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Full Length Research Paper

Assessing the performance of an irrigation scheme in Okyereko, Ghana

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Assessing the performance of an irrigation scheme is an important management function which will indicate the state of the scheme and suggest possible remedial measures to improve the effectiveness of the scheme. This study was conducted to assess the technical and agricultural performances of the Okyereko irrigation scheme in the Central Region of Ghana. Secondary data were collected from the scheme with respect to rainfall, yield for the period of 2011 to 2015 seasons whilst field measurements were carried out to determine the water supply and demand. This study assessed three technical performance indicators and two agricultural performance indicators during the 2014/2015 season. The V-notch and the rectangular weir were used to measure the water delivery and the Manning formula was used to calculate the flow-rates in canals. Water requirements were estimated using the modified Penman method. The results from this study indicated an overall scheme conveyance efficiency of 78.2%, a maximum dependability of irrigation intervals between water applications of 2 and a scheme relative irrigation supply of 1.38. The agricultural performance indicators, output per unit irrigation supply and water productivity per unit crop evapotranspiration (ET), were found to be 0.90 and 20.53 kgm^{-3}, respectively for rice. This study recommends that farmers should be actively involved in all performance assessments and scheme organizations in order to improve the performance since the farmers are major stakeholders of irrigation schemes and are responsible for operation and maintenance after the introduction of Participatory Irrigation Management.

Keywords: Irrigation scheme, agricultural productivity, performance assessment.

INTRODUCTION

Water for irrigation is increasingly becoming limited owing to increased demand from other uses such as domestic water, industries and the environment (Perry, 2005) which give higher economic and social returns. In Ghana, fresh water is becoming scarce due to the activities of illegal miners. As Ghana's agriculture is faced with seasonal rainfall, irrigation remains one of the obvious options to meet future food demands. To meet the increasing demands for food with an increasingly limited water supply, water resources management must be improved.

The Food and Agriculture Organization (FAO) predicted

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that food production must increase by 70% globally and that developing countries must double production to match a 40% increase in World population by 2050 (Mukherji et al., 2009). However, unpredictable climate, depleted water resources and the critical shortage of other production resources pose a challenge to increased food production. In anticipation of a food deficit in future, most researchers in the agricultural sector are looking at efficient utilization of water (Mukherji et al., 2009).

Performance assessment of irrigation schemes has gained momentum since the late 1980s due to the perception that the resources (land and water) in irrigation schemes are not being managed appropriately.

According to Mdemu et al. (2008), improving water productivity is one important strategy for addressing future water scarcity. Water productivity is an indicator of agricultural productivity in relation to the crop's consumptive use of water (World Development Report, 2003). Productivity enhancements are accompanied with optimum resource utilization and maximization of the marginal production.

Improving water productivity in agriculture reduces competition for scarce water resources, gives solutions to mitigate environmental degradation and finally may lead to enhanced food security.

The government of Ghana sees irrigation as a tool for improving the citizen's livelihood, food security and empowering and mainstreaming the previously disadvantaged farmers in the local, national and international economy. Irrigated agriculture has been the major fresh water consumer among the water using sectors in Ghana and the world, and it has been highly threatened under water scarcity situation in the recent past as a result of growing water demands from emerging sectors (Aman, 2003).

The inadequate technical skills in planning, implementing and monitoring of the system, poor man-management, and technical deficiencies in the physical system, salinity and low yield are major problems in irrigation schemes. As such, the government of Ghana and the Japan International Cooperation Agency (JICA) has invested significant financial resources into the rehabilitation of irrigation schemes across the country in order to ensure that Ghana becomes self-sufficient in food production.

The performance assessment of irrigation schemes should employ a holistic approach (interdisciplinary stakeholder approach) to benefit the less privileged farmers. According to Sam-Amoah and Gowing, 2001), little attention has been paid to the perception of the consumer of irrigation services and the fundamental stakeholder – farmers – when discussing the performance of irrigation schemes.

This study focuses on some of the technical aspects of irrigation performance (water balance, water service and maintenance which will be evaluated using conveyance efficiency, dependability of irrigation intervals between water applications and relative water supply); agricultural performance, which will be evaluated using output per unit irrigation supply and output per unit water consumed. Therefore the objective of this study was to assess the performance of the Okyereko irrigation scheme and to identify the best organization practices for the scheme.

MATERIALS AND METHODS

Study area

The research was carried out at the Okyereko Irrigation Scheme at Okyereko which is located on latitude 5° and longitude 5°, 30° N near the Okyereko village in the Central Region of Ghana. The Okyereko scheme is situated about 1.5 km off the Accra- Winneba road, 49 km from Accra. The scheme consists of an earthen dam with a catchment area of about 1685 km^2; the reservoir is fed by the tributary from the Ayensu river with Coastal Savannah vegetation and annual average rainfall of 750 mm.

The scheme has two main canals, the left and the right main canals but due to flooding the left main canal is damaged and no more in use. The scheme spans approximately 81 hectares with 132 farmers. It is divided into 0.68 ha per plot. Water is diverted from a weir constructed across the Ayensu river into a trapezoidal concrete canal which runs for 2.4 km from the diversion point to the end of the scheme (Koie, 2000). This concrete-lined canal with a top width of 2.0 m and a depth of 0.5 to 0.7 m is designed to convey approximately 100 L s^{-1}.

The scheme is divided into 7 lateral blocks of different sizes for management and ease of water distribution. The scheme layout is depicted in Figure 1. Water is diverted from the reservoir and conveyed to the scheme through a trapezoidal concrete canal from which distributary canals of different shapes (U-flume for secondary canal, steep portion for lateral and gentle for sub-laterals) branch to supply water to the plots. The scheme was chosen because it is one of the medium sized schemes in Ghana exhibiting water shortage, salinity and therefore needs to be investigated.

Field measurements

Flow rates at various points in the scheme and crop yields were measured, and crop yields within the scheme were physically measured. Although there are new, accurate and more encompassing technologies such as remote sensing (Perry, 2005), field measurements were used in this study due to resource constraints and the small size of individual irrigated plots which measured approximately 0.68 ha per plot.

Data collection

For the study, all the necessary primary data were collected from the Okyereko irrigation scheme and secondary data from Winneba Meteorological station. In addition, some discussions were also held with farmers. Data collected included: flow rate, crop production records, price of crops, area irrigated, command area, cropping pattern, soil and climatic data.

Flow rate measurement

Measuring devices of irrigation discharge

There are several types of measuring devices, the common ones

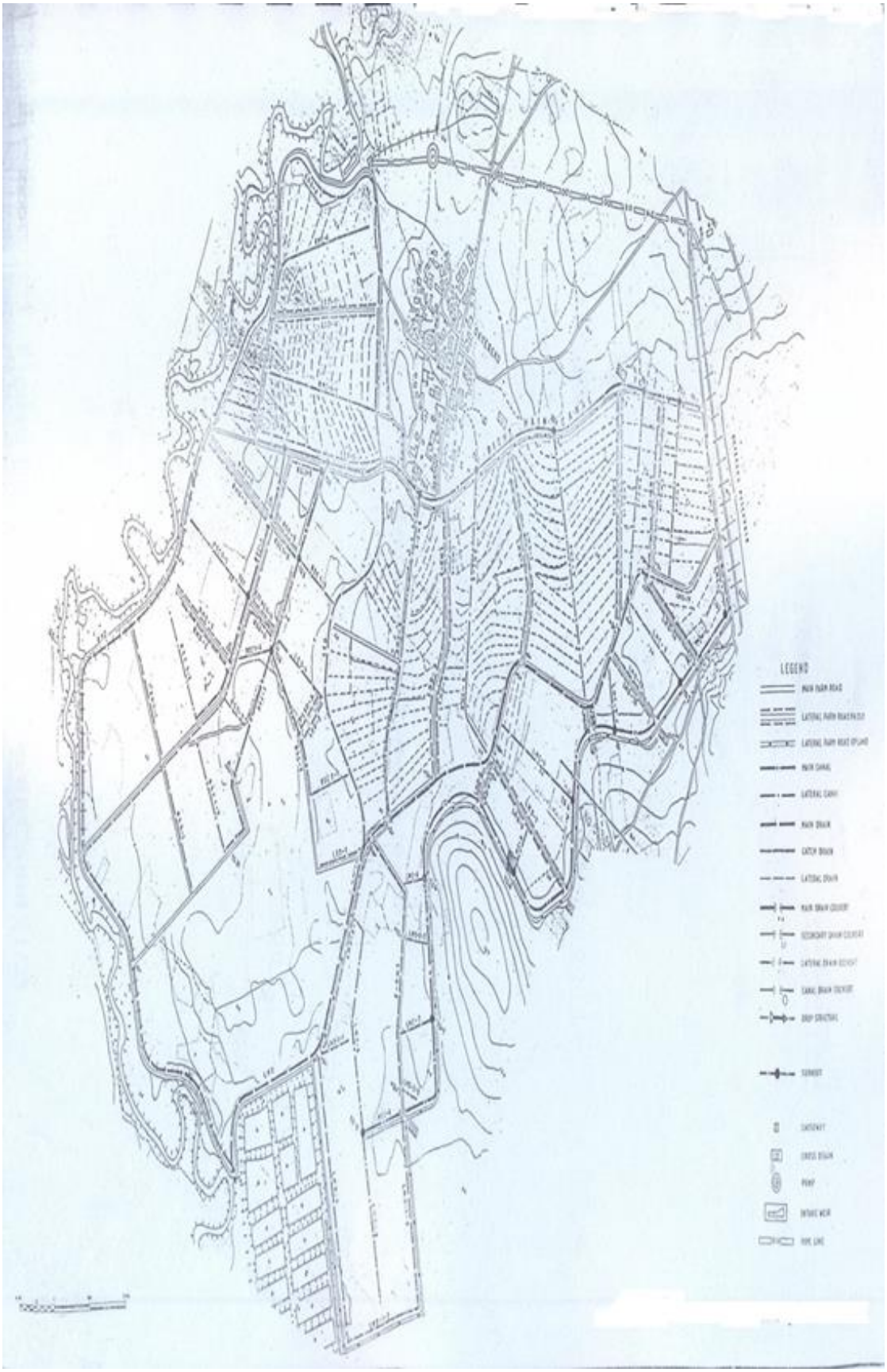

Figure 1. General layout of Okyereko scheme. Scale 1:2000.

Table 1. Daily evapotranspiration, ETo (mm).

May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.8	3.8	3.6	3.6	4.0	4.8	4.9	4.4

being rectangular and V-notch weirs. A V-notch weir measures smaller discharges as compared to a rectangular weir, and was installed at the start of the main irrigation canal, just after the dam outlet pipe to enable discharge to be measured precisely.

The constructed measuring device consists of an outlet box, an energy dissipating wall and a thin V-notch plate with an angle of 120°. An effective free-flow discharge coefficient was adopted with a value of 0.58, which is the theoretical value for C in the Manning formula.

The relationship between the overflow depth and discharge of the V-notch weir is calculated using the Manning equation which is defined as follows:

$$Q = \frac{8}{15\,C} \times \frac{tan\emptyset}{2} \times \sqrt{2g} \times h^{5/2} \quad (1)$$

Where, Q is the Discharge (m^3s^{-1}); C is the effective free-flow discharge coefficient; Ø is the V-notch angle (degree) and h is the overflow depth (m) to be read using a staff gauge installed on the outlet box wall.

Turnout discharge

Turnout gates are constructed at various sections along the main canal. There are seven turnout gates along the main canals. The gate opening is regarded as a rectangular weir to measure discharge of water to farmers' fields.

The turnout gates are of two types, type 1 and type 3 with different effective free-flow discharge coefficients (C value) which are 1.68 and 1.77 respectively. These values were adopted from the operation and maintenance manual of the Okyereko irrigation scheme. The relation between overflow depth and discharge of the rectangular weir used is calculated using the Manning equation which is defined as follows:

$$Q = C \times B \times h^{3/2} \quad (2)$$

Where, Q is the Discharge (m^3s^{-1}); C is the effective free-flow discharge coefficient; B is the effective width of constriction (m) and h is the overflow depth (m) to be read using staff gauge installed on the outlet box wall.

Water demand (ETo)

Reference crop evapotranspiration in mm/day (ETo) was estimated by the modified Penman method. There are many methods to estimate crop evapotranspiration. The modified Penman method was used, since it is likely to provide the most satisfactory results and is adopted for many projects in estimating the reference crop evapotranspiration. The estimated ETo is shown in Table 1.

Technical performance indicator used

Relative irrigation supply (RIS)

The RIS is an indicator that shows the irrigation efficiency of the scheme as a whole. This is because it compares the irrigation water supplied with the irrigation water needed.

Relative Irrigation Supply (RIS) gives an indication of how well crop water requirements are met or satisfied in a scheme (Molden et al., 1998). It is calculated using Equation 3:

$$RIS = {Si}/{Di} \quad (3)$$

Where, RIS is the relative irrigation supply, S_i is the irrigation supply [$m^3.s^{-1}$], and D_i is the irrigation demand [$m^3.s^{-1}$].

Conveyance efficiency (E_c)

Conveyance efficiency refers to the ratio of volume of water leaving a canal section to that introduced into the section.

As a performance indicator, Ec is assessed by measuring inflow and outflow of selected canal and calculated using Equation developed by Bos et al. (2005):

$$E_c = {Qoutflow}/{Qinflow} \quad (4)$$

Where, E_c is the Conveyance efficiency, Q_{inflow} is the total water flowing into a specific section of the canal [$m^3.s^{-1}$], and $Q_{outflow}$ is the total water flowing out of a specific section of the canal [$m^3.s^{-1}$].

This indicator can be analyzed either as a trend in time to quantify the need for system maintenance or spatially to identify sections of the canal sections that need maintenance. The temporal variation of the conveyance efficiency over the same section shows that either the system has deteriorated or has been rehabilitated, depending on whether the variation is positive or negative. A value >1 implies more water leaves a specific canal section than that which enters it, while a value equal to 1 implies there is no water loss over the section under consideration. A value < 1 indicates that there was water loss in the section and therefore a need for maintenance of the system. The amount of water lost will determine the need for maintenance of the system. It is recommended that the conveyance efficiency of concrete lined-canal should be above 85% (Brouwer et al., 1989; Gungor et al., 1996), cited by Korkmaz et al. (2009). The indicator has been used in various performance assessment studies in water scarce regions.

Dependability of irrigation interval between water application

Dependability is the reliability or timeliness of water delivery to the edge of the plots. This indicator, when given as a trend in time, shows changes in service to farmers (timing only) while it illustrates the equity of water delivery service to farmers when analyzed in space (Bos et al., 2005).

$$D_{int} = {Aint}/{Iint} \quad (5)$$

Where,
Dint = dependability of irrigation interval between water applications,
A_{int} = actual irrigation interval [days], and
I_{int} = intended or design irrigation interval [days].

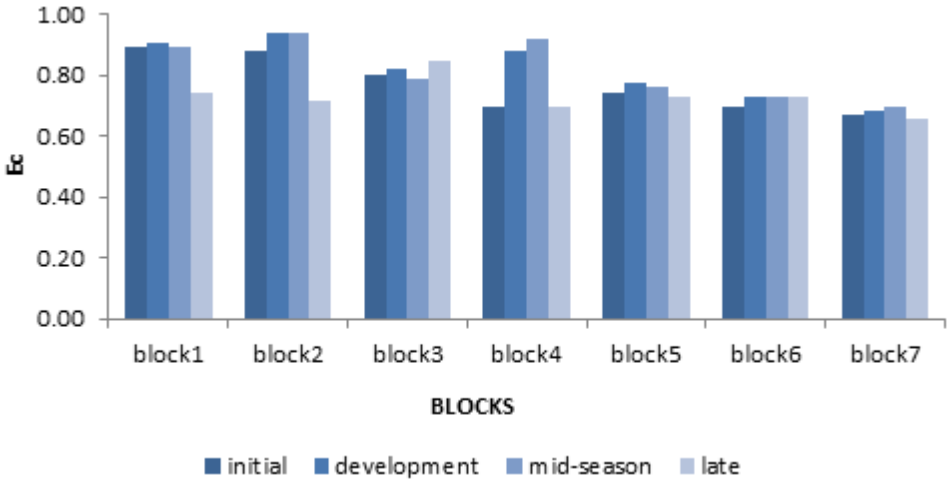

Figure 2. Seasonal variation of conveyance efficiency (Ec) among blocks in the morning (6:00 am to 10:00 am).

Dint equals 1 if water is delivered as scheduled, less than 1 if water is delivered more often than planned and greater than 1 if farmers wait longer than scheduled to receive water.

Agricultural performance indicators used

Output per unit water consumed (WP_{ET})

It is calculated using Equation 6 by Molden et al. (1998):

$$WP_{ET}=\frac{P}{QET} \quad (6)$$

Where
WP_{ET} is the output per unit water consumed [kg/m^3],
P is the yield [kg], and
Q_{ET} is the volume of water consumed by crop (ET_o) [m^3].
This indicator provides information on yield to those who are more concerned with crop behavior such as crop physiologists and agronomists (Gomo, 2012).

Output per unit irrigation supply

This indicator provides information on water use in the field or plot which is expressed in kg/m^3 and it is calculated using Equation 7.

$$WP_I=\frac{P}{Qd} \quad (7)$$

Where
WP_I is the water productivity with respect to irrigation water supply [kg/m^3],
P is the crop yield [kg],
Qd is the diverted irrigation water into a specific plot [m^3].

This indicator is important to water managers and farmers since water managers are usually concerned with water use, and farmers use the water to maximize returns from their investments.

Values for diverted irrigation water into a specific plot [m^3] and volume of water consumed by crop ET [m^3] were for only 2015/2016 cropping season. These values were used for the previous years since no such records were available.

Yield measurements

Crop yields were measured from farmers in the head, middle and lower location in all the 9 plots. Individual paddy rice bags were weighed and an average weight calculated for each plot. The total harvest per irrigated land was calculated from the average weight of yield per plot. The yield measurements were done just before the produce was taken to the market.

RESULTS

Technical performance indicators

Conveyance efficiency (Ec)

The results presented in Figure 2 show the sequential conveyance efficiency values at the scheme. Conveyance efficiency is calculated from the ratio of irrigation supply from the inlet of the V-notch weir as input and discharge to farmers' plots through the turnout gate as the output flow for the various stages of growth for each block.

The variation of conveyance efficiency at the initial, developmental, mid- season and late stages of the season at morning and evening hours for each block can be seen in Figures 2 and 3 while the variation of overall mean Ec per block in the scheme is illustrated in Figure 4.

Dependability of irrigation interval between water applications (Dint)

The dependability for successive water deliveries to the edge of plots varied within each block and along the canal from head to tail-end between 0.43-2.00 (Figure 5).

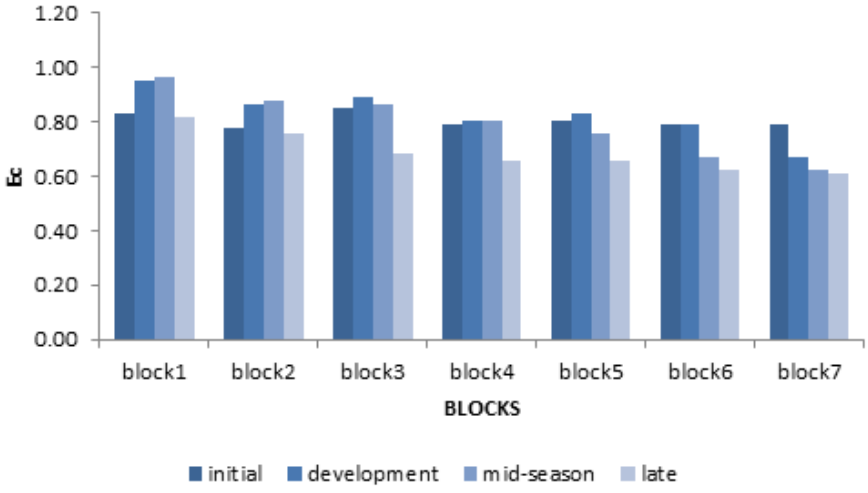

Figure 3. Seasonal variation of conveyance efficiency (Ec) among blocks at evening (4:00 pm to 6:00 pm).

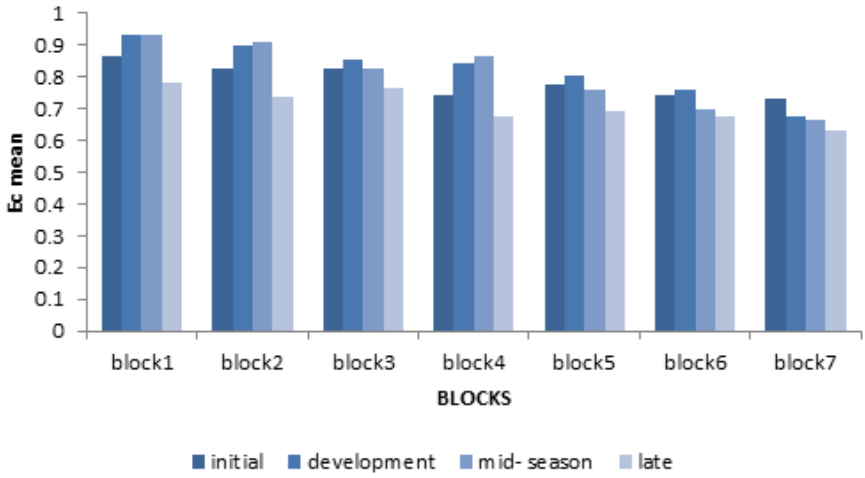

Figure 4. Variation of mean conveyance efficiency (Ec) per block throughout the season.

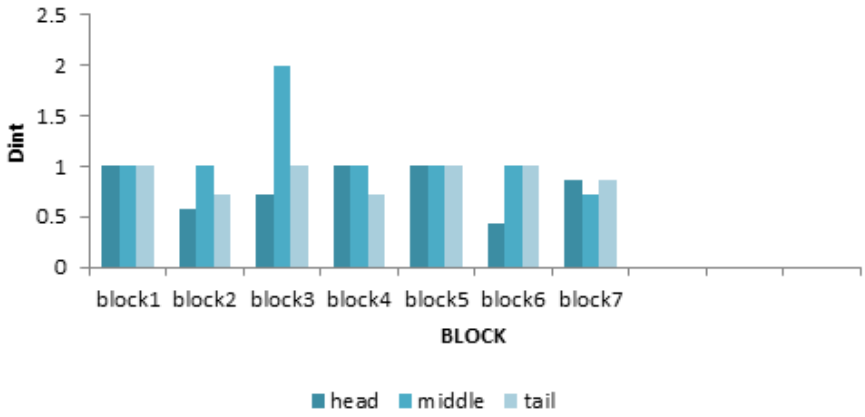

Figure 5. The average dependability of irrigation interval between water applications in 2015 irrigation season.

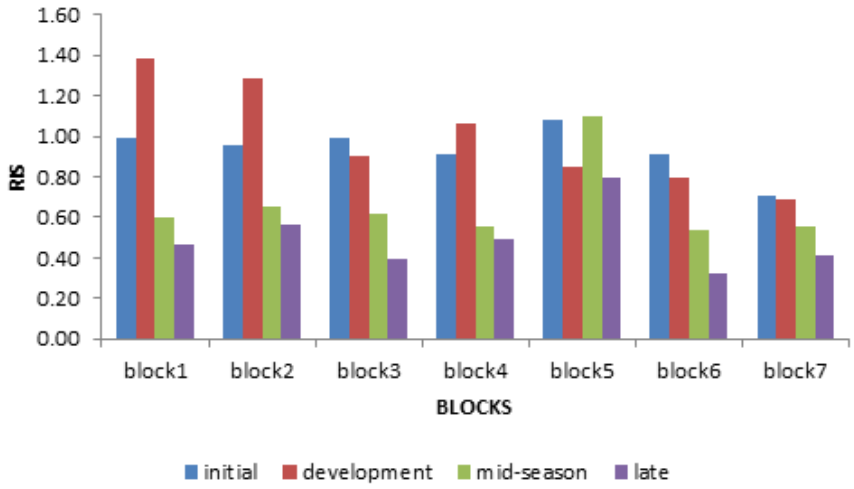

Figure 6. Variation of relative irrigation supply throughout the season at OIS.

In the 2015 irrigation season at Okyereko Irrigation Scheme (OIS), the values of Dint were equal to 1 for Blocks1 and 5, indicating that water was delivered to the edge of the plots as planned from the head to the tail portions of the blocks; Dint values were around 1 in blocks 2, 3, 4 and 6, showing that water is delivered around the planned time on average but only the middle section of block 3 had a Din value > 1 meaning that the farmers wait for a longer time to get water on the edge of their plots than assured. Dint values are < 1 for block 7 indicating that more water was delivered to the edge of the plots than planned. These values were obtained from the intended irrigation interval for the scheme and the actual irrigation interval by the farmers.

Relative irrigation supply

The level to which crop water demands were met varied with the growth stages of the rice growth from the initial, developmental, mid-season and late stages of the season. RIS varied among the blocks from 0.39 to 1.38, increasing in the developmental stage of the season varying between 1.38 to 0.69 from the head to the tail end of the blocks, as can be seen in Figure 6. This graph was obtained from the water supply values obtained from the intake weir using the V-notch weir and the discharge calculated using the Manning formula whilst the crop water demand was obtained from daily ET_o for the various months of the rice growth.

Agricultural performance indicators

Output per unit water consumed (WP_{ET})

The average values of output per unit of water consumed by the rice at OIS for the 2011, 2012, 2013, and 2015 are 19.34, 20.40, 20.93 and 21.44 kg/m^3 respectively (Figure 7). The value for 2014 was not obtained because there was no cropping due to flooding.

Output per unit irrigation supply

The Output per unit irrigation supply is shown in Figure 8. The trend in these results shows that output per irrigation supply increased from 2011 to 2015. The output per unit irrigation supply for rice varied from 0.85 to 0.94 kg/m^3. The highest productivity was in 2015. There was no cropping due to flooding in 2014.

DISCUSSION

Conveyance efficiency

The conveyance efficiency varied within the day, at the initial, development, mid- season and late growth stages of rice during the season and among the blocks throughout the scheme as can be seen from Figures 2 and 3.

The average conveyance efficiency of the concrete-lined U- flume main canal was 78.2%. According to Jadhav et al. (2014), average conveyance efficiency should be 75% for concrete-lined canals and this was also recommended by Bahramlou (2007) who reported conveyance efficiencies of 71.1 and 94.4% for concrete and stone lined irrigation canals respectively.

The conveyance efficiencies in the morning (6:00 am to 10:00 am), mean (12:00 noon), and evening (4:00 pm to 6:00 pm) at the initial, development, mid- season and late growth stages of the season were almost constant in each block, as shown in Figures 2 to 4, for Blocks 1 to 7,

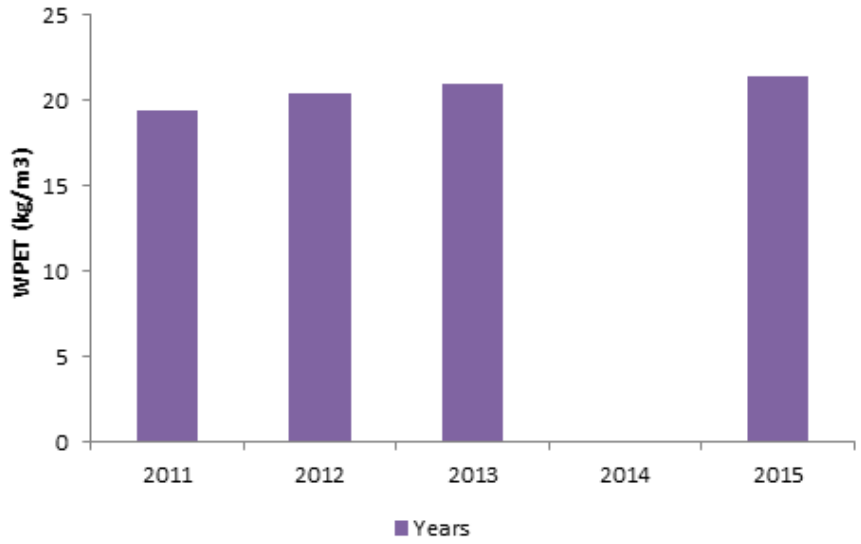

Figure 7. Rice output per unit delivered irrigation water at OIS.

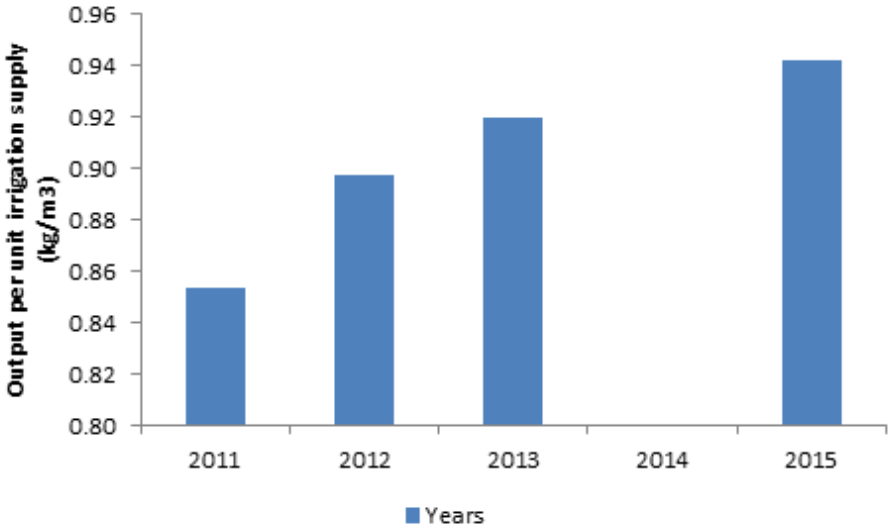

Figure 8. Rice output per unit irrigation water supplied at OIS.

ranging from 61 to 97%, indicating that there was no significant decline of the system nor increased illegal water withdrawals throughout the season. This was because the farmers have access to adequate irrigation water and there are proper maintenance practices. The slight variations can be explained by the fact that water supply is for multiple-use that is, domestic and irrigation. Also there are broken turnout gates as seen in Figure 9.

The conveyance efficiency values obtained from this study were found to be comparable to other results from various irrigation canals in Africa, Iran and other parts of the world which ranged between 61% and 95% (Manzanera et al., 1992). Conveyance efficiency in concrete lined irrigation canal in Asia and Latin America was also found to range from 61 to 93% (Manzanera et al., 1992).

According to Jadhav et al. (2014), average conveyance efficiency was found to be 75% in concrete-lined trapezoidal canal in India, while Awulachew and Ayana (2011) found a conveyance efficiency of 88.7% in Bilate irrigation scheme in Ethiopia, and Gomo (2012) found a conveyance efficiency 86.4% in Mooi river irrigation scheme. Results from this study revealed a scheme average conveyance efficiency of 78.2% which is not so different from those found in South Africa, India, Iran, Sri Lanka and Ethiopia.

Figure 9. Broken check gate and Water used for domestic purposes.

Dependability of irrigation interval between water applications (Dint)

The dependability of irrigation intervals between water deliveries was equal to one in blocks 1 and 5 indicating that water was being delivered to the edge of the plots as planned and from the head to the tail portions of the blocks as intended. The waiting period between two consecutive water applications within and among these blocks is 7 days, averaging 7 days for the season.

In blocks 2, 3, 4 and 6, the Dint value was less than 1 on average. The waiting period between two consecutive water applications within and among these blocks ranged between 1 to 6 days, averaging 4 days for the season. This is less than the intended interval of 7 days between water applications. The farmers have access to water at any time of the day hence they do not wait for the planned day of delivery at the expense of those further away at the tail end.

According to Bos et al. (2005), the pattern of water delivery over time is directly proportional to the overall water that is consumed with a direct impact on crop production. It should be noted that frequent access does not transform directly into adequacy of water unless the supply meets demand over a given period (Gomo, 2012).

The values of dependability of irrigation intervals

Figure 10. Condition of the main canal in blocks with lowest conveyance efficiency.

between water applications shown in Figure 5 are almost uniform along the scheme within and among the blocks from the head to the tail end blocks. The results show that the farmers in the middle part of block 3 waited for longer periods of up to 14 days before water was delivered. The farmers would not be sure of the actual time the water would be delivered and as such would tend to temper with the infrastructure in order to access the little water that reaches them, as can be seen in Figure 10.

The farmers would also not use other inputs such as fertilizers in optimal quantities faced with erratic variation in timing of water delivery. Instead, they would be concerned with the survival of the crop.

The results of this study are comparable to those found in other studies. For example, Bos et al. (2005) found that the dependability of irrigation interval between water application in Chivilcoy canal in Argentina ranged between 0.1 and 1.15, where the water distribution was controlled by the government and Gomo (2012) reported that dependability of irrigation interval between water application in Mooi river irrigation scheme ranged between 0.34 and 2.81. These results are thus comparable to those determined from this study which ranged between 0.43 and 2.00.

Relative irrigation supply

In this study, the average Relative Irrigation Supply (RIS) values for the season were established to be 0.94 at the initial stage of the season, 0.99 in the developmental stage of the season, 0.66 in the mid-season stage and 0.49 at the end of the season.

This indicator was calculated based on measurements of water diverted through turnout gates from the secondary canals; hence there is a possibility of over-estimation of the RIS since other water users such as block molders and siphoning of water to irrigate other crops outside the scheme were evident.

The values of RIS per block in this study were found to vary significantly at the initial to the late stages of growth of the season. Blocks 1 and 2 had the highest values, as can be seen in Figure 6, indicating that they may be over irrigating. This might be because the farmers have access to water at any time of the day since they have most of their check gates damaged and are also responsible for opening the turnout gates for water distribution. The results show that there was an increase in the RIS values for blocks 1 and 2 from 0.47 to 1.38. This can be attributed to the farmers increasing their water application because of damaged check gates, unlined tertiary canals and broken bunds around the plots in the study area. This can be seen in Figure 11. The farmers always wanted to see their plot ponded with water in spite of the fact that there might be enough water in the soil to sustain the crop growth.

Blocks 6 and 7 had low RIS values ranging from 0.32 to 0.92 throughout the season, indicating a fairly huge mismatch between the irrigation water supplied and the crop demand. This may be explained by the fact that more water is used upstream than in the downstream blocks. The relative irrigation supply values for 18 different irrigation schemes located in 11 countries ranged from 0.41 to 4.81 (Molden et al., 1998). De Fraiture and Garces-Restrepo (1997) also suggested that at field levels, RIS values are generally low with an average value of 0.88. In Turkey, the RIS values found were 1.2, 1.4 and 1.5 in the evaluation of Irrigation Management Transfer (IMT) as management intervention in the Aegean region (Uysal and Atis, 2010). Results from this study revealed a scheme average of 0.77 which shows that the performance is comparable to other schemes around the world.

Figure 11. Some damaged check gates and an unlined tertiary canal.

Output per unit irrigation supply (OPIS)

The values for the OPIS show a rising trend over the past five years showing a general trend of increasing agricultural production. Notwithstanding the rising trend, there is a lot of variation between the years, the lowest value being 0.85 and 0.94 kgm^{-3} as the highest value. The value of OPIS was found to range from 8.80-28.78 kgm^{-3} for rice in Sri Lanka (Lakmali et al., 2015). According to De Fraiture and Garces-Restrepo (1997), a closer analysis of irrigation and rainfall showed that if rainfall is higher than irrigation needed, the value of OPIS is high but less in the dry season.

According to Molden et al. (1998), it is recommended that results should be compared in terms of yield obtained when dealing with sole crops, otherwise comparison should be made in terms of standardized market value. In each year, the water productivity with respect to water supply was taken to be constant from 2011 to 2015.

Comparing the results obtained from this study with those from other countries throughout the world, OIS has a low OPIS value even with minimal rainfall or no rainfall.

Various factors which were observed during the study period that could have contributed to the lower water productivity with respect to irrigation are tail-water not re-used and flowing back to the river from the plots, signs of over-irrigation and poor cultural practices such as lack of weeding round canals, laterals and drainage systems. All these reduce crop yield per irrigation water supply. These can be seen in Figure 12.

Output per unit water consumed (WP_{ET})

The average values of water productivity with respect to crop evapotranspiration (WP_{ET}) for 2011, 2012, 2013 and 2014 at the OIS were 19.43, 20.40, 20.93 and 21.44 kgm^{-3} respectively. The variation of WP_{ET} was very small throughout the five years.

The results are comparable to those estimated by FAO (2002), which ranged between 12 to 20 kgm^{-3}. The increase in value can be due to the varieties of rice (Jasmine 45) grown by the farmers. Other factors are proper crop management and farmers having adequate knowledge about the rice variety and the inputs such as fertilizer and pesticides that they apply.

Conclusion

The main objective of this study was to assess the technical and agriculture performance of the Okyereko irrigation scheme, with respect to water supply and delivery and agricultural performance indicators. The results of the study show that the scheme performance is comparable to results found in other parts of the world.

Results from the conveyance efficiency calculation indicate that the system delivers enough water to irrigate the whole scheme but inadequate institutional framework, poor man management and many other technical deficiencies limit effective water distribution within the blocks. Farmers located in the head blocks of the scheme have unlimited access to water at the expense of middle

Figure 12. Factors affecting water productivity (irrigation) at OIS.

and tail-end blocks. If this water distribution is regulated it may improve the effective performance of the scheme. Even though water productivity is generally low within the scheme, it is still performing like other schemes around the world. However, the level of infrastructure damage taking place could lead to further deterioration of the scheme's performance. This can be averted if farmers actively participate in the management of the scheme as well as putting in place a regulating authority, which should involve Ghana Irrigation Development Authority (GIDA) and influential traditional governance system which will be responsible for land allocation and fairness of water distribution in the scheme.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Rural agricultural development and extension in Mexico: Analysis of public and private extension agents

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Agricultural extension in Mexico significantly favors rural development and considers agriculture as a means of promoting economic development by solving problems associated with poverty and food security. The Mexican extension system, as in other Latin American countries, has been transformed into services provided by extensionists (also known as extension agents, or professional service providers). Due to the social, economic and political relevance of the subject, there is increased interest in proposing new studies focusing on the key roles of extension agents given their importance in achieving rural development objectives through training and providing technical assistance to producers. The present work compares opinions of public and private agricultural extension agents regarding the current extension system in Mexico, and inquires about developed activities, problems faced in daily practice, as well as continuous training actions and capacities. The present study methodology was a mix of qualitative (participant observations) and quantitative (structured questionnaires) information. The study population comprised of 44 extension professionals, 17 from the public (government) and 27 from the private (advisory offices) sectors. Analysis of the results report similarities in socio-demographic data; high academic levels and training in the agricultural sciences, and extensive experience in extension services. Both groups of extension agents had the same activities, while private providers also designed projects to obtain financing. Problems faced by both groups were politico-institutional and related to marketing. Both groups were interested in continuous updating with practical methods, and were seen as having outstanding competencies to perform their functions.

Key words: Rural extension, extension agent, public, private, Mexico.

INTRODUCTION

Globalization continues to compel humanity to face great challenges regarding a sustainable future. Most countries agree on the importance of reducing poverty, improving health, providing universal education, and promoting knowledge and skills. In terms of the environment, for example, primary efforts have been to reduce the loss of biodiversity and improve our understanding of climate change and the necessary responses by society to

reduce the severity of its impacts (GM, 2013; ONU, 2015). These action areas are lines of rural development that seek to improve the living conditions of human society (CEPAL, 2015).

In rural areas, agriculture is a primary economic activity and constitutes the core livelihood of the people inhabiting these areas. Internationally, two of the strategies to reduce inequalities among people are promoting greater social inclusion, and promoting sustainable rural development through training, technical assistance and technology transfer to agricultural producers; agricultural extension (Cristovão et al., 2012).

Agricultural extension is highly important for innovation in the rural sector, and is considered a tool that favors rural development processes by promoting agriculture as an engine for economic development. Its strategy is to reduce poverty and improve food security (Aguirre, 2012; Báez, 2013; Ramjattan et al., 2017) by providing a link between administrators, technicians, researchers, and the rural social structure objective.

In Latin America, the public policies of each country reflect their interest in the issues. Several authors have approached the subject by discussing their definitions of extension or communication (Freire, 1973), historical context (Muñoz and Santoyo, 2010; McMahon et al., 2011; Rendón et al., 2015), and changes in models of extension. These efforts have strengthened public extension and rural innovation systems, and integrated them into public policies according to country.

Due to its social, economic and political relevance, the extension theme over time has generated new studies. Currently, extension agents are responsible for promoting development, implementing training and providing technical assistance. These individuals, in rural areas, disseminate scientific knowledge and provide technologies to producers to improve field production, thus providing a link between science and producers to improve sustainable rural development. Research exists that addresses the extension agent profile to determine their characteristics and training (Landini, 2013b; Mayoral et al., 2015; Monsalvo et al., 2017). As well, there are studies that address extension needs, skills, competencies and perceptions of extension agents (Russo, 2009; Vera and Rodríguez, 2011; Ramjattan et al., 2017).

In Mexico and other Latin American nations, agricultural extension has been transformed (Table 1) into systems with services provided by professional service providers. These individuals provide training, technical assistance and technology transfer services through a public and private extension market with the purpose of encouraging the development of producer capacities and skills to improve their production processes, thus increasing yields and economic income.

Agricultural policy in Mexico is based on the Sustainable Rural Development Law [Ley de Desarrollo Rural Sustentable; Diario Oficial de la Federación (DOF), 2001, which is applied by the Secretary of Agriculture, Livestock, Rural Development, Fisheries and Food [Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA)]. The objectives of the law focus on research, technology generation, experimentation, and agricultural extension (McMahon et al., 2011).

The recent national strategy (2012-2018) has been to resume agricultural extension by providing credit, financial services and advice to small-scale producers to boost capacity development. Its purpose is to move towards a society and economy of knowledge through technology and innovation, and promoting extension with professional service providers. Thus, there is a network of more than 7,000 extension agents in the country aimed at providing support services to producers in various value-chains (SAGARPA, 2013).

International cooperation agreements have also been formalized with different institutions to share knowledge, strategies and experiences in order to improve the quality of life in rural communities. As well, national public and private universities have been incorporated through the Extension and National University Innovation Network.

The transformation of agricultural extension services demands changes in the attitudes, skills and capacities of extension agents (Ramjattan et al., 2017). For this reason, SAGARPA proposed a new extension approach, adopting an innovative vision for value-chains called Holistic Extension, based on developing potential, skills and knowledge. The program contains 4298 extension professionals who serve the 32 states of Mexico to benefit 300,000 producers through service provided by specialists in agriculture, livestock, fisheries and aquaculture (SAGARPA, 2015-2016; Rendón et al., 2015).

The demand for extension services are satisfied by two types of professionals: public: providing services to producers through government advisory programs linked to SAGARPA; Private: using advisory offices to obtain resources from producers to self-manage projects with the federal government.

The present study asks: Are there differences between the two groups of agricultural extension agents in the eastern portion of the State of Mexico regarding their opinions about the current national extension system? Answering the question requires contrasting the characteristics and opinions of public and private

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Table 1. Evolution of Agricultural Extension in Mexico.

Year	Event
1950	Mexico initiates its Agricultural Extension Model (Modelo de Extensión Agrícola)
1960	The National Institute for Agricultural Research (Instituto Nacional de Investigación Agrícola; INIA) begins
1960-1970	Extension system oriented to solve agronomic problems; Green Revolution
1980	Traditional Agricultural Extension model is removed
1990	North American Free Trade Agreement (NAFTA) The General Directorate of Agricultural Extension.(Dirección General de Extensión Agrícola) is removed
1996	Restoration of the National System of Extension and Technology Development (Sistema Nacional de Extensionismo y Desarrollo Tecnológico, SINDER) Ley de Desarrollo Rural Sustentable, 2001 (Ley de Desarrollo Rural Sustentable) Sectoral Program for Agriculture, Livestock, Rural Development, Fisheries and Food 2001-2006 (Programa Sectorial de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación)
2000-2010	National System of Research and Technology Transfer for Sustainable Rural Development (Sistema Nacional de Investigación y Transferencia Tecnológica para el Desarrollo Rural Sustentable; SNITT) and the National System of Training and Integral Technical Assistance (Sistema Nacional de Capacitación y Asistencia Técnica Integral; SINACATRI) Private Extension Service arises; Professional Services Providers, 2002 OCDE Diagnostic “Analysis of Agricultural Extensionism in Mexico”, 2011.
2011-2013	National Strategy: New Vision of Rural Extension in Mexico, Integrated Extension System (Sistema de Extensión Integral) International Cooperation Agreements
2014-2017	Incorporation of public and private universities, Extension Network and National University Innovation (Red de Extensión e Innovación Nacional Universitaria, REINU) Holistic Extension: New Extensionist Profile (skills, abilities, values and knowledge) Regional Extension Centers (technical and methodological support)

Sources: Aguirre (2012), Muñoz and Santoyo (2010), McMahon et al. (2011), Rendón et al. (2015).

agricultural extension agents on the extension system in Mexico. To address this, the activities developed, problems faced on the job, ongoing training activities, and potential skills for the performance of their profession are characterized.

MATERIALS AND METHODS

The study area is located in the central region of the State of Mexico, which is one of 32 states comprising Mexico, and represents 1.1% of the national territory. The state is politically divided into 125 municipalities grouped into 16 regions. The present study was conducted within Region XI, which corresponds to the eastern portion of the State of Mexico, and contains seven municipalities: Atenco, Chiautla, Chiconcuac, Papalotla, Tepetlaoxtoc, Texcoco and Tezoyuca. The population of the study area is 407,694 inhabitants in an area of 727.3 km^2, representing 2.69% of the state population [Comité de Planeación para el Desarrollo del Estado de México (COPLADEM), 2012].

The study methodology used a mix of qualitative and quantitative approaches, and is a comparative-descriptive study (Hernández, 2010). The population under study contains two groups of agricultural and livestock extension agents, public and private, working with agricultural producers based in the eastern region of the State of Mexico. The total sample was composed of 44 extension professionals.

In the case of public professionals, the total number of federal employees (17) who worked in SAGARPA participated. They attend to agricultural producers in the State of Mexico, advising on five production chains (Table 2).

In relation to private service providers, the sample is non-probabilistic incidental (Infante et al., 1984), because the answers depended on extension agent interest and willingness to participate (27).

The qualitative method used social research techniques, including participant observation, attendance at laboral meetings, extension forums, and field visits with producers. The observed events are recorded in field diaries.

The quantitative data was collected using a questionnaire (123 questions) coded with different types of questions (open, dichotomous, multiple choice and Likert scale) regarding socio-demographic variables (gender, age, education level, institution of study, study specialty, work experience, working conditions, time dedicated to work, place of residence, place of work, and languages spoken), work functions performed, problems encountered during daily work, self-evaluation of competencies and training needs. The questionnaire design includes some ideas from extension projects applied in other Latin American nations. Several tests were performed, including expert reviews, pilot, content validity, and Cronbach Alpha reliability, which reported a value of 0.895 with a maximum value of 1, and is reliable according to Hernández (2010).

The questionnaire was given to public and private extension agents personally and *via* E-mail. The data was entered into the spreadsheet software Microsoft Excel Version 2010. Data analysis used non-parametric statistical methods [Statistical Package for the Social Sciences (SPSS) version 15.0] such as descriptive statistics (minimum, maximum, average, median, standard deviation and graphs), independent sample comparison tests (Mann Whitney U-test) and bivariate correlations (Spearman).

RESULTS AND DISCUSSION

Results obtained are presented in four sections, and

Table 2. Public Extension and Technical Assistance Services 2016-2017.

Production chain	Extension agents	Producers assisted
Vegetables	7	180
Milking Cows	4	120
Sheep	2	60
Maguey	2	60
Wheat	2	90
Total	17	510

Source: Secretaría de Desarrollo Agropecuario (SEDAGRO, 2016).

Table 3. Socio-demographic and specialty data.

Variable		Public	Private
Gender	Male	64.7%	61.5%
	Female	35.30%	38.5%
Age range		26-60 years	25-65 years
Average age		36 years	35 years
Academic training	Bachelors Degree	70.6%	57.7%
	Postgraduate	29.4%	42.3%
Degree-granting institution	UACh	52.9%	42.3%
	CP	23.5%	38.46%
	UAM	5.9%	0
	UNAM	0	11.54%
	Other	ITSON (5.9%)	Lasalle (3.9%)
Specialty areas	Agriculture	35.3%	23.07%
	Livestock	35.5%	19.23%
	Forestry	-	19.23%
	Rural Development	-	15.4%
	Nutrition	5.9%	3.8%
	Education	5.9%	-
	Other	17.6%	19.3%
Work experience		1-15 years	1-33 years
Full-time extension agents		100%	48.15%

UACh, Universidad Autónoma de Chapingo; CP, Colegio de Postgraduados; UAM, Universidad Autónoma Metropolitana; UNAM, Universidad Nacional Autónoma de México; ITSON, Instituto Tecnológico de Sonora; Lasalle, Universidad Lasalle.

contrast responses provided by extension agents: 1) Analysis of Socio-demographic Data of Both Groups; 2) Information about Extension Agent Functions and Problems; 3) Formative/Development Needs, and 4) Extension Agent Competencies (Table 3).

In both groups of extension agents, male labor participation (more than 60%) stands out, although female participation is higher in the private sector (38.5%). Women experts in field agricultural activities stand out; their expertise is increasing noticeably (FAO, 2011). Ages reported over both groups range from 25 to 65 and the mean age is 35 years. These results agree with those of Mayoral et al. (2015) who mention that it is the range for productive ages.

Regarding academic training, private professionals have a higher level of study, and both groups have bachelor's degrees. Both groups predominantly come from Mexican academic institutions specializing in the agricultural sciences: Universidad Autónoma de Chapingo (UACh) and Colegio de Postgraduados (CP). The rest come from other public institutions: Universidad Autónoma Metropolitana (UAM), Universidad Nacional Autónoma de México (UNAM), Instituto Tecnológico de Sonora (ITSON), and Universidad Lasalle (a private university).

Regarding areas of specialization, both groups are experts in agricultural and livestock sciences, including forestry, rural development, nutrition, education,

Table 4. Socio-demographic correlations.

Variables 1	Variables 2	Rho	Pr>F	SIG
Age	Extension experience	0.714	0.000	**
Type of Extension Agent	Maximum level of education	0.480	0.001	**
	Working conditions	0.608	0.000	**
	Full-time extension work	0.542	0.000	**
Graduating Institution	Maximum level of education	0.387	0.009	**
	Specialty area	0.348	0.020	*
Laboral conditions	Full-time extension work	0.500	0.001	**

*Significant correlation; **highly significant correlation.

Table 5. Laboral activities.

Frequency	Public	Private
Always	Offering technical assistance Group training Technology transfer Training in multiple areas Work with social groups*	Design productive projects
Frequently	Design productive projects Identify demands Develop training materials Promote producer self-management	Identify demands Elaborate plans Group training Technical assistance Work with social groups* Promote producer self-management

*Work with social groups such as the young, handicapped, women, and seniors.

agroindustry, agribusiness, biotechnology, botany and economics. These academic profiles are consistent with the training and technical assistance activities carried out in extension service (Landini, 2016a). Both groups have extensive work experience, with private agents having more experience (1 to 33 years); suggesting greater knowledge of producers, and a better extension service environment.

Correlation analysis results show that older extension agents have more experience. Labor conditions determine the type of extension agent; public professionals are employees of the federal government and work full time (Table 4). In contrast, the private sector has advisory offices, their activities arise from producer demands and availability of projects, and they do not work full-time (Table 5). There is a relationship between academic institution and educational level; Bachelor's degrees at the Universidad Autónoma de Chapingo, and Master's degrees in Science and Doctorates in Agricultural Sciences at Colegio de Postgraduados in Mexico State.

The guidelines governing the day-to-day activities of public extension agents are registered in the Programa de Desarrollo de Capacidades y Extensionismo Rural de SAGARPA (Capacity Development and Rural Extension Program), with public funding for their work development. The primary activity of private extension agents is to design projects based on perceived needs, then obtain financial resources from the producer and government sources. Subsequently, they develop their extension tasks.

Aguirre (2012) points out that the time and transformations developed under the Mexican extension system continue as the main axes for promotion and transfer of new technologies, technical assistance, advisory services, and producer training.

Agricultural professionals, during their work with producers and extension practice, face various problems that reduce the impact of their actions (Uzeda, 2005). From the perspective of both professional groups, interviews show coincidences in problems that can be generalized: 1) Public policies and changing development

Table 6. Problems encountered.

Difficulties	Opinions
Public Extension Agents 1). Changing rural development and extension policies and projects 2). Difficulty in marketing and linking to the market	Extension agents mention that there is no continuity in programs, and extension work must be supported and given continuity from the moment progress with producers is truncated, because there is no follow-up. Extension and producer participation should be strengthened. Production costs are very high and there are no marketing channels. There is unfair competition and lack of credit.
Private Extension Agents 1). Changing rural development and extension policies and projects 2). Difficulty in marketing and linking to the market 3). Individualism, distrust, lack of producer associations 4). Poor public and institutional support 5). Projects and initiatives do not respond to the needs of beneficiaries 6). Little adoption of technology	Producers are not trusted, so there is reluctance to learn because of the negative influences against them. Programs have lost credibility, so producers become indifferent. There is a shortage of public resources and most are focused on the most vulnerable sectors. There is a bureaucratic barrier for investment, and any process a producer wants to carry out can lead to loss of interest in continuing. The problem exists between producers, government technicians and policy, requiring structural changes, where program approaches are by specialists in the field.

projects, and 2) Problems marketing products and linking to the market (Table 6). These observations are political-institutional in nature, some of them generated by government policies and administrations that are changing over time.

According to Landini (2013a), rural development policies have been a recurrent problem from the extension perspective, not only in Mexico but in other Latin American countries. McMahon et al. (2011) point out that bureaucratic structures are inflexible and do not respond to a changing sector. Therefore, the level of organization by farmers is low, and must be taken into account when designing government policies.

In addition to these problems, statistical tests by type of extension worker (Correlations and Mann-Whitney U-test) show other recurrent problems for private extension agents, such as poor public and institutional support, projects that do not respond to beneficiary needs, and little adoption of technology.

Training is fundamental in the institutional area, and the government executes actions to promote the formation of capacities through institutions linked to the agricultural sector. It is a national public policy instrument that boosts rural development to meet the challenges of the agricultural sector (DOF, 2001).

Both groups of extension professionals are in constant training, with public service providers showing greater interest in their continuous training (94.1%). The highest percentage of training has been provided by public institutions (INCA RURAL) over semi-annual and annual periods. Financing is related to the type of extension (private service providers pay for their training), and the preferred forms are personal (face-to-face) and semi-personal, and private individuals are more familiar with on-line courses (42.3%). The demand for training is in response to the importance of the technicians who receive it, and includes practical methods such as field trips, participatory workshops with producers, and meetings with technicians to exchange experiences (Table 7).

The areas of interest differ in both groups with public professionals preferring training in training methodology and rural extension. These results are similar to those of Valentinuz (2003), Ardila (2010), and Landini (2013c), where they address how technicians should work, and where more training is required for extension workers and analysis of their needs. Private services providers prefer improved management of financial resources to carry out productive projects and to highlight marketing issues.

Some studies mention that the government, in collaboration with organizations, is dedicated to training rural peoples. However, there are doubts regarding the quality and coverage of rural education services. This situation is due to the lack of coordination of projects, and resources, and scarce planning over the medium to long-term. The programs are designed based on the offer, without ensuring a balance based on the needs of rural actors (Aguirre, 2012).

In this context, public sector organizations establish strategies in rural areas to create capacities, skills, values and knowledge in extension agents because they are knowledge managers. Adequate training, extension of individual autonomy and updating of extension workers is a fundamental element for the success of their tasks and improvement of the quality of life of their beneficiaries

The results indicate that both groups of professionals

Table 7. Training and development needs.

Training and development		Public (%)	Private
Training		**94.1**	**84.6**
Institutions	SAGARPA	41.2	23.1
	INCA RURAL	82.4	30.8
	FIRA	11.8	15.4
	DGETA	23.5	3.8
	ICAMEX	-	3.8
	INIFAP	29.4	11.5
	CP	29.4	19.2
	UACh	58.8	38.5
	Other	-	34.6
Period	3 months	23.5	15.4
	6 months	-	38.5
	Annual	58.8	26.9
	Occasional	17.6	-
Form	Personal (Face-to-face)	100	61.6
	Semi-personal	88	73.1
	On-line	53	42.3
Method	Practicals	100	92.3
	Field visits	100	84.7
	Workshops	94.1	73.1
	Theories	70.6	46.1
	Integrating TIC	94.1	73.1
Areas of interest		Training and rural extension methods	Management of financial resources for projects Design of productive projects Commercialization

SAGARPA, Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación; INCA RURAL, Instituto Nacional para el Desarrollo de Capacidades del Sector Rural; FIRA, Fideicomisos Instituidos en Relación con la Agricultura; DGETA, Dirección General de Educación Tecnológica Agropecuaria; ICAMEX, Investigación y Capacitación Agropecuaria; INIFAP, Instituto Nacional de Investigaciones Forestales, Agricolas y Pecuarias; TIC, Tecnologias de la Información y Comunicación.

have a positive perception about their abilities, values, skills and knowledge (Table 8), and their leadership skills, values and ethics (responsibility, respect, group integration and personal growth). They are considered very skilled in communicating with producers, generating empathy and confidence (Landini, 2016b).

The people interviewed have a skill profile of learning to learn, practicing creative and innovative thinking, decision-making and problem-solving. Thus, they are competent at organizing, managing resources, working as teams, coexisting, understanding reality, and incorporating technologies. These skills coincide with those proposed by Cano (2004): 1) learning to learn; 2) ability to communicate; 3) ability to coexist (live with others); 4) decision-making; 5) ability to organize; and 6) managing personal and collective development initiatives. Russo (2009) includes reading, writing, cognitive reasoning, and use of technology. The primary difference is that public extension agents show more knowledge of current Mexican laws and regulations.

CONCLUSIONS AND RECOMMENDATION

Extension is a public good, significant element of innovation in the rural sector, a tool with great potential to favor local development processes by promoting agriculture and rural development, thus reducing poverty and improving food security. Thus, strengthening the capacities and skills of extension agents as promoters of such development is very important.

There is greater male participation in both extension groups, even though female participation in agricultural

Table 8. Extension agent competencies.

Category	Public*	Private*
Training		
Learning to learn	A	A
Creative thinking and innovation	A	A
Decision-making	A	A
Problem-solving	A	A
Leadership	A	A
Ethics	VA	VA
Values		
Responsibility	VA	VA
Respect	VA	VA
Group integration	VA	VA
Personal growth and development	VA	VA
Changing people's attitudes	A	A
Strengthening respect for the land	VA	A
Abilities		
Organization	A	A
Management	A	A
Team-work	VA	A
Living together	VA	A
Communication	A	VA
Reality comprehension	A	A
Empathy for and trust of producers	VA	VA
Technology incorporation	VA	A
Knowledge		
Methods of production	A	A
Rules and laws	A	LA
Research for problem-solving	A	A

Sources: SAGARPA (2015-2016), Méndez (2006), Field Work (Spring - summer, 2016). *Evaluation according to the median, where 3 = Little Ability (LA), 4 = Able (A), and 5 = Very Able (VA).

extension activities is important. High academic levels (postgraduate) and training in the agricultural sciences (agronomists and zoo-technicians) and extensive work experience means that professionals provide continuity to their extension services.

Both groups of professionals emphasize their training, technical assistance and technology transfer abilities, while the private extension agents also design productive projects to obtain financing. Both groups detect the same problems, changing rural development and extension policies, and difficulty in marketing and linking to the market.

Both extension groups require continuous training and interest in rural (public) training and extension methodologies, project design, financial resource management, group management, and marketing (private). Regarding self-assessment of competencies, both groups emphasize their abilities, values, skills and knowledge. They show leadership are skilled in communicating, and generate empathy and trust with producers.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

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Effect of contract tobacco farming on the welfare of smallholder farmers in Angonia District, Mozambique

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The use of contract farming, which constitutes a subject of current debates, especially on the issue of whether or not participating farmers improve their welfare and thus contribute to the local economy as an agricultural intervention is being adopted by many African countries including Mozambique. The Mozambique government adopted contract farming which is being implemented in the central region, mainly involving production of cash crops (Tobacco, cotton and sugarcane) using smallholder farmers. To this end, this study was carried out to assess the effect of contract tobacco farming on the welfare of smallholder farmers in the district of Angonia in Mozambique. Data were collected using questionnaire from 359 randomly selected farmers. Checklists with 27 focus group discussions, 67 key informants' interviews were also used. The results show that some farmers are able to improve their welfare as a result of their participation in contract farming. Although farmers are motivated by income generation, the contractor offers low prices which result in low returns and debts accumulation by farmers. Considering these, the study concludes that contract tobacco farming is dysfunctional, as it fails to improve the welfare of farmers. The findings of this study offer guidance on how contract farming should be organised so that both parties involved in contract can benefit and improve the chance of a win-win situation. The study further generates useful information that evaluates the subsector in terms of its contributions to the local economy.

Key words: Contract tobacco farming, welfare of farmers.

INTRODUCTION

The concept of contract farming emerged in the 1980s, as a strategy for rural transformation in Africa (Watts et al., 1988; Bellemare, 2012). The strategy advocates the interaction between small and large-scale producers who both look for benefits without sacrificing the rights of either party (Watts et al., 1988). Proponents of contract farming perceive it as a means to increase welfare for farmers in developing countries (Bellemare, 2012). Some

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argue that it is relevant to food policy decision-making, because the system has pro-poor impact. Such arguments highlight that farmers ensure food security, and they mostly tend to experience positives effects, especially when revenues from contract farming enable them to meet their household expenses (Barratt et al., 2003; Miyata et al., 2009; Barrett et al., 2012).

Despite significant efforts made by the government towards poverty reduction through agricultural production, the economic welfare of smallholder contract farmers in Mozambique remains vulnerable, given the fact that almost 10 million people live in absolute poverty, suffering from food insecurity, low incomes and unemployment (Ministry of Agriculture, 2011; Pauw et al., 2011). Rural poverty in Mozambique is on the rise due to limited development in agriculture, along with limited access to markets and low productivity of food and cash crops (Ministry of Agriculture, 2011).

As a strategy to alleviate rural poverty, the government of Mozambique launched its Strategic Plan for Agricultural Development (PEDSA) in 2011, with the objective of contributing towards food security and increased income for agricultural producers, in a competitive and sustainable way, and at the same time guaranteeing social and gender equity (Ministry of Agriculture, 2011).

One of the strategies adopted by PEDSA is the Mozambique Leaf Tobacco Company (MLTC), which produce tobacco involving smallholder farmers. This is in accordance with the Decree 176/2001/Act 12, in which the government recognises the value of tobacco production in the country. Through this approach, the government credits the MLTC for exercising contract tobacco farming, with the understanding that allowing companies to operate contract tobacco farming, will contribute to increased farmers' incomes and enable the integration of the global tobacco market, as well as promote the participation of the private sector in contract farming (Decree 176/2001 Act 12).

Tobacco farming is an activity that generates export earnings, and promotes local economic development. It is one of the major sources of income, uplifting the welfare for more than 129,755 farmers in the central and northern regions of Mozambique. On average, the tobacco sub-sector contributes close to 34% of the total agricultural exports and almost 4% of the total exports of goods and services (Benfica et al., 2004). Overall, tobacco is one of the most important agricultural export crops in Mozambique, accounting for 7.8% of total exports in 2011 (Hu and Lee, 2015).

While the government believes that tobacco, as a cash crop, enables farmers to increase their purchasing power and raise their household standard of living above poverty level, contract tobacco farming has received mixed reviews. According to Miyata et al. (2009), contracted tobacco farmers improve their income and livelihoods, which lead to reducing absolute poverty, when compared with non-contracted tobacco farmers. Moreover, tobacco production overcomes market imperfections and shortage of agricultural inputs for smallholder farmers and the poor (Barrett et al., 2012).

On the other hand, Hu and Lee (2015) argue that the individual small tobacco farmer lives in poverty because the tobacco production does not benefit them, but benefits the intermediaries or the middlemen, instead. Tobacco farmers receive inputs from the tobacco leaf company, hoping to earn cash income. However, the tobacco leaf company, which grades the leaves and set prices, purchase their harvest at a set low price. As a result, the contract tobacco farmers end up with a negative income, after they use their meagre revenue to pay their loans for the inputs received from the company.

Similarly, Miyata et al. (2009) and Chepkurui and Kinoti (2014) argue that contract tobacco farming is a way of companies using cheap labour and transferring production risks to farmers. Other studies have shown that the returns from alternative crops such as corn are higher than the returns from contract tobacco farming in Mozambique (Abdurramane, 2007; Hu and Lee, 2015).

Given the diverging views of the effects of contract tobacco farming on the welfare of smallholder farmers, this study aims at assessing the roles of different stakeholders and other factors involved in contract tobacco farming, for a clearer understanding of the effect of contract tobacco farming on the welfare of smallholder farmers in the Angonia district in Mozambique.

Study objectives

The principal objective of this study is to analyse the effect of contract tobacco farming on the welfare of smallholder farmers in the district of Angonia (Mozambique). Specifically, the study aims to:

(1) Identify the roles of different stakeholders in contract tobacco farming,
(2) Identify the reasons influencing the participation of smallholder farmers in contract tobacco farming, and
(3) Assess the effect of contract tobacco farming on the welfare of participating farmers.

METHODOLOGY

Study area

The study was conducted in the district of Angonia, which is located in the north-western part of Mozambique, bordering Malawi.

According to the 2005 census, the population of Angonia approximates 330,378 people (Ministry of State Administration, 2005). Agriculture is the most important economic activity practiced in the area, contributing one-quarter of the gross domestic product (GDP), and employing 80% of the rural adult population. Tobacco is one of the cash crops cultivated by smallholder farmers, both men and women. The district of Angonia was chosen for the study

because of its favourable agro-ecological conditions for tobacco production, and for accessibility to tobacco processing facilities in a nearby district.

Research design

The study was an evaluation impact design, which consisted of a descriptive survey method to assess:

(1) The effect of contract tobacco farming on the welfare of participating farmers.
(2) The contractor's compliance with the terms of contract farming, and
(3) The government's actions or interventions in contract farming.

Specifically, the study aimed to assess issues related to income distribution and physical welfare (availability of food, assets, education level, occupation, health care, household improvement and skill gaining) of participating contract farmers. The contractor was evaluated in terms of honour of the contract, inputs supply, technical assistance, risks sharing, market availability, prices and some cross cutting issues (corruptions). The government was evaluated in terms of legal framework, transfer of technologies and research activities, especially to identify occurrences of social and organisational programmes or interventions. The study approach was chosen because it enables an in-depth understanding of nature of the context by examining the causal factors that inhibits or promotes changes within contract tobacco farmers (Bryman, 2012).

Sampling technique

The present study used probability sampling technique, in which the respondents had the same chance or probability of being selected. To ensure this, the study used random sampling without replacement (Cochran, 1977).

Sample size determination

The MLTC contracted with about 10,000 farmers to grow tobacco in Angonia district. These farmers are divided into two sections, based on regions: one section with 5,600 farmers and the other with 3,400. The sample size (n) of tobacco growers was determined based on the following formula (Cochran, 1977):

$$n = \frac{z^2(1-p)p}{e^2} = \frac{(1.96)^2[(1-(.5)](.5)}{(.05)^2} = 384 \text{ Tobacco farmers} \quad (1)$$

where Z=1.96 for 95% level of confidence, e=0.05 for margin of error, p= proportion of contract tobacco growers, n= sample size. The sample size formula for the finite population is given as:

$$N = \frac{n}{1+(\frac{n-1}{pop})} = \frac{384}{1+\left(\frac{384-1}{5600}\right)} = 35 \text{ Tobacco farmers} \quad (2)$$

N is the sample size of finite population; n is the sample size calculated from infinite population; and Pop is the population. Calculating from the above formula, a sample of 359 contract tobacco farmers was obtained (Cochran, 1977).

Sampling design

First, the list of all villages producing tobacco under contract was obtained, and then 27 villages were randomly selected from the list, followed by household simple random sampling. Club leaders in each of the 27 villages helped identify members who participate in contract tobacco farming. From there 359 farmers, representing 13 to 14 farmers per village, were selected and administered an individual survey questionnaire, and a checklist in groups. Focus group discussions were organized immediately following the questionnaire survey. In addition, key informants composed of a government respondent, three non-governmental organisations (NGOs): (one each from Total Land Care, International Institute Tropical Agriculture (IITA) and Society of Jesus (SJ); one government extension worker and two tobacco extension workers were interviewed to provide their independent opinions concerning tobacco contract farming. Similarly, 60 randomly selected non-tobacco contract farmers from the 27 villages (2 to 3 per village) were surveyed to determine their perceptions of contract tobacco farmers. These include community leaders and ex-contract farmers, and they were also considered as key informants, for the purpose of the study.

Data collection methods

Individual interviews

Individual interviews were structured to cover different sections, including identification of participants, socioeconomic characteristics of households, tobacco production, food security, and land use. The variables were measured at nominal level in which symbols were used to classify observations into mutual categories. The interviewers used interpersonal skills such as questioning, conversing and listening to provide an understanding of social phenomena. During data collection, special attention was also given to how people responded to the questions and how the interviews were conducted and recorded (Gill et al., 2008). These measures/approaches are necessary to ensure the quality of data in the study. As for tools, the study used survey questionnaires for 359 small households; and two (2) sets of checklists: one for 27 focus group discussions, and another one with 67 key informants. The survey questionnaire was designed to gather socio-economic and demographic information, while the checklists were based on the specific objectives of the study. To ensure content validity and usability, both the questionnaires and the checklists were developed in consultation with the experts in the area of tobacco production and supervisors of the study.

Focus group discussions

Qualitative methods using semi-structured interviews were also used to collect data. Semi-structured interviews consisted of several key questions that explored specific area of interest. They allowed interviewees and interviewers to diverge where necessary in order to pursue responses in more detail. The checklist covered areas such as access to knowledge and skill gaining in tobacco contract farming, third parties involvement and their roles in tobacco contract farming, how contract farming is implemented by the MLTC, marketing and input supply. Again, variables were measured through classification of responses into categories. Using semi-structured interviews, focus group discussion took the form of focus groups with multiple participants sharing their experiences on specific subject matter oriented by the objectives of the study (Bloom and Crabtree, 2006). Focus group discussions were used to generate collective views and the meanings behind those views. Focus group discussions then provided evaluative ideas of the topic. Moreover, focus group discussions were used to understand the process and meanings to the group norms relating to tobacco cultivation. These were always facilitated by two people each of

whom had specific responsibilities: one was the moderator of the discussions, another one took notes. Hence, the study employed the method of Gill et al. (2008), who stated that successful focus group discussions work with as few as 3 and as many as 14 participants.

Key informants' interviews (KII)

The purpose of key informants' interviews was to gather information from people with diverse backgrounds and opinions, who were considered informed experts, based upon their particular knowledge and understanding of contract tobacco farming (Carter and Beaulieu, 1992). The inclusion of key informants was to gather independent ideas on the value or effect of contract tobacco farming.

Qualitative analysis (focus group discussion data)

Given the nature of the study, content analysis was used to quantify content in terms of predetermined categories in a systematic manner (Bryman, 2012). To this regard, the data underwent categorisation of verbal or behavioural data for the purpose of classification, summarisation, and tabulation in order to produce quantitative accounts of raw material in terms of categories. Moreover, qualitative data was organized into major and minor categories (themes); comparing and contrasting of major and minor categories to avoid repetition. After this, data were entered into a computer in order to be labelled and coded, counted and analysed into Statistical Package for the Social Science (SPSS 20.0.) (Bhattacherjee, 2012). This process resulted in frequencies and percentages through descriptive statistics. Analysis of key informants' checklist responses was done by assigning each participant comments or quotes, the meanings of which were then brought to the presentation of the results and discussion. This means that data from key informants did not go through classification, summarisation and tabulation. The purpose of this was to bring live meaning and expressions of key informants into discussion.

Quantitative analysis (questionnaire data)

Quantitative method measured numerical comparison and statistical inferences (Casley and Kumar, 1988). Questionnaire survey data were labelled and coded to facilitate entry into computer for analyses using Statistical Package for the Social Science (SPSS 20.0.) and Excel 2013, for Descriptive Statistics (Bhattacherjee, 2012).

RESULTS AND DISCUSSION

Role of stakeholders in contract tobacco farming

The government

The government of Mozambique and Total Land Care (TLC) were considered as the other actors in contract tobacco farming, besides the contractor and the farmers. The participation of TLC and the government is explained in terms of their roles in contract tobacco farming. According to Eaton and Shepherd (2001), government has an important role of protecting farmers who are faced with the risk, enforce legal framework and ensure that financial and managerial obligations are followed if contract farming is to be successful. Enforcing the legal framework requires clear mechanisms such as practical guidelines that explain when the government should act on which legal basis.

Table 1 shows the results on the role of the government in contract tobacco farming, as reported by the farmers in focus group discussion. The results show that in 16 out of 27 villages, tobacco contract farmers demonstrated knowledge on the question of the role of government. There were 22 responses of which 59.1% of the farmers indicated that they are aware of the role of the government, which is mainly to "protect them". The government also knows its role, as confirmed by a government key informant: "the government is like a labour union that tries to protect farmers from risks or problems that might occur between the parties". However, the observation from the field is that farmers are unhappy with the role of the Government. They reported that the "government only needs us when it is time for the electoral campaign". Farmers requested the government to help them solve the issue of corruption during the grading period and to negotiate better prices of tobacco. The interpretation is that the government assistance is limited because the issues of negotiating better price and corruption during the grading period have been the cause of conflict between the farmers and the company.

In addition, a respondent from the government when asked whether the district holds any document as law and policy that regulates the contract tobacco farming in practice, the district respondent reported that "I have not seen any document"; and the provincial respondent provided the strategic plan document (PEDSA). It was therefore, understood based on the above government responses, why farmers complained about corruption.

The manner in which Mozambique exercises contract tobacco farming makes it difficult to understand why its policy encourages companies to work in the country on the basis of contracting schemes when the government itself does not support contract farming in practice. Bronwyn et al. (2012) has argued that a successful contract scheme should be based on harmonised laws and policy that are clearly written incorporating the necessities of the country and context rather than basing on the general strategic plans like that of PEDSA. Such policy should show the vision, mission and principles that every company wishing to start a contract scheme should follow. This support document should be a guideline that includes all the steps a business should follow through the first activities of contract. Not having a support document endangers the welfare of the farmers, as it depends not only on economic variables or good agricultural practices, but also on policy implemented on the ground.

As shown in Table 1, only 16 out of 27 villages had

Table 1. The role of the government in contract farming.

Role	Frequency	Percentage (n=16)
Protect the farmers (including protection from corruption)	13	59.1
Transfer of technologies	5	22.7
Research	2	9.1
Bring in additional tobacco companies in the country	1	4.5
Coordinating MLT and farmers	1	4.5
Total	22	100.0

knowledge of the government's role, and 11 villages representing 40.7% had no knowledge. Again, this re-enforces the argument that the farmers had no knowledge of role of the government. In line with this, farmers recommended that the government should protect them from market, and negotiate better prices accordingly. Unfortunately, this cannot be done successfully, if the laws and policies concerning contract tobacco farming are not properly implemented and enforced.

Still on the recommendations, the farmers advised that the government should conduct research (9.1%) in contract tobacco farming in order to evaluate its contribution to the welfare of smallholder farmers. While a government informant mentioned that the government acts as labour union that solve the problems arising between the farmers and the contractor, the farmers feel unprotected and left behind by the government. Therefore, doing research could be a way of trying to protect not only the farmers, but also the contractor. The recommendation seems pertinent because the findings of any kind may contribute to improving the welfare of the farmers.

Another important issue that came out from the farmers is about technology transfer (22.7%). Farmers showed satisfaction in terms of technical assistance they received, including extension services. However, the government should pay attention to technologies that the contractor does not wish to provide, for example, assistance in intercropping, technologies which relate to processing and others. In fact, many contractors dislike offering some of these technologies because they are not part of their business. Rather, contractors capitalise on good tobacco quality for their productive business. However, if government supplements technologies that the farmers lack, to improve operations of contract tobacco farming, farmers will be able to improve their welfare.

The total land care (TLC)

Contracted tobacco farmers mentioned that the main role of TLC is afforestation (50%) followed by seed provision and supervision (25%). The TLC offers trees to be planted in the plots that had already been used for tobacco production in previous years and in so doing, restore soil fertility. However, trees are given to farmers on credit basis. Unfortunately, some farmers reported that they were not able to receive the trees because they did not have enough land for fallow, and insufficient money to pay for the loan. The TLC also provided other agricultural inputs on credit such as agro-chemicals (16.7%), and helps farmers build small dams (8.3%) for cultivation of other crops during dry season. However, some farmers reported that they were not provided with such assistance. This suggests that neither the MLTC nor the TLC were able to provide agro-chemicals to all participating farmers, as it calls for the government to provide inputs that the contractor could not provide. Figure 1 summarizes the relationship between the contractor, government and TLC. As shown in Figure 1, the MLTC communicates directly with the farmers and administers contract to them. The MLTC uses and finances the services of TLC for afforestation and other services. Since the government is the entity that gives the companies a monopsony, it trusts the company to work with farmers according to the project presented to it. As mentioned previously, the government's role is limited; its involvement is not felt by the farmers and above all, communication between farmers and the government is almost inexistent. This leaves the farmers vulnerable, as they lack protection from the government through regulations.

Factors influencing smallholder farmers to participate in contract tobacco farming

Contract farmers were asked during the survey to provide the reasons that motivated them to join the contract tobacco farming; and those who dropped out of contract tobacco were asked to provide their reasons for doing so. Table 2 shows the reasons why farmers joined the contract farming as reported by those in focus group discussions.

There were thirty-eight (38) responses from all 27 villages on the question pertaining to the reasons influencing farmers to join contract farming. As shown in Table 2, an overwhelming 55.3% of respondents

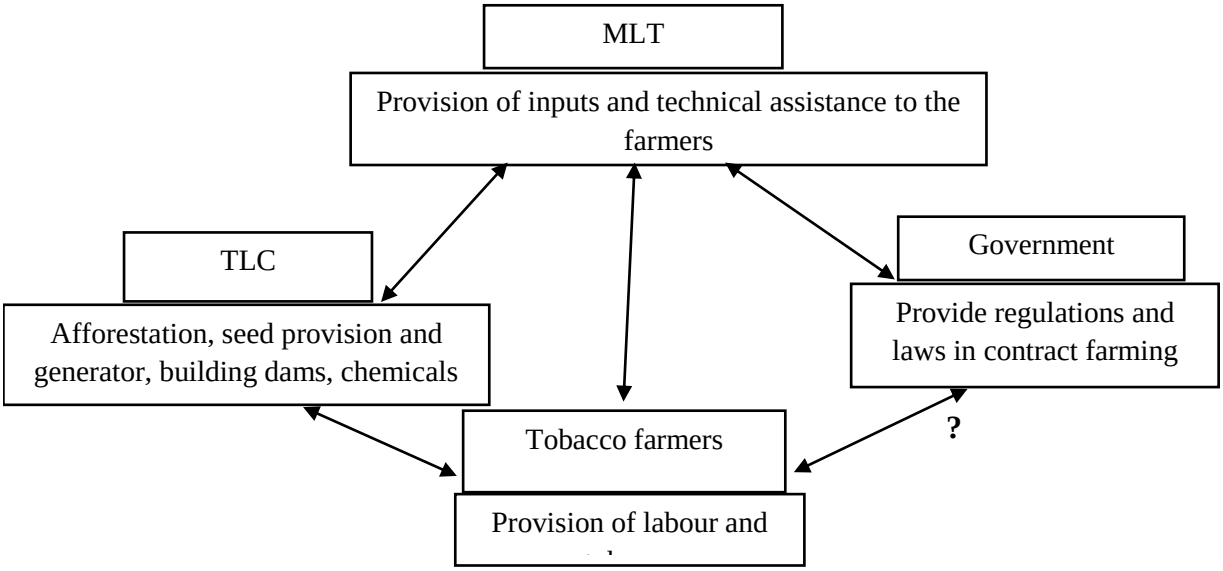

Figure 1. The relationship among the MLTC, TLC, government, the farmers and their roles.

Table 2. Reasons why farmers joined contract tobacco farming.

Reason	Frequency	Percentage (n=27)
Income generation	21	55.3
Occupation	7	18.4
Learn new technology	5	13.2
No other contract company	3	5.3
To get easy access to inputs	1	2.6
Just for fun	1	2.6
Total	38	100.0

identified “Income Generation” as the principal reason for influencing farmers to participate in contract tobacco farming. Interestingly, one of the factors motivating farmers to participate in contract farming is their inability to access production tools and materials on their own. Therefore, if one could separately offer farmers the means of production, would they still opt to produce tobacco or produce crops other than tobacco? Considering some complaints from farmers in the field, one would argue that some farmers would give up the contract if they acquire the means of production from sources other than the tobacco contractor. Given that some farmers were unhappy with the contract, the study went further to assess the retention of farmers under tobacco contract farming. The results presented in Table 3 show the reasons why some farmers dropped out of contract tobacco farming as reported in focus group discussions.

Thirty-five survey participants from 26 villages responded to the question of why farmers are giving up contract tobacco farming. The results show that 45.7% of them stated low income and 20% identified debts accumulation, as the main factors influencing farmers to leave the contract farming (Table 3). These results indicate that some farmers do not generate enough revenues through contract tobacco farming, which is attributable to high cost of farm inputs and poor agricultural management. Generally, farmers do not manage two production fields at the same time; that is, one for staple food and another for cash crop (tobacco production). Barrett (2012) observed that farmers moved in and out of contracts because of food security and risks associated with markets structure. This was confirmed by a key informant who reported that “farmers have reduced food crop production in the last decade because of tobacco growing”. This means that farmers used to have surplus of food, which is not observed after farmers joined contract tobacco farming.

This study establishes that though farmers consider contract farming as the main activities to ensure food security, tobacco production does not contribute to this end. It is for this reason that the majority of farmers

Table 3. Reasons why farmers left contract tobacco farming.

Reason	Frequency	Percentage (n=26)
Low income	16	45.7
Debts accumulation	7	20.0
Low market prices	5	14.3
Corruption	3	8.6
Labour intensive tobacco demands	3	8.6
Difficult to adopt technologies	1	2.8
Total	35	100.0

Table 4. Positive changes that farmers experienced after they joined contract tobacco farming.

Positive effect	Frequency	Percentage (n=290)
Be able to meet family expenses (food, clothes, education and health)	231	46.9
Capacity to buy household assets (radio, bicycle, motorbike and oxcart)	63	12.8
Improved income	59	12.0
Be able to buy livestock	53	10.8
Have a means of livelihood	14	2.8
Household improvement	33	6.7
Acquired some good agricultural practices skills (farm management techniques,)	13	2.6
Bought agricultural inputs (access to credit of inputs)	11	2.2
Contributing to pay off debts	11	2.2
Provide readily markets	5	1.0
Total	493	100.0

Source: Questionnaire survey.

(54.3%), reported to have meals twice per day. This shows that farmers reduce the number of meals taken into account the stock they have per year. This research will now shed more light on the changes that farmers experienced as the result of contract tobacco farming.

Changes that farmers experienced after they joined contract tobacco farming

Among the 359 contracted tobacco farmers surveyed, 290 responded to the questionnaire on “changes perceived by farmers after they joined contract farming”. The questionnaire yielded 493 responses from 10 categories of perceived changes (Table 4). The majority of farmers (46.9%) responded that they experienced positive changes as a result of being in contract tobacco farming; and were able to invest in education and household assets, food and health. These results are consistent with the findings of the previous studies by Barratt et al. (2003), Benfica et al. (2004), Miyata et al. (2009), and Barrett et al. (2012) who found that contracted tobacco farmers tend to invest in home improvement, education, healthcare, buy durable goods (radios, bicycles, motorcycles) and clothes. Moreover, the finding is also consistent with what is mostly reported by the mass media, the government and tobacco officials who believe that contracted tobacco farmers improve income.

Nonetheless, Glover and Kusterer (1990) argued that few farmers buy things of high value; therefore, such investment does not create noteworthy impacts. Similarly, this study established that farmers could only afford to buy food for a short period of time. Thus, the stock of food that farmers possess is not enough to cover the 12 months each year. Farmers themselves affirmed that in order to cope with the situation of hunger, they work on someone’s garden in addition to tobacco contract farming, to receive food or money to purchase food. With regard to short-term investment, a question arises as to whether buying clothes creates a real positive effect on the welfare of an individual. On the other hand, though education can be recognised as a long-term welfare of households, can investment in education create a direct and measurable effect on the farmers’ lives? These and many other questions need to be given appropriate attention, suggesting that an assessment should be done over time, as opposed to a “snapshot” of farmers at a single point in time.

Moreover, Table 4 shows that 12.8% of respondents stated positive changes in house improvement as the result of their participation in contract tobacco farming.

Table 5. Negative effects of tobacco contract farming.

Negative effects	Frequency	Percentage (n=304)
Labour intensive and time consuming	172	38.4
Getting low prices offered by MLTC	169	37.7
Corruption and attribution of wrong grading	54	12.1
Exposure to pesticides	21	4.7
High cost of inputs (crop spray and fertilisers)	10	2.2
Climate related shocks/poor rainfall patterns	10	2.2
Hard to adopt some technologies	4	0.9
Lack of legal framework to protect farmers	4	0.8
Cumulative debts	3	0.7
Transportation problems	1	0.2
Total	448	100.0

However, it should be noted that house improvement was associated with many factors: Farmers may buy roofing material with revenues from contract farming, but they make bricks by themselves, use trees from their own farm, and build the house with the help from other members of the community or from relatives.

Table 4 further shows that 1% of farmers who responded to the questionnaire do not see “readily market” as an important aspect of contract tobacco farming (that overcomes market imperfection). Located along the borders of Malawi and Zambia, farmers in the study area have many market options. Even though side selling is strictly not allowed, farmers could export their tobacco products to Malawi and Zambia, in case the company fails to buy them, as stated by key informants during the study. Table 5 shows the negative effects of contract tobacco farming as reported in questionnaire survey.

Out of 359 contracted tobacco farmers surveyed, 304 responded to the question of negative effects of contract tobacco farming. There were a total of 448 responses and from these, 37.7% reported that the MLTC offers low prices, and 38.4% indicated that contract tobacco farming is labour intensive. A comparative study by Dias (2013) of four countries (Malawi, South Africa, Kenya and Mozambique) also concluded that the price paid to farmers in Mozambique is lower than the prices in the other three countries. As observed from the field during this study, low tobacco price is the source of conflict between the farmers and the contractor, which is resulting in unhealthy relationship. Consequently, farmers do not stay loyal to the company.

Buying tobacco at low prices is an unequal exchange whereby big companies such as these exchange primary goods produced with labour at below subsistence cost for manufactures produced with non-competitive expensive labour; and as such, the exchange value of primary goods is below the true value.

The question then arises as to why farmers should be allowed to participate in a business where their welfare is at risk? Actually, contract farming in the Angonia district contributes to the impoverishment of farmers, partly because of problems associated with the monopsony system in place. First, the buyer has total control over the price and quality; second, the buyer can break the contract without penalty, and third, the government has to approve the monopsony system that presently creates space for corruption (Smart and Hanlon, 2014).

Conclusion

Based upon the results of this study, farmers receive training on good husbandry for tobacco production, and they receive inputs on credits, all within the expectation that they will improve their welfare. However, this study concludes that the skills and technologies that the farmers acquired, did not translate into improved welfare. Instead, farmers appeared to be the losers in the contract tobacco farming scheme implemented in the district of Angonia in Mozambique.

Essentially, farmers are motivated to join in contract tobacco farming and mainly invest to increase their income and thus, their welfare. Few of the farmers who experience increased income, invest mainly in durable goods and after that, end up with no money and nothing in their possession; it is rather a temporal investment. The study recommends that farmers should be trained on how to invest their money.

Although farmers are motivated to enter into contract tobacco farming because of income generation, the contractor offers low prices, resulting in farmers getting low returns. In addition, contract tobacco farming results in debt accumulation by farmers due to high cost of inputs, and this induces poverty rather than alleviating poverty. The monopsony system contributes to an unequal relation that exploits farmers and benefits the contractor. Given these and other effects, the study concludes that contract tobacco farming is dysfunctional if not, non-beneficial to the farmers. It fails to promote the

welfare of farmers, which is measured by the progress in terms of wellbeing, including income generation (that is not fulfilled), and food security (that is inefficient to cover 12 months in a year), and the like.

For contract tobacco farming to be beneficial for both the farmers and the contractor, the government of Mozambique should regulate it in practice. The government should develop clear written policies and guidelines to provide the context of contract tobacco farming in the country. The policy guidelines should show rationale for developing the policy, vision, mission, principles, optimal farmer's selection, records and management systems. This will prevent problems such as lack of prices information, conflicts between the farmers and the contractor. Besides, farmers should improve negotiation power by forming an organisation to protect their interests and solve problems such as corruption when grading tobacco. Thus, the government cannot address contract farming issues with each individual farmer, but rather with the group. Again, this will increase an opportunity for farmers to participate in decision-making, with regard to price determination for tobacco. Limited government role in contract tobacco farming increases the power of the company to control farmers and production. In this scenario, farmers are subordinates and their earning does not compensate the labour and the use of their land for to the company.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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