compared to the current farming generation.

Theoretical Framework

Theories relating to social cognitive career choices (Lent et al., 2002) and experiential learning (Kolb, 1984) underlie this study. Social cognitive career theory addresses how basic career interests develop and may be shaped through education. Experiential learning theory focuses upon the role of practical experience in learning and suggests that knowledge results from the transformation of experience. Ord (2012), based upon earlier work of Dewey (1938), stressed that knowledge is not merely information passed to students for their direct future application, but instead provides experiential understandings that are interpretively applied to better inform new practices. Learners should be able to connect aspects of the new experience to what they already know, in addition to actively interacting with their environment and further testing ideas developed through interaction (Grady, 2003). Akella (2010) reflected that educators themselves should be able to assess individual student's learning styles, that instructors must also undergo self-improvement, and that this feature is especially important in non-traditional learning situations.

These two theories relating to cognitive career choice and depth of experience converge at the critical point where all factors are considered when the learner makes the decision to pursue a particular career path and is confident, they possess the necessary starting skill sets to do so. In this way, agricultural curricula that provide strong elements of practical experience can nurture the career aspirations in learners and readjust career goals (Lent, 2005). Combining these theories in Africa within the context of secondary school courses, practicals and extracurricular activities, and linking these activities to proven agribusiness models suggests that the future engagement of youth in agriculture can be influenced in a constructive manner.

Methods

A baseline study was conducted to generate information on the attitudes of secondary school students toward agriculture as a candidate career choice. A formal survey was constructed that described the proportions of youth enrolled in agriculture courses, belong to young farmer clubs and practice different agricultural enterprises. The survey was developed in conjunction with the STEP teams in DR Congo, Kenya and Nigeria (Adefioye et al., 2019) to allow for comparability of results between countries and school systems.

A multistage sampling method was employed in selecting the sample. The first stage involved purposive selection of eight secondary schools located in contrasting areas of the three

countries using selection criteria developed by a cross-section of STEP program collaborators (Adefioye et al., 2019). Three schools were selected in both Nigeria and DR Congo and two in Kenya. The second stage involved use of simple random sampling to select the student respondents whose parental consent was then obtained through the school administrators. Comprehension of the informed parental consent was assured using both verbal and written means. Barriers to language were overcome using both the national and local languages.

The data collection tool contained 75 closed and open-ended queries segmented into five sections corresponding to the study objectives. These queries were phrased in English, translated into French and Kiswahili, and then field tested at Institut Weza in South Kivu Province, Eastern DR Congo; and later refined by STEP officers from all three countries. The structured questionnaire was loaded into android mobile devices using KoboToolbox software (Harvard Humanitarian Initiative, 2020). Enumerators were trained in the use of the application, and then the survey was conducted in DR Congo, Kenya and Nigeria between October and November 2019.

In DR Congo the survey was conducted in three public schools of South Kivu Province in Eastern DR Congo; Institut Weza, EDAP/ISP, and Institut Mushunguri. In Kenya our intention was to survey three public schools; Mwiki Secondary School (Nairobi County), Afraha High School (Nakuru County) and Muongoiya Secondary School (Kiambu County) but Muongoiya's examination schedule (and then the emergence of the COVID-19 pandemic) conflicted with the survey so only the first two schools are included. In Nigeria, the survey was conducted in three schools in the south-western part of the country; Fasola Grammar School, Oluponna High School and Lead City International School. Data was aggregated in the *kobotoolbox.org* platform (Harvard Humanitarian Initiative, 2014) and compiled in Microsoft Excel, inspected for errors, exported to STATA for analysis (StataCorp, 2019), and results prepared as summary statistics, frequencies and regression models. To better partition and understand attitudes of youth and their preferences and practices, data was disaggregated by country, gender, and other parameters of interest.

Results

The attitudes of 1264 secondary school youth toward careers in agriculture were assessed across eight schools in three African countries. The average age of these youth was 16 years old, and in general the sample was drawn from students in their final three years of school. This age represents a critical time in determining career pathways following graduation, particularly for youth not destined for tertiary education. Of the three schools in DR Congo, EDAP/ISP is the largest (2026 students) and located in a mixed market farming setting, while the other two schools are in more subsistence farming areas. Weza has a student body of 904 and is the only institute that is both a primary and secondary school. Mushunguri is the smallest, with only 320 students. Secondary schools in DR Congo introduce agriculture in year two as an optional subject, in year 3 subject specialization begins and agriculture becomes optional, students may wish to continue or drop the subject. Agricultural instruction is provided at least three times in a week and offered over several grades. All the schools have field area for course practicals in crops but rely on rainfed agriculture and lack irrigation systems. Two schools include practical training in the rearing of small animals, but marketing and value-addition are underrepresented in the curriculum. There are few computers in these schools but when available are shared between teachers and students for agricultural instruction. Extracurricular agricultural clubs have been in existence for the past two years in Weza and EDAP but are not available in Mushunguri.

Of the two schools in Kenya, Afraha Secondary School has a student population of 1202 and is located adjacent to a large commercial farming area within Nakuru and the Great Rift Valley. It has adequate land and irrigation for field activities with facilities also available for food processing, operates a computer laboratory but lacks animal enterprise facilities and small-scale farm equipment. Mwiki Secondary School has 501 students and is located on the outskirts of Nairobi but is near mixed highland farming systems, has modest field space, water for irrigation, and ongoing animal enterprises, but lacks a computer laboratory and food processing facilities. Both schools have neighboring schools that could replicate the STEP approaches and require assistance with farm inputs, new crop varieties, mechanized tools, and modest renovation. Secondary schools in Kenya have agriculture as an optional subject in all the four years. At the end of year 2 subject selection and specialization begins, those already in the agriculture course may choose to proceed with the subject or drop the same for a preferred elective course. The COVID-19 pandemic prompted school closure in early-2020 so we had no opportunity to survey Muongoiya School or to conduct follow up activities as first intended.

Two of the Nigerian schools are in Oyo State (Fasola and Lead City) and have student bodies of 326 and 274, respectively. Oluponna School is in Ogun State and has 993 students. Two of these schools (Fasola and Oluponna) have sufficient land for agricultural practice on crop production and horticulture, while opportunities in value addition are emphasized in Lead City. Secondary schools in Nigeria have compulsory agricultural training during the junior year, and then offer it as an elective during the senior year. Fasola School is located close to Fasola Farms, a government farm settlement operated by the Ministry of Agriculture. Oluponna High School is adjacent the Offer Agricultural Center that provides farmer training in agriculture.

Sample sizes were similar but not identical across countries. Of the 1264 students surveyed, 382 were in DR Congo (30%), 451 in Kenya (36%) and 431 in Nigeria (34%). In terms of gender, 41% of the respondents were female and 59% were male with near parity in Nigeria (51% female) but only 33% and 38% in DR Congo and Kenya, respectively. In terms of age, 70% of the students were between 14 and 17 years old with 16% younger and 14% older (data not presented). A substantial majority (86%) of the students from the eight secondary schools in the three countries were studying agriculture at the time of the survey although in some cases that participation is mandatory (Table 1). Half of the schools are based in rural areas, and the other half evenly distributed between urban and peri-urban areas, although only 30% of the students identified themselves as originating from farming households.

Table 1

Summary results of a survey among secondary students concerning attitudes toward agricultural career pathways

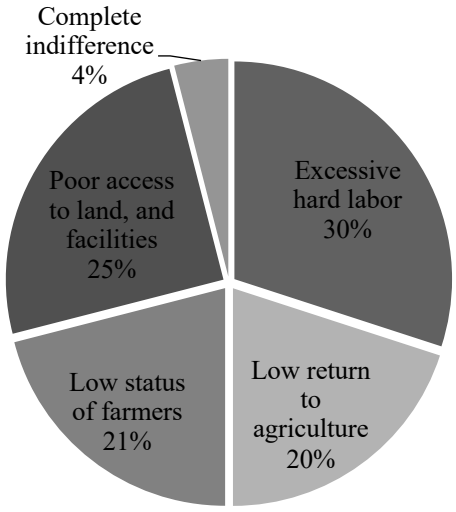
	F	±	*SEM*
Young women	41%	±	1.4%
From a farming background?	30%	±	1.3%
Future plans for farming	54%	±	1.4%
If yes: future plan involves field crops	30%	±	1.5%
If yes: future plan involves animals	42%	±	1.6%
If yes: future plan involves processing	15%	±	1.2%
No future plans for farming	46%	±	1.4%
Currently study agriculture in school	86%	±	1.0%
Member of young farmer club	9%	±	0.8%

Currently involved in agriculture	69%	±	1.3%
If yes: grow field crops	58%	±	1.7%
If yes: raise animals and livestock	37%	±	1.7%
If yes: practice horticulture	24%	±	1.9%
Not currently involved in agriculture	31%	±	1.3%

A slight majority of these students (54%) imagined agriculture playing some role in their future, with animal enterprise (42% of them), field cropping (30%) and food processing (15%) being the most attractive options. At the same time, 46% of those surveyed had no attraction to agriculture for a variety of reasons (Figure 1) including its requirement for excessively hard labor (30%) while offering reduced returns to effort (20%) and an overall unfavorable image of farmers (21%). At the same time, 25% of these youth stated that they lack the land or facilities needed to practice farming and this excluded it as an option in their career planning.

Figure 1

Reasons stated for lack of interest in agriculture



It is important to note that most of these students attended courses in agriculture (86%) and that in many cases it was a required course. For the most part (81%) these courses included practicals and field work (data not presented). Very few of these students (6%) expressed a strong dislike for their agricultural courses. Also, very few of these students (9%) were members of extracurricular young farmer clubs for a variety of reasons, mostly because schools outside of DR Congo do not offer such clubs, and where offered many youth did not have time to participate. Disinterest in these clubs does not mean, however, that students are not presently engaged in agriculture. Indeed, 69% of those surveyed are involved in farming, mostly as part of family enterprise with field cropping (58%), animal rearing (37%) and vegetable horticulture (24%) the most common activities.

Students were also asked what a project such as STEP could do to assist them to successfully pursue careers in agriculture, and again a wide variety of responses were collected including help to better access inputs (26%) or new agricultural technologies (22%), finance for

their new enterprises (20%), support for improved instruction (14%) and assistance in securing access to land or facilities (12%). These results were then disaggregated by country and gender.

Strong trends and differences were expressed between the countries (Table 2). Slightly younger students were surveyed in Nigeria and fewer girls surveyed in DR Congo and Kenya (data not presented). Large differences in farm family backgrounds exist with nearly half from farms in Nigeria and <10% from farms in Kenya. Fewest future plans for agriculture are made in Nigeria (29%), most in DR Congo (91%). Field cropping is least attractive among students in DR Congo, maybe due to the area's steep terrain. Animal enterprise is more appealing than field crops across all countries. Aquaculture is most attractive in Nigeria (24% of respondents), much less so in Kenya (2% of respondents). Results related to horticultural ambitions suggest that Nigerians do not understand horticultural enterprise, and do not distinguish it from field cropping. Value-added processing was most attractive in DR Congo, suggesting stronger opportunity for cottage and small-scale processing enterprises but across all countries, youth appear to under-recognize marketing and agro-industrial career opportunities.

Table 2

Students' future plans toward agriculture in DR Congo, Kenya and Nigeria

	DR Congo (± SEM)	Kenya (± SEM)	Nigeria (± SEM)
From a farming background	34% ± 2.4%	9% ± 1.4%	46% ± 2.3%
Future plans involve farming	91% ± 1.4%	49% ± 2.4%	29% ± 2.1%
If yes: future plan involves field crops	21% ± 2.2%	31% ± 3.2%	39% ± 2.6%
If yes: future plan involves fish farming	10% ± 1.6%	2.0% ± 1.0%	24% ± 2.3%
If yes: future plan involves horticulture	19% ± 2.1%	13% ± 2.3%	<1% ± <1%
If yes: future plan involves business	35% ± 2.4%	24% ± 1.9%	15% ± 1.5%
No future plans for farming	8.6% ± 1.4%	52% ± 2.4%	71% ± 2.1%
If not, why: no land or facilities are available	22% ± 7.4%	33% ± 3.2%	6.9% ± 2.7%
If not, why: farming offers poor opportunity	13% ± 5.9%	26% ± 3.0%	9.2% ± 3.1%
If not, why: unfavorable image of farmers	9.4% ± 0.05%	23% ± 2.9%	23% ± 4.5%

Aversion to agriculture appears strongest in Kenya and Nigeria and farming is widely viewed to involve drudgery across all countries. The potential profitability of farming is recognized least in Nigeria (9% of respondents) and most in Kenya (26% of respondents). Availability of land poses a problem to many youth in DR Congo (22%) and Kenya (33%). Many youth, but not most, have no interest in agriculture, but have difficulty in articulating their reasons.

Career ambitions toward agriculture are very low in Kenya (8% of respondents) but remain high in DR Congo and Nigeria (71% to 80%, respectively). Fewest students in Kenya attend agricultural courses (62%) where it is handled as an elective against other vocational

fields; in contrast to the schools in DR Congo and Nigeria where it is a core course. All courses involve classroom lectures but slightly fewer courses include field practicals (data not presented). Very few students in DR Congo and Kenya strongly dislike their course (3% and 10%, respectively, data not presented). Many of these results appear to reflect the level of agricultural development within the survey area and the presence and strength of alternative economic sectors within their communities and countries.

Young farmer clubs were in widespread operation only in DR Congo but well attended there (24% of respondents). Nigerian youth are least familiar with farming equipment (only 8%) as opposed to Kenya (20%). A large majority of students remain involved in farming enterprises across all three countries (69%), mostly through home enterprises, but fewest in Kenya (53%). In Nigeria, animal enterprises were not differentiated between small animal rearing (e.g. poultry) and livestock. Fish farming is most common in Nigeria (12%), least in Kenya (<1%) suggesting differences in diets, water resources and available infrastructure. Horticulture appeals to many youth in DR Congo and Kenya (between 20 to 28% of respondents) but was not understood as a separate enterprise opportunity in Nigeria. To a large extent, opportunities for food processing are not widely appreciated among youth in Kenya, likely because of its more advanced food industry. Youth are seldom involved in marketing (<3%) within home enterprises, suggesting that these activities are intended for household needs or that older family members assume this responsibility.

A more nuanced understanding of differences between countries with regard to agricultural opportunities appears in Table 3. Relatively few students are not currently involved in some form of agricultural enterprise, with disinterest greatest in Kenya and Nigeria (25% and 32%, respectively). Many of the disinterested youth in Nigeria claim to have no time for outside enterprise (45%), presumably so that they can concentrate more on their studies, less so in DR Congo and Kenya (10% and 14%, respectively). Funding poses a smaller obstacle to outside enterprise than might be expected, but the availability of land and facilities appears to pose a major barrier in DR Congo and Kenya (72% on average). Relatively few students are forbidden permission to practice outside farming enterprises by their parents (1% to 13% in different countries), in part because a majority of them are already doing so (Table 2).

Table 3

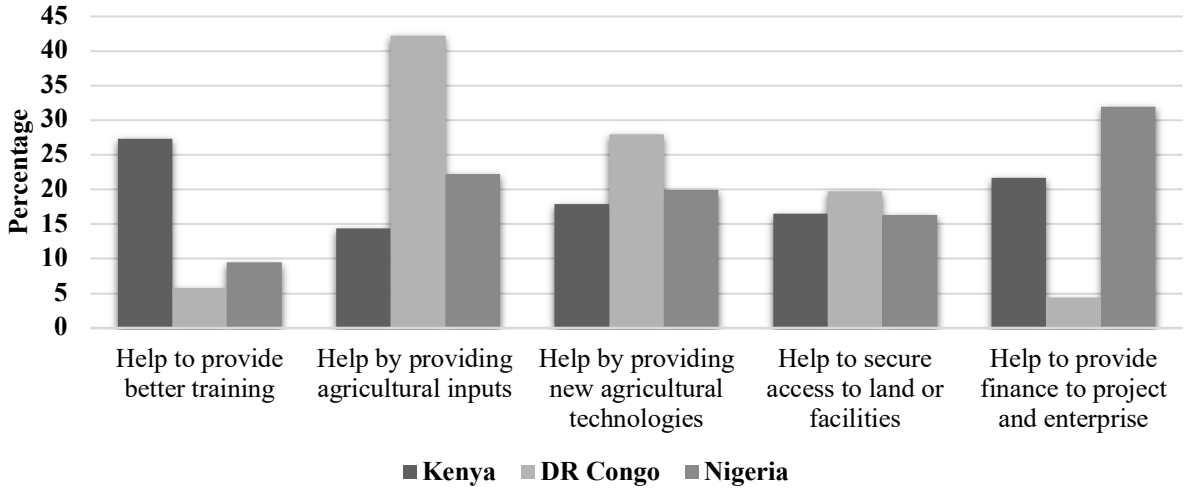
Student participation in agriculture in DR Congo, Kenya and Nigeria

	DR Congo (± SEM)	Kenya (± SEM)	Nigeria (± SEM)
Currently study agriculture in school	96% ± 1.1%	62% ± 0.023	100%
Member of young farmer club	24% ± 2.2%	4.0% ± <1%	1.8% ± <1%
Use machinery in club (or elsewhere)	18% ± 2.0%	20% ± 1.9%	8.4% ± 1.3%
Currently involved in agriculture	72% ± 2.3%	53% ± 2.4%	82% ± 1.9%
How can STEP best assist you?			
Help to better access inputs	42% ± 2.6%	14% ± 1.8%	22% ± 2.1%
Help to provide finance	4.4% ± 1.1%	22% ± 2.1%	32% ± 2.4%
Help to provide better training	5.8% ± 1.2%	27% ± 2.3%	9.5% ± 1.2%

The survey solicited students' opinions on better advancing career pathways in agriculture, and some important differences are revealed between countries (Figure 2). When asked how their instruction can be improved, few students ask for better agricultural training except in Kenya (27%), suggesting that courses are either adequate or viewed through a less critical lens in DR Congo and Nigeria. Proportionately greater demand exists for better access to inputs and new technologies, particularly in DR Congo (42% and 28% of respondents, respectively). Students fail to distinguish between new technologies and the need for training in their application in DR Congo and Nigeria, again suggesting a lack of technical sophistication. It is important that farming clubs provide land and facilities to its members, a need identified by between 18% and 28% of respondents in different countries. Practicals should include labor-saving technologies in its approach. Finance concerns must be addressed but are secondary, although the very low perceived need for investment opportunity in DR Congo (only 4% of respondents) may actually be related to its reduced level of agricultural commercialization compared to Kenya and Nigeria (22% and 32% of respondents, respectively). Note that concerns over food security are reduced among these students across all countries (between <1% in Kenya to <7% in Nigeria), suggesting that educational efforts should focus upon higher-value and value-added crops in addition to basic food commodities.

Figure 2

Students' opinions on better advancing career pathways in agriculture



Of the students surveyed in three countries and eight schools, 41% were girls, allowing for strong gender comparisons (Table 4). Fewer girls profess to originate from farming backgrounds (-12%) or to have future plans involving farming (-28%). Both of these factors imply a gender basis for stigma associated with agricultural careers. Of those girls attracted to careers in agriculture, fewer are attracted to field cropping (-16%), animal rearing (-31%) and fish farming (-20%); but girls are far more attracted to opportunities involving food processing (+36%) and marketing (+46%). More girls than boys are discouraged from farming because it involves drudgery (+43%), but fewer girls believe that agriculture offers reduced opportunity (-3%).

Table 4

Differences in relationship, attitudes and plans for career paths toward agriculture among secondary school male and female students

Relationship to agriculture	Females (± SEM)	Males (± SEM)
Future plans for farming	45.3% ± 2.2%	60.7% ± 1.8%
If yes: future plan involves animals	34.3% ± 2.5%	47.3% ± 2.1%
If yes: future plan involves marketing	12.2% ± 1.7%	7.8% ± 1.1%
If not, farming is too labor intensive	36.4% ± 3.9%	23.8% ± 3.2%
Member of young farmer club	6.7% ± 1.1%	11.2% ± 1.2%
Use machinery in club (or elsewhere)	9.0% ± 1.3%	19.8% ± 1.5%
Currently involved in agricultural enterprise	66.2% ± 2.1%	70.7% ± 1.7%
If not, no time for outside enterprise	21.6% ± 3.2%	17.9% ± 2.7%
If not, lack funds to invest	17.3% ± 3.0%	22.4% ± 2.9%
If not, land or facilities are not available	55.6% ± 3.9%	60.7% ± 3.5%

In general, equal proportions of girls and boys study agriculture and participate in field practicals (±2%) although slightly more girls strongly dislike agriculture as a subject (+8%). Girl's attitudes toward agriculture are further illustrated by their reduced involvement in extracurricular agricultural clubs (-48%) and experience in the use of small-scale farming machinery (-78%). However, about equal proportions of girls and boys continue to be engaged in agriculture (±7%), usually through their family farms and enterprises, but with much fewer girls involved in animal and fish rearing (average -26%) while remaining far more active in food processing and marketing (average +78%).

Several other findings reflect upon students' appreciation of agricultural opportunities. Of youth engaged in agriculture at home, 58% grew field crops and 37% raised animals, suggesting that rearing animals warrants attention in the schools as well. At the same time, insufficient access to land resources may account for the popularity of small animal enterprises (e.g. poultry). When asked why students were not practicing agriculture, 59% cited lack of facilities, 21% were simply not interested and very few (5%) lacked parental permission (Figure 2); suggesting that more students would become involved with experiential learning of agriculture if provided resources and time to do so. Very few of the students had experience with any type of farm machinery (15%), likely reinforcing their associations with excessive labor. Results related to horticultural ambitions suggest that few Nigerians (1%) distinguish it from field cropping while 39% of Kenyan students are specifically attracted to horticultural enterprises; likely the result of horticulture as a major export industry in Kenya. Value-added processing was most attractive in DR Congo (26%), suggesting stronger opportunity for cottage and small-scale processing enterprises within its economy. Across all countries few youth (10%) appear to recognize marketing and agro-industrial career opportunities; likely because they imagine start-up to be beyond their economic reach, or do not recognize employment opportunities within that sector (Fox et al. 2020). Clearly, these students relate to the stage of agricultural development within their societies, and the best means to make it a more attractive career pathway is to increase agriculture's prestige and profitability.

When the database across all schools and students was analyzed, a simple three-component model emerged that identifies students' attraction to agriculture as a career choice: *Choice = 0.20 + 0.47 Study + 0.20 Engage + 0.07 Background* ($p < 0.05$, $R^2 = 0.25$) where *Study* = current enrollment in an agricultural course, *Engage* = engagement in a current agricultural enterprise, and *Background* = originating from a farming background and parents' primary occupation being agriculture. The intercept value indicates that 20% of youth remain attracted to agriculture as a career choice regardless of changes in education but then increases in response to curricular improvement and opportunities for more direct participation in this field. While this model is relatively simplistic, it provides insight into how agricultural curriculum can be shaped, and the weight of its coefficients suggests that careers in agriculture are not only for those from farming households.

Discussion

This study reinforces many widely held assumptions about African youth concerning their attitudes and orientation toward career pathways in agriculture (Fox et al., 2020; Mukembo et al., 2014; Okiror et al., 2011), but also illustrates important differences among these youth between countries, socio-economic settings and gender. Many unfavorable attitudes toward agriculture are held by youth (Sumberg & Okali, 2013); including those originating from farming families, but at the same time these youth recognize that opportunity exists from adopting modern farming methods and commercial agricultural enterprises (Mukembo et al. 2014; Okiror et al. 2011). These youth regard agricultural enterprises as much more than just involving field cropping, but also consider animal enterprises, horticulture and food processing as attractive options. At the same time, opportunities related to marketing remain under-appreciated and food processing appears viewed more as a cottage industry than an agro-industrial entry point and employment opportunity. Less progressive attitudes concerning agricultural opportunities are held in more subsistence-type settings, particularly in DR Congo. Despite reduced agricultural intensification involving the strong transition from traditional to commercial farming as is driving agriculture elsewhere, many youth in DR Congo remain committed to becoming successful farmers, perhaps for lack of better options.

A large majority of secondary students include agriculture as part of their studies, and most regard this course in a positive light; even where these courses are handled as an elective offered against other vocational fields. That agriculture courses are so well attended, and are generally regarded in good standing, provides an important foundation upon which career pathways may be reinforced. Field practicals are less appreciated, in part because tasks of land preparation and weeding may be assigned or perceived as a punishment. Introducing mechanization as a component of these practicals is an important means to altering these negative attitudes. So too is the role of introducing Information and Communication Technologies that are reliant upon both instructional computer workstations and personal mobile devices as a means to obtain planning information, diagnostics and market intelligence. Unfortunately, computer studies are too seldom offered within the public secondary schools, and even fewer of them link computer access to agricultural studies. Indeed, it is very important that improved agricultural courses include stronger components of both small-scale mechanization and information technologies within efforts to improve how agriculture is taught and how many students grow committed toward it.

Too few schools appear to sponsor extracurricular young farmer clubs, but the cause for this shortcoming was not examined across our study. Nonetheless, designing these clubs and

offering incentives for their success emerges as another important task in educational improvement (Adebo, 2009; Mukembo et al., 2015). At the same time, differences in how girls and boys aspire to careers in agriculture emerge. Girls are particularly adverse to the excessive labor required in farming, and this drudgery conditions their unfavorable attitudes to the field as a whole. This aversion may be well founded in that across rural areas women often bear the brunt of this hard labor, and may be seen doing so on a daily basis. At the same time, girls appear to be more aware of the benefits of agricultural intensification, and the need for investment in modern technologies. This awareness is particularly strong toward horticulture, rearing of small animals and value-added processing. One concern among girls that tempers their attitude toward farming is that they will have less access to land and facilities following graduation, and explaining their tenure rights may be important in many settings (FAO, 2011). While the access to small-scale farming machines is limited across all schools, a trend emerged that girls have an aversion to using and learning about these equipment as well. For these reasons, presenting agriculture as a profitable family business built upon joint decision making and fair allocation of labor responsibilities (Acosta et al., 2020) must be better presented in agricultural education. Other elements necessary for career pathway attraction were also identified. Students recognize the need for new technologies; particularly better understanding and access to production inputs such as fertilizer and improved seed in less developed settings, and the provision of higher-value and value-added ones in more developed ones. Also among student needs are greater access to land, improved facilities and credit; although this situation varies strongly between countries (Figure 2).

The results of this study provide insight into the proportions of students formulating plans involving agriculture and how their interests can be stimulated and serviced (Figure 3). A large majority of these students from selected schools in DR Congo, Kenya and Nigeria are enrolled in agricultural courses (86%), in large part because it is either a required course or is one of relatively few elective vocational subjects. A surprisingly large proportion of these students are currently engaged in an agricultural enterprise (69%), mostly through commitments to family household wellbeing, as well as by providing realistic commercial perspectives to those 17% of students who are not actively practicing agriculture activities. Opportunity exists for their agricultural education to augment the commercial potential of these enterprises, rather than to see them as a form of involuntary obligation to household wellbeing, as well as by providing realistic commercial perspectives to those 17% of students who are not actively practicing agriculture.

A large proportion of these students have future plans that involve agriculture (54%) although most of them aspire for other fields as their main careers (see Table 5). Note that in Kenya, attraction to the agriculture and veterinary field ranked sixth in popularity behind several well-known white collar professions, but ahead of education. This broadening of interest presents opportunity to make more profitable use of family lands, or to practice modern agriculture as a side business, with either option contributing to incomes and job creation. School can also provide the perspectives allowing the 15% of students that practice agriculture now, but do not intend to do so in the future a chance to change their perspective. We also note that many students who do not originate from farming backgrounds claim to have future plans that include

agriculture (46% vs 30%, respectively), suggesting that demand will exist for incentives that provide services to these 16% of youth entering agriculture for a first time (Figure 3).

Figure 3
Entry points for secondary school students considering careers in agriculture

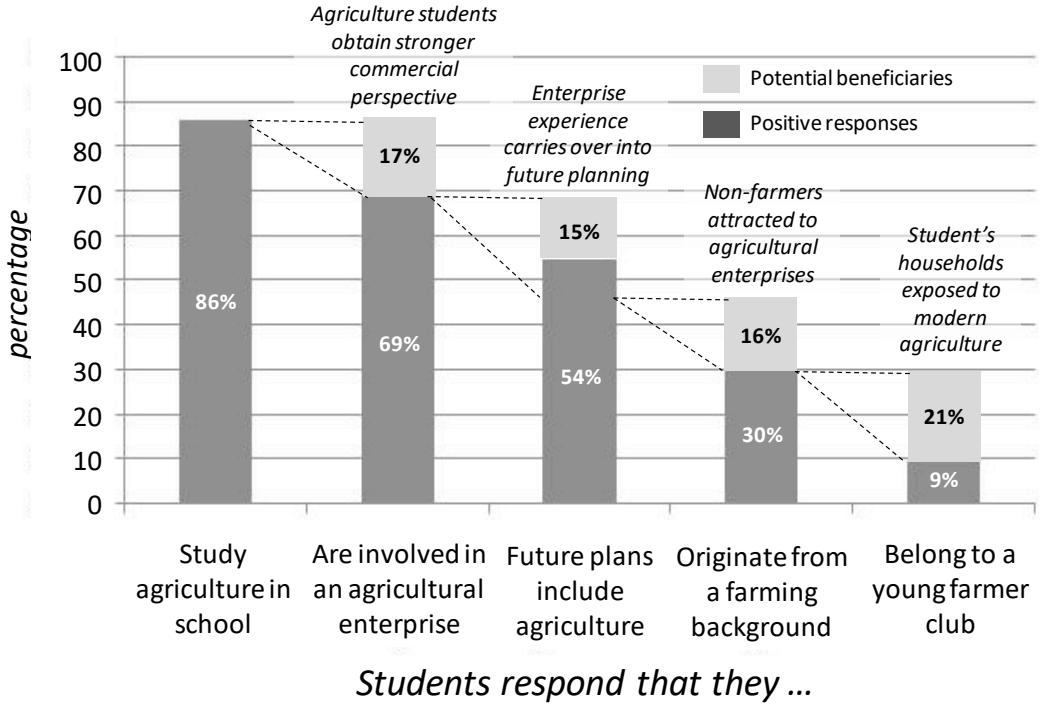


Table 5
The distribution of student's career ambitions in Kenya

Career ambition	Preference among students
Medicine	25%
Science and engineering	19%
Entertainment and media	11%
Travel and hospitality	11%
Business and commerce	10%
Agriculture and veterinary	9%
Law	8%
Education	5%
Other fields	2%

Another benefit of agricultural education exists through participation in extracurricular young farmer clubs (Mukembo et al., 2014). While participation in such clubs is infrequent (9%), this is because the clubs are not in place, not that there is no demand for them. Indeed, if club membership were more widely available, 21% of the students would be in a better position to take modern farming technologies home to their family farms. In this way we see the improvement of agricultural courses, particularly through improved field practicals and

participation in young farmer clubs, as offering a sequence of opportunities through developing and applying more commercial agricultural perspectives, attracting additional youth to agricultural enterprises, and applying the skills they develop to their family farming (Okiror et al., 2011).

The results of this survey shed important light on the way forward for agricultural education in DR Congo, Kenya and Nigeria. Career ambitions of the students interviewed in Kenya appear in Table 5. These choices are expectedly skewed toward more prestigious, white collar professions as they aspire for better lives away from rural areas. Achieving these careers in the proportions as specified is unlikely, as with 25% attraction to the field of medicine. While youth planning careers in agriculture remain in a minority (9%), we note that 49% of those interviewed in Kenya (data not presented) included agriculture in their future plans (compared to 54% overall, see Table 1). Together these students seeking careers in agriculture as well as those intending agricultural sidelines are positioned to benefit from better understanding of modern agriculture and agribusiness through their secondary school education and extracurricular participation.

Modern farming is a primary driver of Africa's economic growth, and youth can be readied to adjust to the realities of opportunity by preparing for careers in agriculture, even when it is not their first choice. At the same time, agribusiness need not be organized by full time farmers, as those who find success in other professions can then commit savings to invest in actions by other family members. Indeed, for every youth committed to agriculture as a primary career path, there are four others who envisage future engagement with agriculture despite their stated preference for other fields of employment. Furthermore, it is important that agriculture not be presented to students in rural areas in a fatalistic manner that precludes wider opportunities, because it is important that youth have dreams and strive to achieve them as reflected in Table 5.

Conclusions and Recommendations

Opportunity exists to improve approaches to agricultural education among secondary school students in Africa by reinforcing career choices in a manner that meets expectations of agricultural modernization and rural economic growth, but these improvements must be adjusted to specific schools and settings. These improvements involve coursework, practicals and extracurricular activities. Courses must better cast agriculture as an economic frontier and modern farmers as pioneers rather than forgotten victims of poverty. Greater reliance upon electronic instructional tools and digital agriculture is required to stimulate students' interests. Practicals must be based upon solid agribusiness models with schools offering experiential learning in proven enterprises. At the same time, this learning must be open-ended and gender-differentiated in that imparted skill sets can be applied to other related enterprises and assist in securing decent employment within agribusiness. These skill sets can be further developed through participation in extracurricular young farmer clubs, and such clubs appear to be offered too infrequently. Furthermore, the activities of these clubs can also be built upon profitable enterprises that provide modest incentives to club members and benefits to the farming households from which they arise. This study casts insight into how these improvements may be achieved.

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