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# Genetic Analyses of Generation Means for a Cross between Two Local Breeds of Chickens: 4- A Model for Hatchability Prediction as a Function of Some Egg Quality Traits

By Abou El-Ghar & R. Sh.

*ARC, Ministry of Agriculture, Egypt*

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*Keywords :* *multiple linear regressions, physical characteristics of eggs, hatchability.*

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*Keywords : multiple linear regressions, physical characteristics of eggs, hatchability.*

## I. Introduction

Experimental studies have shown that predicting hatchability may depend on the main physical characteristics of eggs (Peruzzi et al., 2012). Hatchability is very important trait in breeding program which has a great economical impact in the poultry industry and insures the sufficient day-old chicks. The variability between and within strains raises the question weather reproductive performance can be improved by breeding program, Sapp et al. (2005) reported a low direct heritability below 10% in most studies. Also, estimated of heritability for hatchability of fertile eggs in the literature range from 0.15 to 0.20 (Förster, 1993; Szwacz kowski et al., 2000 and Bennewitz et al., 2007). Therefore their improvement would be achieved through the optimization of environment by hatchery and breeder farm management (Förster et al., 1992). Egg characteristics greatly influence the process of incubation and responsible for its success (Narushin and Romanov, 2002a,b). Egg weight and egg shell quality were effective on hatchability of fertile eggs (Altan et al., 1995 and Wolanski et al., 2007). Concerning egg weight, it is preferable to have eggs of average weight to achieve good hatchability as far as chickens, turkeys, ducks and ostriches are concerned (Wilson, 1991; Brah et al., 1999 and Gonzales et al., 1999). The egg shell has important rule in hatchability, an increase in shell thickness of one micrometer in the range of 0.29 to 0.35 mm led to an increase in hatchability of about 2% (Sergeyeva, 1986). Moreover, it isolated the embryo from the external environment while allowing the proper gas exchange across the shell at the same time, Shatokhina (1975) reported that eggs with extremely thick or thin shells resulted in increased embryonic mortality when compared to embryonic mortality from eggs of average thickness. Moreover, some other quality traits are also important for hatching and consumed egg like shell thickness, specific gravity, albumen height and yolk height (Wolanski et al., 2007), and yolk/albumen ratio (Harms and Hussein, 1993). Egg shape, which can be easily described in terms of the ratio of the maximum breadth and length, remains constant during the whole period of incubation; Burtov et al. (1990) reported that eggs of normal shape hatch more successfully than those shaped abnormally. As demonstrated that Gimmizah and Bandarah local developed strains of chickens, while available domestic literature on selection deals with problems may be associated with hatchability. Sonaiya and Swan (2004) reported that the satisfactory range of hatchability among free range chickens is considered from 75 to 80%. A model encompassing some egg quality traits may be used for predicting hatchability as closely as possible to the realized hatchability. Such prediction needs to incorporate egg weight, egg shape index, egg shell thickness and yolk/albumin ratio. Therefore, this study aims to use information about some egg quality traits and reference hatchability of the third generation

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and backcrosses to establish a model for hatchability prediction.

## II. Materials and Methods

Present experiment had been carried out at El-Sabahiah Poultry Research Station, Animal Production Research Institute, Agriculture Research Center, Egypt.

*a) Experimental Design*

Hatching eggs produced by the third generation and backcrosses hens aged 42 wks, the birds which divided from intercrossing of all the second generation families of the two parental lines Gimmizah and Bandarah to produce all the third generation ($F_3$) progeny, at the same time the males of second generation were backcrossed with females of Gimmizah and Bandarah to produce the two backcrosses ($BC_1$) and ($BC_2$), respectively. A sample of 57 eggs was selected at random from the eggs produced to measure egg weight, egg axes (length and width), egg shell with membranes thickness from 3 different regions by using a micrometer and weights of yolk and albumen using the standard procedure. Egg Shape Index was calculated by the formula cited by Carter and Jones (1970). The remainder hatching eggs were stored for 7 d and incubated in full-automatic draft machine to calculate the hatchability % in relation to the number of total eggs set from the genetic groups F3, $BC_1$ and $BC_2$, which considered as reference of obtained hatchability.

*b) Statistical Analysis*

The data of egg weight (EW), egg shell thickness (Sh.Th), egg shape Index (E.Sh.I) and yolk/albumin ratio (Y/Al ratio) which derived from F3 and backcross generations were performed using the GLM procedure of SAS software (2003). To satisfy the requirements of multiple linear regression arcsin transform was applied. A Logistic regression was applied to fit a model to the binomial response variable considering the probability of hatching. The logistic regression model fits the log of the odds by a function of the explanatory variables (Hosmer and Lemeshow, 1989).

$$\text{Logit}(\pi) = \log\left[\frac{\pi}{1-\pi}\right] = \alpha + \sum_{i=1}^{m} \beta_i \chi_i$$

Where $\chi$ indicates the explanatory variables (e.g. EW, Sh.Th, E.Sh.I and y/al ratio), $\pi$ is the probability defined by the proportion of hatched eggs, given a set of $m$ explanatory variables including reference hatchability, $\alpha$ is the intercept parameter, $\beta_i$ is the slope parameter for the $ith$ explanatory variable and $x_i$ is the observation for the ith explanatory variable.

## III. Results and Discussions

*a) Effect of Genotype on the Studied Traits*

It is obvious in Table (1) that the backcross $BC_1$ was the heaviest egg weight (50.8 g), compared with $F_3$ generation and $BC_2$ (49.7 and 46.3 g, respectively). Moreover, EW trait revealed significant differences ($P<0.01$) in the three studied groups (Table 2). The previous results are in agreement with those reported by Joseph and Moran (2005) they showed that selection for live body weight of chicken resulted in increased egg size with more proportionately shell weight. Shell thickness and yolk/albumin ratio were highest (0.43 mm and 0.62, respectively) in $F_3$ generation females compared with the other genetic groups. These values of Sh.Th and Y/Al ratio were differ significantly ($P<0.01$ and $P<0.05$, respectively) in $F_3$ generation. While, the traits Sh.Th and Y/Al ratio in $BC_1$ being 0.32 mm and 0.61, while the $BC_2$ had 0.31 mm and 0.59 values for the same traits, respectively, with no significant differences between the backcrosses as shown by Duncan test. The contrasts are shown for egg shape index, where $BC_2$ backcross being the best among all genetic groups 76.5 while, the same trait (E.Sh.I) being similar in $F_3$ and $BC_1$ 74.5 and 74.2%, respectively. Table (2) revealed that all egg quality traits showed significant differences among all genetic groups (genotypes). Whereas, the backcrosses ($BC_1$ and $BC_2$) were differ significantly ($P<0.01$) for only egg weight trait, the same trend was found for shell thickness between $F_3$ and the two backcrosses ($BC_1$ and $BC_2$). While egg weight differences between F3 generation and $BC_2$ were insignificant, as shown by Duncan test (Table, 2). The genetic differences between the studied groups for egg weight were reported by Carter and Jones (1970); Arafa et al. (1982) and Nwachukwu et al., (2006) found that shell thickness was not significantly differing among different genetic groups of chicken. Regarding the obtained hatchability, it could be seen that the hatchability of total egg sets had insignificant differences in the three genetic groups (Table 2). Hatchability was highest (70.8%) in $F_3$ generation, this value was insignificantly higher than for $BC_1$ (66.7%) and $BC_2$ (68.9%), as shown by Duncan test (Table 1). The obtained hatchability in local chickens are in agreement with low hatchability reported in Aseel hen by Kamble et al. (1996); (Byarugaba et al., 2002) reported it ranged

45-75% in earlier studies in Uganda; (Sola-Oja, 2011) 70.1-78.3% in Nigeria and it was lower than 70-100% reported in other studies by (Fayeye et al., 2005; Alaba, 1990; Atteh, 1990).

Comparing the results of predicted hatchability in relation to input variables (EW, Sh.Th, E.Sh.I and Y/Al ratio) it could be noticed that as the EW in $BC_1$ (50.8 g) was increased by 1.1 and 4.5 g for F3 and $BC_2$, respectively. It could be concluded that EW had no significantly affect as the predicted hatchability. As far as the Sh.Th was concerned significant reductions from 0.34 mm in $F_3$ generation to 0.32 and 0.31 mm in $BC_1$ and $BC_2$, respectively. These observed differences have insignificant effects on predicted hatchability. Also Table 1 pointed out that E.Sh.I and Y/Al ratio had no significant effects on predicted hatchability in all genetic groups. These results reflect the application of prediction of hatchability models in this study appears not sufficient to fit all the investigated variables.

*b) A Model for Predicting Hatchability*

This study provides related model hatchability prediction using EW, Sh.Th, E.Sh.I and Y/Al ratio as well as reference hatchabilities. The following model output where $\alpha$ is the intercept parameter, $\beta_i$ is the slope parameter for the *ith* explanatory variable and $x_i$ is the observation for the ith explanatory. Table 3 shows the estimated values of parameters and their significance levels. In $BC_1$ the intercept parameter ($\alpha$) 241.6 was a highly significant, this means that, if an intercept parameter is included then the determination coefficient ($R^2$) is simply the square of the sample correlation coefficient between the outcomes and their predicted hatchability. Also, there was a highly significant of slope parameters ($\beta_i$) for (Sh.Th) 213.5 in $F_3$ generation and (EW) 1.126, (E.Sh.I) 79.54 and (Y/Al ratio) 28.03 in $BC_2$. Furthermore, the mentioned approach above confirms the existence of a highly significant relationship between the main regression parameters and predicted hatchability (Table 3). On the other hand, the linear relationship between the obtained and the predicted hatchabilities in the three genetic groups were insignificant (Table 4).

These results provide that EW, Sh.Th, E.Sh.I, Y/Al ratio and obtained hatchabilities can be used to predict hatchability. These results correspond with those of Farooq et al. (2001) who considered egg and shell weights as the two most important factors affecting hatchability. Moreover, the curvilinear relationship between egg weight and hatchability was investigated by Shatokhina (1975) in fowls, he observed that the hatchability of eggs weighing between 46 and 50 g as well as those weighing between 66 and 74 g was between 8 and 10.5% lower than for eggs weighing between 50 and 66 g. Similar results were obtained by Nordskog and Hassan (1971) who found that hatchability was maximal at an egg weight of about 50 g. Also many authors agree that it is preferable to have eggs of average weight to achieve good hatchability (Wilson, 1991; Brah et al., 1999; Gonzales et al., 1999). Moreover, Tsarenko (1988) suggested that hatchability is not well estimated by considering egg weight alone, but also, by taking into account the ratio of egg weight to shell surface area. On the other hand, determination coefficients adjusted were found ($R^2$) = 0.08, 0.11 and 0.13 for $F_3$, $BC_1$ and $BC_2$, respectively. These $R^2$ were closer to 0 indicates a regression line does not fit the data, although the model above confirms the existence of a significant relationship between the main morphological parameters of the egg and predicted hatchability (Wilson, 1991; Narushin, 1997; Narushin and Romanov, 2002a,b). This low relationship could be justified by the fact that, in the hatching process, there were embryos that can adapt to hatch despite inadequate egg morphological parameters.

## IV. Conclusion

It could be concluded that the multiple linear regression equation for predicting hatchability using some functional characteristics of egg as well as reference hatchability led to the following model output: $Y = 241.6 + 1.126\ x_1 + 213.5\ x_2 + 79.54\ x_3 + 28.03\ x_4$, where Y presents the predicted hatchability, 241.6 presents the intercept parameter ($\alpha$) and the 1.126, 213.5, 79.54 and 28.03 are the slope parameters ($\beta_i$) of egg weight ($x_1$), shell thickness ($x_2$), egg shape index % ($x_3$) and yolk/albumin ratio ($x_4$), respectively. Furthermore, the approach above confirms the existence of a highly significant relationship between the main regression parameters and predicted hatchability. On the other hand, determination coefficients adjusted ($R^2$) were found to be 0.08, 0.11 and 0.13 for $F_3$, $BC_1$ and $BC_2$, respectively. These $R^2$ were closer to 0 indicates a regression line does not fit the data.

*Table 1 :* Means and standard deviation of some egg quality traits from third generation and backcrosses

| Genotypes | Traits | | | | | |
|---|---|---|---|---|---|---|
| | E.W | Sh.Th | E.Sh.I | Y/Al Ratio | Ob. H % | Pr. H % |
| F3 | 49.7±5.6[a] | 0.34±0.03[a] | 74.5±3.5 | 0.62±0.075 | 70.8±24.9 | 71.1±7.1 |
| BC1 | 50.8±3.8[a] | 0.32±0.03[b] | 74.2±3.3 | 0.61±0.065 | 66.7±19.8 | 66.9±6.5 |
| BC2 | 46.3±3.0[b] | 0.31±0.03[b] | 76.5±6.4 | 0.59±0.097 | 68.9±16.3 | 70.1±5.6 |

E.W = egg weight, Sh.Th = shell with membranes thickness, E.Sh.I = egg shape index, Y/Al ratio = yolk/albumin ratio, Ob. H %= obtained hatchability, Pr. H %= predicted hatchability, BC1 = backcross of $F_2$ x Gimmizah parents, BC2 = Backcrosses of $F_2$ x Bandarah parents, F3 = the third generation, means with the same letters in the same column are not significantly different.

*Table 2 :* Mean squares of some egg quality traits from third generation and backcrosses

| S.O.V | d.f | Traits | | | | | |
|---|---|---|---|---|---|---|---|
| | | E.W | Sh.Th | E.Sh.I | Y/Al Ratio | Ob. H % | Pr. H % |
| Bet. Genotypes | 2 | 104.1** | 0.00439** | 0.00290** | 0.00397* | 48.51$^{NS}$ | 48.03** |
| Error | 54 | 18.3 | 0.00089 | 0.00221 | 0.00660 | 425.7 | 41.99 |

E.W = egg weight, Sh.Th = shell thickness, E.Sh.I = egg shape index, Y/Al ratio = yolk/albumin ratio, Ob. H %= obtained hatchability, Pr. H %= predicted hatchability, BC1 = backcross of $F_2$ x Gimmizah parent, BC2 = Backcrosses of $F_2$ x Bandarah parent, F3 = the third generation, *= significant differences, **= highly significant differences, NS= insignificant differences.

*Table 3 :* Estimated values of arithmetic parameters in relation to predicted hatchability

| Genotype | Arithmetic parameters of hatchability | | | | | |
|---|---|---|---|---|---|---|
| | Intercept | E.W | Sh.Th | E.Sh.I | Y/Al Ratio | Pr. H % |
| F3 | -3.05 $^{NS}$ | -0.462 $^{NS}$ | 213.5 $^{**}$ | 43.15 $^{NS}$ | -12.96 $^{NS}$ | 71.1 |
| BC1 | 241.6 $^{**}$ | -1.091 $^{NS}$ | -73.99 $^{Ns}$ | -103.9 $^{NS}$ | -30.19 $^{NS}$ | 66.9 |
| BC2 | -42.01 $^{NS}$ | 1.126 $^{**}$ | -57.09 $^{NS}$ | 79.54 $^{**}$ | 28.05 $^{**}$ | 70.1 |

E.W = egg weight, Sh.Th = shell thickness, E.Sh.I = egg shape index, Y/Al ratio = yolk/albumin ratio, Pr. H %= predicted hatchability, BC1 = backcross of $F_2$ x Gimmizah parent, BC2 = Backcrosses of $F_2$ x Bandarah parent, F3 = the third generation, *= significant differences, **= highly significant differences, NS= insignificant differences.

*Table 4 :* Relationship between obtained and predicted hatchability

| Genotype | Ob. H % | Pr. H % | $R^2$ |
|---|---|---|---|
| F3 | 70.8 | 71.1 | 0.08 |
| BC1 | 66.7 | 66.9 | 0.11 |
| BC2 | 69.9 | 70.1 | 0.13 |

$R^2$ = coefficient of determination. BC1 = backcross of $F_2$ x Gimmizah parent, BC2 = Backcrosses of $F_2$ x Bandarah parent, F3 = the third generation.

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# Utilisation of Soybean in Oniyo Community of Oyo State, Nigeria

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*Keywords :* *soy product, malnutrition, food fortification, infant food, diet.*

*GJSFR-D Classification :* *FOR Code: 820405*


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*Keywords : soy product, malnutrition, food fortification, infant food, diet.*

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## I. Introduction

Soybean *(Glycine max)* is an herbaceous annual legume with a bushy, erect and leafy plant structure. It originated from China around 1100 to 1700 BC (Sinclair and Backman, 1989). Soybeans were first introduced into Nigeria in 1908 (Fennel, 1966), but the first successful cultivation was in 1937 with the Malayan variety, which was found suitable for commercial production in Benue State in Central Nigeria (Root *et al.*, 1987). Nigeria has been the largest producer of soybeans for food in Sub Saharan Africa (IITA, 2009).

Soybean is valued as a productive and adaptable crop which fits well into the cropping patterns of varying agro-climatic conditions. Soybean is generally considered as a highly versatile grain which has about 365 applications in the formulation of both human and animal foods and other industrial uses (Omotayo *et al.*, 2007). Soybean is a cheap source of quality protein that is superior to all other plant foods because it has good balance of the essential amino acids. Its seed has a close protein content and fairly close amino-acids with cow milk (Belewu and Belewu, 2007). The fat from the soybean is unsaturated type unlike saturated fats from animal origin and hence is good for heart disease patients (Adegoke *et al.*, 2002). Other than the high protein content, it also has good amount of calories and fat. It contains the eight essential amino acids and is a rich source of polyunsaturated fatty acids (including the good fat-omega 3) and is free of cholesterol (Food and Agriculture Organization, 1999). Soybean contains 43 grams of protein per 100gms, which is the highest among the pulses. It also contains 19.5gms of fat, 21gms carbohydrate and provides 432 kcal per 100gms (William and Akiko, 2000). It is one of the best vegetarian food items as far as protein content is concerned, with an average production cycle of 90-110 days from planting to harvesting (Fabiyi, 2006).

Research has it that one kilogram of soybean contained as much protein as 2kg of boneless meat or 45cups of cow's milk or 5dozen of eggs (Dashiell, 1993). Soybean seed contains about 40% protein, 30% carbohydrates, 20% oil and 10% mineral (Osho and Dashiell, 1998). The beans can be utilized in the liquid, powdery and curd forms for human consumption. The oil could be converted to margarine and salad oil. In most cases, soybean has found wide application in the

reduction of malnutrition related problems. Owning to its nutritional value there is a growing demand for soy products such as soymilk, soy oil, soy cake, and soy cheese like soybean curd rich in protein. The medicinal nature of soybean is extremely essential in building body immune system. Soy food has been reported to provide significant, but not total protection against heart disease, high blood pressure, stroke, ulcer, menopause, diabetes and cancer (World Healthiest Foods, 2004; Fabiyi, 2006). Recently, soybean is found to be an industrially important crop used as anti-corrosion agent, core oil, and bio-fuel due to less or no nitrogen element in the oil, and as disinfectant, in pesticides, printing inks, paints, adhesives, antibiotics and cosmetics (Ngalamu *et al.*, 2012).

The most important domestic processing forms are *dadawa*, soy milk, soy *ogi* and soy cheese (*wara*). The soy based products produced by commercial processors are soy oil, soy cake and meal, infant foods, instant foods, soy flour, soy gum and flax. The infant and instant foods industries also utilize the bean in producing soy flour, baby foods, breakfast foods, snacks and other confectioneries. In addition, feed mills utilize between 8.5 - 11 per cent soy for poultry mash and between 18-49 per cent for poultry concentrates; instant food companies utilize between 20 - 80 per cent soy depending on the products while infant food companies utilize 30 per cent soy in their products (Omotayo *et al.*, 2007).

At the household level, soybean serves as a good substitute for locust bean in preparation of *dadawa* (local condiment in soup preparation), when ground it is used in place of melon in soup and is a good source of cheap protein. Soybean has been used to fortify many traditional foods of different ethnic groups in Nigeria. These include soy-*ogi*, soy-vegetable soup, soy-*gari*, soy-*akpu*, soy-*hatsi*, soy-*tuwo*, soy ice cream, soy cheese among many others. Soybean meal is used as a protein supplement in poultry feeds, hog and cattle feed. Soybean meal is the material remaining after solvent extraction of soybean flakes and oil. Soybean oil is an edible oil that can be refined to produce paints, varnishes, soap, lubricants, sealant and in pharmaceutical oil.

In the traditional soybean growing areas of Nigeria, soybean is most commonly intercropped with cereal crops like maize, sorghum and millet to replenish soil nutrients. Soybean entered Nigerian diets in an attempt to improve nutrient intake, especially the protein intake of the low-income populace (Obatolu *et al.,* 2006). Adequate food and proper nutrition are basic requirements for economic development, since an underfed nation is an under productive nation. Poverty and malnutrition often afflict the same groups of people, so rates of malnutrition are used as indicators of poverty (Adewale, 2005). Inadequate protein in diet appears to be the greatest nutritional problem facing Nigerians today. This is because most sources of animal protein are expensive and only few people can afford enough of them in the diet. When needs to alleviate poverty, malnutrition, and to improve the welfare of poor people are considered, issues relating to high quality protein food and greater income opportunities are of paramount importance.

The household use of soy bean is therefore aimed at suiting local dishes for communities all over the country. According to Dugje *et al.* (2009), it is believed that soybean production will increase as more farmers become aware of the potential of the crop, not only for cash/food but also for soil fertility improvement and *Striga* control. The result of a previous study carried out by Olatunji *et al.* (2012) revealed that, although 74 percent of farmers in Abia State were aware of soya bean products, about 27 percent either did not adopt or discontinued adoption. It is, therefore, pertinent to investigate the consistency with which farmers are using and possible constraints to usage of soy bean products among farm families. Oniyo community of Oyo State was purposively selected for this study because it was adopted fifteen years ago by the Institute of Agricultural Research and Training of the Obafemi Awolowo University because the community was recognized to have high soybean production. The adoption was according to the Adoption Village Scheme, an innovation of the National Agricultural Research Project in 1997 to facilitate trial of new research findings and to increase farmers' adoption rate. The institute has since been building resources within the existing social, cultural, environmental and economic context of Oniyo community. It is against this background that this study seeks to answer the following research questions:

1. What is the socioeconomic profile of soybean farmers in Oniyo community?
2. Are these farmers aware of the benefits of soybean?
3. What is their perception of the importance of soybean?
4. What is the socio-cultural significance of soybean in Oniyo community?
5. What is the level of use of soybean in the community?
6. What are the constraints to the use of soybean in the community?

The hypotheses of this study are: that there is no significant relationship between selected socioeconomic characteristics of soybean farmers and their utilization of soybean; and there is no significant relationship between farmers' awareness of soybean benefits and their utilization of soybean.

## II. Methodology

The study area is Oniyo community (Lat. 08002"N, Long. 04002"E) in Orire Local Government Area. The community is located in the southern guinea

savanna agro-ecological zone of Oyo State with average annual rainfall of 1100mm to 1250mm and average daily temperature of 250C and 350C. It is about 21 kilometers North West of Ogbomoso town. The Local Government has a total land area of 2,040 square kilometer and 149, 408 inhabitants, out of which 42,242 dwells in Orire community (National Population Commission, 2006). The community is agrarian and the predominant food crops grown are maize, cassava, yam, soybean, cowpea, tomatoes, pepper and sorghum.

The population of the study is all soybean farmers in Orire community. The list of all soybean farmers in Oniyo community was collected from Institute of Agricultural Research and Training to serve as the sampling frame. One hundred and thirty soybean farmers were afterwards selected using simple random sampling. Primary data was collected using interview schedule from the 130 selected farmers, but 123 of the schedules were found to be useable. Data were described and analyzed using frequencies, percentages, means, chart, chi square and Pearson Product Moment Correlation.

## III. Results and Discussion

### a) *Socioeconomic Characteristics*

Soybean is cultivated by male and female, as well as old and young. Yet, more males are more involved in its cultivation than females. Also, majority of the farmers are between ages 41 and 50 years, unlike Adewale (2005) that stated that soybean farmers are in their active years. Almost all of these farmers are married and many of them only have primary education. Result of analysis on table 1 thus implies that soybean is a prominent crop in Oniyo community. First, because men are only interested in cultivating prominent crops; second, its cultivation cut across all age groups; and third, 96.7% of the farmers regards soybean as their primarily cultivated crop. However, the low level of education of the farmers is not satisfactory. On the other hand, most of the soybean farmers have a household size of between four to six people and consequently, most of them have household labor of between one and two people. This indicates that farm families do not have as much household labor as much as they used to have, and therefore have to incur more labor or mechanization expenses or overwork themselves. Rahman (2008) suggested that female headed households tend to be poorer, therefore table 1 show that in this respect, there are fewer poor households among the soybean farmers. Finally, majority of the farmers have had between 11 to 20 years of soybean cultivation and have mean income of between =N=20,000 to =N=40,000 per month. This suggest that these farmers are not novice in the act of soybean cultivation and are not poor because they can well afford to spend more than $1 on each member of their household per day.

*Table 1 :* Distribution of soybean farmers' socioeconomic characteristics

| Variables | Frequency | Percentage |
|---|---|---|
| Sex | | |
| Male | 80 | 65.0 |
| Female | 43 | 35.0 |
| Age | | |
| <30 | 8 | 6.5 |
| 31-40 | 28 | 22.7 |
| 41-50 | 43 | 35.0 |
| 51-60 | 39 | 31.7 |
| >60 | 5 | 4.1 |
| Marital status | | |
| Single | 3 | 2.4 |
| Married | 111 | 90.3 |
| Once married | 9 | 7.3 |
| Education | | |
| Non formal | 40 | 32.5 |
| Adult education | 11 | 8.9 |
| Primary education | 60 | 48.8 |
| Secondary education | 12 | 9.8 |
| Household size/Dependency ratio | | |
| 1-3 | 12 | 9.8 |
| 4-6 | 77 | 62.6 |
| 7-9 | 28 | 22.8 |
| >9 | 6 | 4.8 |
| Household labour/Human capital | | |
| None | 37 | 30.1 |
| 1-2 | 79 | 64.2 |

| | | |
|---|---|---|
| 3-4 | 4 | 3.3 |
| 5-6 | 3 | 2.4 |
| Household head | | |
| Male | 92 | 74.8 |
| Female | 31 | 25.2 |
| Primary crop grown | | |
| Maize | 123 | 100.0 |
| Soybean | 119 | 96.7 |
| Yam | 82 | 66.7 |
| Cassava | 99 | 80.5 |
| Vegetables | 48 | 39.0 |
| Years of soybean production experience | | |
| <10 | 21 | 17.1 |
| 11-20 | 50 | 40.7 |
| 21-30 | 34 | 27.6 |
| 31-40 | 18 | 14.6 |
| Average monthly income | | |
| <20,000 | 40 | 32.5 |
| 20,000-40,000 | 65 | 52.8 |
| >40,000 | 18 | 14.7 |

*Source: Field survey, 2012*

*b) Awareness of soybean benefits*

Soybean farmers in Oniyo community generally have high awareness of soybean nutritional benefits, but low awareness of its health benefits. For instance, they do not know that soybean consumption reduces chances of cancer, obesity and ulcer development, and reduces the various discomforts of menopause. Also, because of the popular knowledge that soybean cultivation replenishes soil fertility, these farmers do not know that even soybean grow better with NPK fertilizer application. This indicates that soybean farmers' knowledge of soybean benefits is yet inadequate as also opined by Olatunji *et al.* (2012), because the most uncommon benefits of soybean are its health benefits.

*Table 2 :* Distribution of farmers' awareness of soybean benefits

| S/No | Variables | No Freq | % | Yes Freq | % |
|---|---|---|---|---|---|
| 1 | Soybean products are supplements to meat and fish | 3 | 2.4 | 120 | 97.6 |
| 2 | Cooking oil can be extracted from soybean | 4 | 3.3 | 119 | 96.7 |
| 3 | Soybean by-product can be used to feed livestock | 6 | 4.8 | 117 | 95.2 |
| 4 | Soybean intake reduce side-effects of menopause | 116 | 94.3 | 7 | 5.7 |
| 5 | Inclusion of soybean in diet reduce chances of cancer infection | 114 | 92.7 | 9 | 7.3 |
| 6 | Soybean menu reduce chances of obesity | 105 | 85.4 | 18 | 14.6 |
| 7 | Diabetic patients are advised to increase soybean intake | 79 | 64.2 | 44 | 35.8 |
| 8 | Soybean intake reduce the chances of high blood pressure | 12 | 9.8 | 111 | 90.2 |
| 9 | Soybean cultivation fertilises the soil | 0 | 0.0 | 123 | 100.0 |
| 10 | Milk can be processed from soybean | 5 | 4.1 | 118 | 95.9 |
| 11 | Soybean can be used to flavour food | 3 | 2.4 | 120 | 07.6 |
| 12 | Soybean is a raw material for industries | 2 | 1.6 | 121 | 98.4 |
| 13 | Soybean production still requires the use of NPK | 75 | 61.0 | 48 | 39.0 |
| 14 | Soybean cultivation reduces weed population | 2 | 1.6 | 121 | 98.4 |
| 15 | Soybean intake reduces chances of ulcer development | 98 | 79.7 | 25 | 20.3 |

*Source: Field survey, 2012*

*c) Perception of soybean importance*

Majority of the soybean farmers agreed that soybean consumption increases blood quality and quantity, and consequently makes one look healthy. Also, most of the farmers agreed that soy products are palatable and even use it to flavour soup, yet most of them still prefers fish and meat to soy cheese. This implies that soy products are only perceived to be substitutes for fish, meats and other food materials. Moreover, 82.9% of the farmers agreed that soybean cultivation is socially respected; corroborating the statement that soybean is a prominent crop in the area under socioeconomic characteristics. Soybean cultivation will be sustained in the area as suggested by item 20 on table 3 despite that poor pricing is a challenge to this venture contrary to Omotayo *et al.* (2007) which stated that local prices are within international price range. This indicates that reasons for soybean cultivation transcend profit making.

*Table 3 :* Percentage distribution of farmers' perception of soybean importance

| S/No | Perception statements | SD | D | U | A | SA |
|---|---|---|---|---|---|---|
| 1 | Soybean consumption increases blood quality and quantity | 4.9 | 7.3 | - | 80.5 | 7.3 |
| 2 | Soybean consumption makes one look fresh | - | - | - | 85.4 | 14.6 |
| 3 | Soybean flavours soup | - | - | - | 85.4 | 14.6 |
| 4 | Soybean diet enhances children's growth and development | - | - | - | 46.3 | 53.7 |
| 5 | Soybean products are palatable | 4.9 | - | 2.4 | 80.5 | 12.2 |
| 6 | Soybean products upset my stomach | 7.3 | 75.6 | 4.9 | 12.2 | - |
| 7 | Soybean production is labour intensive | - | 75.6 | 7.3 | 17.1 | - |
| 8 | I had rather eat fish than soy-cheese | 2.4 | 7.3 | 4.9 | 82.9 | 2.4 |
| 9 | I had rather eat meat than soy-cheese | 2.4 | 9.8 | 4.9 | 80.5 | 2.4 |
| 10 | Soybean processing is labour intensive | - | 26.8 | 4.9 | 65.9 | 2.4 |
| 11 | Soybean products have short shelf life | - | 2.4 | - | 75.6 | 22.0 |
| 12 | Soybean activities are socially respected | - | 2.4 | 7.3 | 82.9 | 7.3 |
| 13 | Soybean enterprises is a good source of money | - | - | - | 87.8 | 12.2 |
| 14 | Livestock enjoy soybean by-products | - | 2.4 | - | 85.4 | 12.2 |
| 15 | Low patronage is a challenge of soybean enterprise | 4.9 | 43.9 | 2.4 | 46.3 | 2.4 |
| 16 | Poor pricing is a challenge in soybean enterprise | - | - | - | 87.8 | 12.2 |
| 17 | Mixed cropping with soybean maintains soil fertility | - | - | - | 87.8 | 12.2 |
| 18 | I had rather drink cow milk than soy-milk | 41.5 | 12.2 | 2.4 | 29.0 | 4.9 |
| 19 | Soybean products are readily available | - | - | 4.9 | 85.4 | 9.8 |
| 20 | I will not withdraw from soybean enterprise | 2.4 | 2.4 | - | 82.9 | 12.2 |

*Source: Field source, 2012*

*d) Relative socio-cultural significance of soybean*

Soybean compared with other prominent crops like cassava, yam and maize revealed that majority of farmers considers soybean lowest in social relevance and yield. Most also have more years of experience in the other three crops and dedicate the least acres of land to soybean cultivation. However, table 4 reveals that almost all of them acknowledge that soybean has the most diversity of usage, as also suggested by New Nigerian Foundation (2007), among the four crops.

*Table 4 :* Percentage distribution of relative socio-cultural significance of soybean

| Variables | First | Second | Third | Fourth |
|---|---|---|---|---|
| Acres under cultivation | 9.8 | - | 36.6 | 46.3 |
| Labour input | 12.2 | 17.1 | 34.1 | 29.3 |
| Years of experience | - | - | 12.2 | 80.5 |
| Consumption | - | 9.8 | 56.1 | 26.8 |
| Income generation | 7.3 | 7.3 | 61.0 | 17.1 |
| Social relevance | - | 2.4 | 4.9 | 85.4 |
| Diversity of usage | 92.7 | - | - | - |
| Yield | 2.4 | - | 26.8 | 58.5 |

*Source: Field survey, 2012*

*e) Utilisation of soybean*

Table 5 shows that usage of soybean for milk, soup, income and cheese purposes rank highest and in agreement with Fabiyi (2006), while its use for flour, feed, cooking oil and flavour is low. This further suggests that other oil, feed and flavour sources were preferable to the farmers. This may be due to soybean palatability, availability, accessibility, affordability compared to other alternatives or they were just used to other alternatives.

*Table 5 :* Percentage distribution of soybean utilization

| Variables | Never | Rarely | Sometimes | Often |
|---|---|---|---|---|
| Milk | - | 2.4 | - | 97.6 |
| Cheese | - | 2.4 | 7.3 | 90.2 |
| Steamed cake | - | 65.9 | 34.1 | - |
| Fried cake | 4.9 | 63.4 | 31.7 | - |
| Cooking oil | 2.4 | 14.6 | 80.5 | 2.4 |
| Feed | 4.9 | 4.9 | 80.5 | 9.8 |
| Flour | - | 24.4 | 73.2 | 2.4 |
| Flavour | 2.4 | 4.9 | 68.3 | 24.4 |
| Income | - | 4.9 | 2.4 | 92.7 |
| Soup | - | 2.4 | - | 97.6 |

*Source: Field study, 2012*

*f) Constraints in soybean utilisation*

Table 6 suggests that soybean is well accepted as a veritable component of household diet because of its palatability. It also reveals that soybean is readily available and marketable. However, farmers acknowledged that inadequate processing skills and its attendant high processing drudgery are constraints, corroborating the result of New Nigeria Foundation (2007). This may negatively affect the choice of soy products in diet despite their high level of acceptance. On the other hand, the opinion that soybean consumption is for the people that could not afford high priced animal protein was also made bare in the table.

*Table 6 :* Percentage distribution of constraints to soybean utilisation

| Variables | Not a constraint | Not a severe constraint | A severe constraint |
|---|---|---|---|
| Low household acceptance | 80.5 | 19.5 | - |
| Low palatability | 90.2 | 9.8 | - |
| Inadequate processing skills | 26.8 | 68.3 | 4.9 |
| Low patronage | 90.2 | 9.8 | - |
| High processing drudgery | 2.4 | 87.8 | 9.8 |
| Low soybean availability | 82.9 | 14.6 | 2.4 |
| Short shelf life | 2.4 | 4.9 | 92.7 |
| Consumption is synonymous with poverty | 12.2 | 85.4 | 2.4 |

*Source: Field study, 2012*

*g) Level of awareness, perception, constraints and utilization*

Fig. 1 shows that the level of farmers' awareness of soybean benefits was neither significantly high nor low and consequently the level of perception as also concluded by Olatunji *et al* (2012). However, it should be noted that more farmers had lower awareness and unfavourable perception of soybean benefits and importance respectively. Nevertheless, the level of constraints to soybean use was remarkably low and thus the level of soybean utilisation was high. The low awareness suggests that farmers need to know more about the uniqueness of soybean in preventing diseases and this will also positively impact on their perception. This will ensure that soybean use will not just be circumstantial, but deliberate.

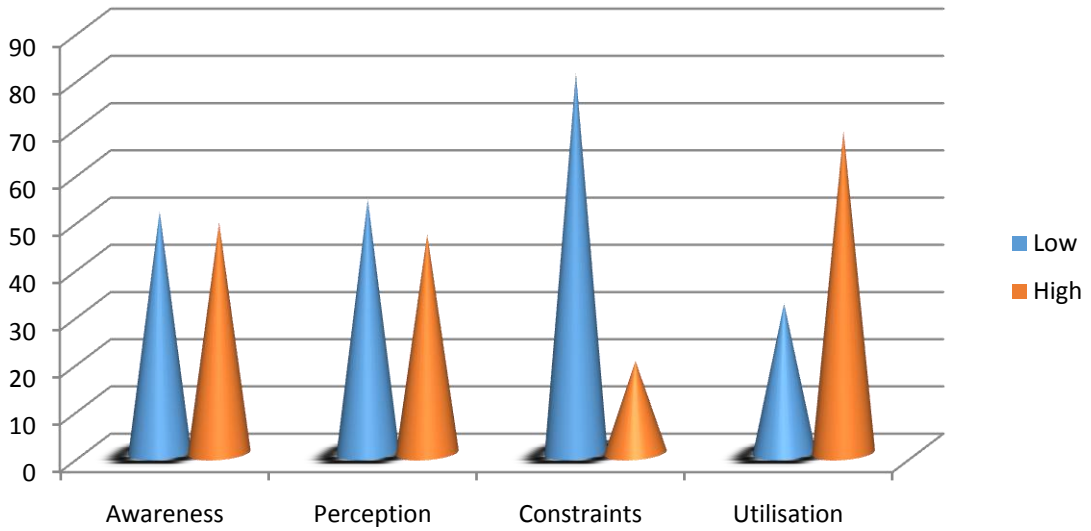


*Figure 1 :* Chart showing level of awareness, perception, constraints and utilisation

*Source : Field study, 2012*

*h) Chi-square tests of hypotheses*

Result of analysis in table 7 shows that soybean use is irrespective of individual sex and the sex of household heads. This implies that soy products are acceptable to both male and female, and also in both male and female headed households. The table also show that there is significant relationship between marital status and education, and soybean utilisation. This indicates that the use of soybean in nurturing children to ensure proper growth and development. Also, as stated by Ajao *et al.* (2012), the more educated farmers are the higher there utilisation of soybean. This infers that more educated farmers understand and

appreciate the uniqueness of soybean for nutrition and health. The contingency of coefficient reveals that a unit increase in farmers' educational status leads to 0.34 increase in their utilisation of soybean.

*Table 7 :* Chi-square result of hypotheses

| Variables | df | Chi-square value | p-value | Decision |
|---|---|---|---|---|
| Sex versus soybean use | 1 | 0.473 | 0.492 | Not significant |
| Marital status versus soybean use | 4 | 10.667 | 0.031 | Significant |
| Education versus soybean use | 3 | 16.321 | 0.001 | Significant |
| Sex of household head versus soybean use | 1 | 0.053 | 0.817 | Not significant |

*Source: Field study, 2012*

*i) Correlation test of hypotheses*

Table 8 reveals that the higher the age and monthly income of a farmer, the lower his/her utilisation of soybean. This agrees with the assumption that income increases with age and years of working experience. This corroborates the earlier assertion that soybean use is associated with low income by Obatolu *et al.* (2006) and disagreed with Haddad and Alderman (2000) that stated that more income leads to better nutrition over time. In addition, there is no significant relationship between awareness and use of soybean, contrary to the assertion of Dugje *et al.* (2009). This could be due to the level of awareness that is neither low nor high in the figure above.

*Table 8 :* Pearson Product Moment Correlation test of hypotheses

| Variables | r-value | p-value | Decision |
|---|---|---|---|
| Age versus soybean utilisation | -0.043 | 0.640 | Not significant |
| Monthly income versus soybean utilisation | -0.084 | 0.358 | Not significant |
| Years of experience versus soybean use | -0.153 | 0.091 | Not significan |
| Awareness versus soybean utilisation | 0.079 | 0.383 | Not significant |

*Source: Field survey, 2012*

## IV. Conclusion

This study inferred that soybean was cultivated by male and female, as well as old and young. Majority of the farmers are between ages 41 and 50 years. Almost all of these farmers were married and many of them only have primary education. Soybean was a socially prominent crop in the community, especially because of its diversity of usage. Most of the soybean farmers had a household size of between four to six people and consequently, most of them had household labor of between one and two people. Majority of the farmers have had between 11 to 20 years of soybean cultivation and had mean income of between =N=20,000 to =N=40,000 per month. Soybean farmers had low awareness and perception of soybean benefits and importance respectively, but had high level of utilisation of soybean, with low level of constraints to its uses. Individual sex, sex of household heads and awareness do not influence soybean utilisation, but marital status and education do. However, the higher the age, monthly income and years of experience of farmers, the lower their utilisation of soybean.

## V. Recommendations

In order to upgrade farmers' awareness and change their negative perception, extension service needs to re-package and dynamically disseminate information, educate and re-educate farmers on several health benefits of soya bean use. Emphasis should be made on nutrition and health consciousness for adults and aged, irrespective of more income. Research and extension must come up with programs to build farmers capacity in simple processing of soybean into diverse products efficiently. Diverse soy products will ensure that farmers have various alternatives to choose from, while simple processing skills will facilitate soybean adoption in diets. Periodic monitoring and assessment of nutrition status of farm families should be done by extension workers to maintain or promote rural heath in order to keep them productive. Public and nongovernmental organizations should promote publicity on importance of adequate nutrition in relation to soybean potentials.

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# Interest Groups and the Price of Cereals in Kenya

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# Interest Groups and the Price of Cereals in Kenya

Benjamin Onyango[α] & Rigoberto A. Lopez[σ]

*Abstract* - This article examines Kenya's post-independence cereals pricing policy (maize, wheat, and rice) within a political economy framework. The model posits commodity pricing policy decisions in terms of balancing the conflicting interests of consumers, producers, and the government's budget. Empirical results confirm that policy outcomes are influenced by urban consumers, farmers, and, more recently, by structural adjustment programs. Furthermore, perpetual deficits by the marketing board handling cereals can be explained by the simultaneous subsidies to producers and consumers. In fact, structural adjustment programs have moved prices closer to free market levels by disengaging government involvement, reducing the cost of operating the marketing boards but increasing the political cost to the Kenyan government.

*The Politics of Food Pricing Decisions: The Case of Cereals in Kenya*

## I. Introduction

Government intervention in African food markets has been pervasive (e.g., Bates, 1981), especially through the use of marketing boards and other forms of state-owned enterprises (Jackson, 1982; Niskanen, 1971). Evidence suggest that although the stated goals of intervention have often been self-sufficiency, addressing missing credit markets, or promoting cheap food policies, intervention has often resulted in substantial redistribution of wealth that benefits some groups at the expense of others as well as in perpetual budget deficits incurred by marketing boards that have been subsidized out of general funds or international aid (Buccola and McCandish, 1999; Toye, 1992).[1]

In the 1980s, African along with other developing countries adopted programs to liberalize agricultural policies and to implement macroeconomic reforms under pressure of the World Bank and the International Monetary Fund. These changes meant the targeting of marketing boards for extinction or reform, elimination of input subsidies and credit programs, and hopefully, better incentives to producers under macroeconomic reform.[2] The design of food policy reform, however, requires an understanding of the role played by consumer and producer interests in the pre-reform period and the implications of the proposed reform for producer and consumer prices.

The Kenyan cereal market provides a useful case study typical of food markets in Africa. First, the issue of interest group influence has been at the core of cereal pricing decisions by the Kenyan marketing board. Second, the extent of government intervention in the market has been significant, especially in the form of regulating prices and providing fertilizer and guarantee minimum returns to farmers. Third, market has been a subject to reform under the Structural Adjustment Programs (SAPs) signed by the Kenyan government in 1979. Fourth, cereals represent the staple diet of the increasingly urban population and plays a prominent role in the agricultural economy of the country.

The objectives of this paper are to (1) examine the pricing decisions of the marketing board for cereals (maize, wheat, and rice) in post-independence Kenya and (2) assess the impact of SAPs and domestic interest groups on consumer and producers prices for cereals. A political economy model is presented which posits the pricing problem as trade-offs of the conflicting special interests of consumers, producers, and the government's budget. Empirical results show that the board's pricing decisions are importantly influenced by consumer and producer interests with an urban bias, and that they have been reshaped by SAP reforms. In fact, SAPs have moved cereal prices closer to free markets by lowering producer prices and increasing consumer prices.

## II. The Case of Cereals in Kenya

Cereals (maize, wheat and rice) constitute the staple diet in Kenya. Maize alone, for instance, provides 40% of the population's caloric requirements. Wheat and rice, although far less important than maize in terms of consumption, have experienced demand growth at twice the population growth. Maize is grown in the Rift Valley and Western Province by a mixture of large and small to medium scale farmers. Wheat is grown predominately by large-scale farmers in the Rift Valley while rice is grown largely by small-scale farmers in the area of the Mwea irrigation district in the Central Province.

A major policy goal of cereal pricing decisions has been to maintain broad domestic self-sufficiency in the basic foodstuffs. On the other hand, the government attempts to remunerate farmers adequately to elicit

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enough production while ensuring affordable prices to consumers at (Republic of Kenya, Session Paper No. 1, 1981). To meet these ends, a Marketing Board regulates all prices and marketing.[3] This degree of cereal market regulation has opened avenues for the proliferation of rent seeking activities (Mosley, 1991).

The cereal price-setting process starts with a technical paper that gives recommendations on producer prices issued by the Ministry of Agriculture. This technical paper is then forwarded to a Price Review Committee composed of the Permanent Secretaries from the Ministries of Agriculture and Finance. Then a revised recommendation is forwarded to the Kenyan Cabinet for final discussion and approval. Once approved, the Minister of Agriculture announces the floor prices for the following crop year. In June of the same year, the Minister of Finance announces the consumer and producer prices for the relevant commodities during the official Budget Speech (Agricultural Act cap. 317). These prices are then administered by the Marketing Board.

Consumer interests are well represented in the cereal pricing decision-making. Because cereals are considered a wage good; therefore, it is in the interest of the government and industrialists to have lower food prices for the urban dwellers. From a political organization cost point of view, the urban group is highly enlightened and able to forcefully register its demands (Bates, 1989). It should be noted that rapid urban expansion and urbanite taste for bread have been the main factors responsible for the rapid growth in demand for wheat and rice. Finally, Cabinet members from food deficit regions (e.g., Nairobi, Eastern and Northeastern provinces) formed a coalition to ensure food availability and affordable cereal prices to their constituencies (Himbara, 1994).

Producer interests are also well represented in the pricing decision process. In the post independence period (after 1963), policies favorable to producers have resulted from the stake senior political elite hold in farming enterprises, especially in the large operations of wheat. In 1963, for instance, the key Ministries of Agriculture and Finance were under the control of Central Province representatives, and policies initially favored cash crops in that area. In 1978, the incoming President shifted responsibility to the new Ministry of Agriculture from the Western Province. He also created three cabinet positions in the Office of the President that were aimed at influencing agricultural policies to benefit the Rift Valley and Western Kenya, thus creating a favorable policy atmosphere for maize and wheat producers (Loftchie, 1989; Bates 1991).

In addition to geo-political representation and rent seeking by the political elite, cereal producers have exerted influence through their main lobby group--the Kenya National Farmers Union (KNFU), whose mission is to promote the well-being of its members, largely comprised of commercial farmers.[4] A major policy instrument sought before the implementation of SAPs to influence the level and defend the existence of a price floor to farmers, namely a guarantee minimum return (GMR) which applied mostly to maize and wheat farmers. In fact, much of the budget of the marketing board was devoted to subsidize the GMR (Policy Framework Paper, 1995).

External factors have also shaped cereal pricing decisions in Kenya. Like many developing countries, the cereal markets were also subject to Structural Adjustment Programs (SAPs). In 1979, Kenya signed an agreement with the World Bank and the International Monetary Fund (IMF) to undertake policy reforms (Cassen, 1995). By 1982, Kenya initiated a number of agricultural reforms, including dismantling of the state-sponsored pricing and marketing arrangements, cost recovery for government services, privatization of state enterprises, and removal of input and output subsidies (Bigsten and Ndung'u, 1995). For cereals, in particular, a major piece of reform involved the dismantling of the GMR program. The impact of SAPs, however, goes beyond sector policy reform into exchange rate devaluation which also affects incentives to agricultural producers.

Overall, one can assert that cereal price outcomes in post-independence Kenya has been a result of interest group competition for political influence as well as a result of external constraints binding the cereal market since the 1980s, i.e., conditions demanded by the World Bank and the IMF. The following section formalizes this premise through a political economic model to explain the government's decisions in setting producer and consumer prices for cereals in Kenya and the situations in which the marketing board can run into budget deficits in spite of its monopolistic and mono psonistic position.

## III. A Conceptual Price Regulation for Cereals

For the purpose of this article, interest groups are aggregated into three broad categories, namely producers, consumers, and the marketing board. To characterize the domestic market for cereals, their demand and supply equations are presented by:

$$Q_i^s = f\left(p_i^s, Z_i^s\right), \tag{1}$$

$$Q_i^d = g\left(p_i^d, Z_i^d\right), \tag{2}$$

where *i* denotes maize, wheat or rice respectively. The factors that determine domestic production ($Q_i^s$) are the farm level price ($p_i^s$) and a vector of shifter factors ($Z_i^s$) such as the prices of competing crops and weather.

The factors determining domestic consumption $(Q_i^d)$ are the wholesale price $(p_i^d)$ and a vector of shifter factors $(Z_i^d)$ such as the price of substitutes and consumer income. Thus, the demand function of interest is the derived demand function at wholesale level. Following Just, Hueth and Schmitz (1982), let the producer surplus (*PS*) and consumer surplus (*CS*) be defined by

$$PS_i = \sum_i \int_{a_i}^{p_i^s} f\left(p_i^s \mid Z_i^s\right) dp_i^s, \tag{3}$$

$$CS_i = \sum_i \int_{p_i^d}^{b_i} g\left(p_i^d \mid Z_i^d\right) dp_i^d, \tag{4}$$

where $a_i$ is the supply price $Q_i^s = 0$ and $b_i$ is the demand price when $Q_i^d \to 0$. The board buys cereals at $P_i^s$ and sells them to wholesalers at $p_i^d$. Assume the per unit cost for assembling and distribution each cereal is $\alpha_i$ and $\beta_i$, respectively. Thus, the net marketing cost is incurred by the board is $c_i = \alpha_i + \beta_i$. The board's surplus (*MBS*) is thus given by

$$MBS = \sum_i \left(p_i^d - \alpha_i\right) Q_i^d - \left(p_i^s + \beta_i\right) Q_i^s \tag{5}$$

Following Gardner (1987) and Lopez (1989), let the political preference function be represented by a linear welfare function of the consumers, producers and the board's surpluses. Setting the coefficient for the board surplus weight to one, define the political preference function as

$$W = \theta CS + \delta PS + MBS, \tag{6}$$

where $\theta$ and $\delta$ are consumer and producer welfare weights. Substituting (3), (4), and (5) into (6) and maximizing it with respect to the price policy instruments, and solving for the producer and consumer prices, one obtains:

*Consumer Price Equation*

$$p_i^d = \frac{\alpha_i}{1 + \left(\frac{\theta_i - 1}{\eta_i}\right)}, \tag{7}$$

*Producer Price Equation:*

$$p_i^s = \frac{\beta_i}{1 + \left(\frac{\delta_i - 1}{\varepsilon_i}\right)}, \tag{8}$$

where the terms $\varepsilon_i$ and $\eta_i$ are the price elasticities of supply and demand of the *ith* cereal in absolute values. From equations (7) and (8), $\theta, \delta = 1$ results in competitive producer and consumer prices (i.e., they are charged the cost of distribution and assembly, respectively. Note that $\theta, \delta > 1$ results in favorable prices to both consumers and producers. On the other hand, when $\theta, \delta < 1$, the marketing board pays unfavorable prices to consumers and producers by exerting monopoly and monopsony power, respectively. In fact, $\theta, \delta = 0$ leads to a pure monopolistic/ monopsonistic situation. Thus a wide range of outcomes can be explained based on the relative political weights attached to the welfare of consumers and producers vis-à-vis the budget of the marketing board.

To gain a further insight, equations (7) and (8) are rearranged to obtain a net marketing margin for the pricing decisions:

$$p_i^d - p_i^s - c_i = \alpha_i \left( \frac{1}{1 - \frac{1}{\eta_i}(1 - \theta_i)} \right) + \beta_i \left( \frac{1}{1 + \frac{1}{\varepsilon_i}(\delta_i - 1)} - 1 \right) \tag{9}$$

From equation (9), a balanced budget outcome will emerge in the situation $\theta_1, \theta_2 = 1$. However, other situations may arise, for example where the board could extract rents from consumers to subsidize the producers $(\theta = 0,\ \delta > 1)$ or vice versa $(\theta > 1, \delta = 0)$.

Equation (9) can also be instructive in terms of pointing out the case where a marketing board incurs budget deficits, i.e., when the marketing margin is less than the marketing cost $c_i$. This case arises when producers and consumers of the cereal in question are simultaneously powerful relative to those financing the marketing board; that is, when $\theta_i$ and $\delta_i$ are greater than one (recall that the weight attached to the budget surplus of the marketing board is one in equation (6)). In such a case, the deficits are financed out of taxpayers or international aid funds as pointed out by Buccola and McCandish, 1999).[6]

## IV. Empirical Procedures

Equations (7) and (8) are the basis for the empirical analysis. Those equations involve political-economic equilibria prices that are a function of the assembly and collection costs incurred by the marketing board, the price elasticities of supply and demand, as well as the relative political power of producers and consumers. To empirically operationalize the regulation model, annual data for the 1963-74 period post-independence Kenya were collected. These data sources are summarized in Table 1 and their descriptive statistics are given in Table 2.

Data for the dependent variables ( $p_i^d$ and $p_i^s$ ), the wholesale (i.e., consumer) and producer prices for maize, wheat, and rice were collected from the Kenyan Ministry of Agriculture Annual Reports. Per unit cost for assembling and distribution each cereal ( $\alpha_i$ and $\beta_i$ ) came from the Annual Reports of the National Cereals and Produce Board, the institution handling pricing and marketing of cereals. [5] The price elasticities demand ( $\eta_i$ ) were estimated using a linear approximation to the Almost Ideal Demand System (Deaton and Muellbauer, 1980). The price elasticities of supply ( $\varepsilon_i$ ) for each cereal were estimated using using a normalized, quadratic dual profit function approach (Shumway, 1983).[6]

It is assumed that the relative political weights of consumers (θ) and producers (δ) vary according to the factors discussed below:

The degree of Urbanization *(URB)*, the first explanatory variable assumed to determine the welfare weights, is measured by proportion of urban population to the total population. Following the reasoning of Peltzman (1976), as the number of urban dwellers increases, lobbying cost increases while the per capita benefits of subsidizing producers decreases suggesting a negative impact of *URB* on $\theta$ (and hence, a positive effect on consumer prices) and a positive impact on δ (and hence, on producer prices). On the other hand, many scholars argue that there is an urban bias with regard to food policies in Africa (Iyegha, 1988) since politicians are more sensitive to the urban poor. This situation suggests a positive impact of *URB* on θ (leading to lower consumer prices) and possibly a negative impact on δ (and hence on producer prices).

Another consumer-related factor, as discussed in section 2, is Cabinet representation from food deficit regions *(CAB)*, measured by a Herfindahl index constructed using the shares of cabinet positions of each food deficit province. Besides representing the interest of consumers from those provinces, this variable attempts to partially capture ethnic- or tribal- based representation as well, an important factor in Kenyan food politics. A region with more cabinet members from food deficit regions will favor lower cereal prices, with less regard for producer prices. Thus, *CAB* is expected to be positively related to $\theta$ (and hence a lowering effect on consumer prices) and negatively related to δ.

Next, we turn to a producer-related variable to explain the political weights: the geographic concentration of production *(GEO)*, measured by the proportion of production accounted for by two major producing areas. Following Pelzman (1976) and Becker (1983), as production becomes more geographically concentrated, lobbying cost decreases although geopolitical representation diminishes. Nonetheless, this factor is expected to be negatively related to consumers' political power and positively related to producer's political muscle.

Two event variables are used to capture the effects of Structural Adjustment Programs on cereal prices. One is the official signing of the agreement to SAP conditions in 1979 which dealt mostly with macroeconomic reforms and the second is the removal of cereal-specific price floors (Guarantee Minimum Returns) which dealt mostly with market reforms.

The first SAP-related variable (*SAP1)* is introduced to explain changes in the welfare weights after SAP conditions were agreed upon. This variable is equal to 1 for the post-1980 period (after Kenya's endorsement of SAPs), and zero otherwise. Thus, *SAP1* is expected to be positively related to $\theta$ and negatively related to δ as it was obvious that a simultaneous subsidies to both consumers and producers was prevalent before the introduction of reforms (Onyango, 1998).

The second SAP-related variable reflects the dismantling of Guaranteed Minimum Returns *(SAP2)* program. This variable is defined as zero during its existence for a particular cereal and one thereafter. The GMR program was the main goal of the producers' lobby group--the KNFU. The levels of GRM in the pre-reform period varied widely across commodities, with maize and wheat generally getting higher levels of subsidies than those received by rice producers. Therefore, *SAP2* is expected to have a negative impact on political weight of producers ( $\delta$ , resulting in lower producer prices after the reform) and a weak but positive effect on the political weight of consumers (θ, resulting in unchanged or lower consumer prices).

Assume the political weights are linear functions of the factors discussed above. Substituting in (7) and (8), the resultant estimating cereal price equations are:

$$p_{it}^d = \frac{\alpha_{it}}{1+\left(\frac{\theta_{i0}+\theta_{i1}URB_t+\theta_{i2}CAB_t+\theta_{i3}GEO_{it}+\theta_{i4}SAP1_t+\theta_{i5}SAP2_{it}-1}{\eta_t}\right)}+U_{it}, \quad (10)$$

$$p_{it}^s = \frac{\beta_{it}}{1+\left(\frac{\delta_{i0}+\delta_{i1}URB_t+\delta_{i2}CAB_t+\delta_{i3}GEO_{it}+\delta_{i4}SAP1_t+\delta_{i5}SAP2_{it}-1}{\varepsilon_{it}}\right)}+V_{it} \quad (11)$$

The terms $\theta_{ij}$ and $\delta_{ij}$ are parameters to be estimated, $i$ is a cereal, $t$ is a year subscript (t=1963,…,1994), and $U_{it}$ and $V_{it}$ are random errors. As the price elasticities and the marketing (assembly and distribution) costs are part of the data, the parameters of the determinants of the welfare weights in (10) and (11) are the only ones to be estimated.

As setting consumer and producer prices for cereals in Kenya are certainly not independent decisions, it seems plausible that the pricing equations for all three cereals are joined in a system of equations. This was done using Zellner's seemingly unrelated techniques with time-series data covering the 1963-1994 period. All calculations were implemented using the SHAZAM 7.0 software. The results are presented in the following section.

## V. Empirical Results

Table 2 presents the parameter estimates for the determinants of $\delta$, for the producers prices of maize, wheat, and rice. All the parameters have the expected sign and most are significant at the 5% level.

The results indicate that the *SAP1* dummy played a minimal role in producer outcomes. In interpreting the insignificant impacts of signing SAPs one should take into consideration the fact that Kenya's SAPs is a recent policy undertaking which was gradually implemented and has been riddled with backtracking problems coming into operation fully only in 1993.

The most significant policy move by the government was the removal the use of GMR. This policy instrument (*SAP2*) seemed to have played a greater role in determining the producer price outcomes than other aspects of structural adjustment programs. The parameters associated with the production subsidy were all significant, with maize and wheat being significant at the 5% level and rice at the 1% level. As argued earlier, the maize and wheat producers took full advantage of this interest-free credit and price subsidy. However, this is a subtle result, relevant to the top bureaucrats and ruling elite who are responsible for crafting policies while being part of the wheat-farming group. From a self-interest point of view, their main objective is to obtain high producer prices through a production subsidy that provided direct income benefits (Loftchie, 1989; Bates, 1991; Widner, 1994).

The parameter associated with urban population pressure (*URB*) turned out to be significant for maize and rice, but was insignificant for wheat. Maize is the main staple food of both urban and rural populations. The signs for wheat and rice are unexpected, a result that may be supported by the rural bias food price policies in that with rising urban population their prices correspondingly increase. The budgetary implications for such support minimal given that wheat and rice farmer are few (Bates, 1989; Pearson, 1995; Gow and Parton 1996; Loftchie, 1989).

The geographic concentration of production (*GEO*) was significant at the 1% level for maize producing areas but it turned out insignificant for wheat and rice, it had the expected sign. Producer concentration in a given area was assumed to work to the producers' advantage, as demonstrated in the case of maize. However, in the case of rice, one may argue that although rice farmers are concentrated, they are largely small-scale poor farmers with fewer resources for political organization.

Cabinet concentration (*CAB*) for the food deficit regions had the expected sign and was significant at the 5% level for all three cereals producer prices. Its negative association with producer prices reflects the strength of the lobby of ministers from the food deficit regions pushing for lower consumer prices in Cabinet decisions. As pointed out by Loftchie (1986, 1989), the President sought to strengthen his hold on power by forging a coalition of the food deficit regions with his home area. Thus, food deficit (in this case maize) area representatives in cabinet decisions support higher producer prices in return for assurance that the subsidized maize distribution from the government will reach their people. The losses of course have to be covered by general government funds.

Table 3 presents the parameter estimates for the determinants of $\theta$ for the wholesale prices of maize, wheat, and rice. Most parameters had the expected sign and were significant at the 5% level.

*SAP1* is associated with higher prices for maize and rice, indicating that previously the consumer prices were artificially low and that they have increased with policy reforms. It should be noted that international donors, notably the World Bank, the European Union, and the IMF have been persistently pushing for liberalization of the cereals market, given the board's deficits, especially maize prices. Overall, the results indicate that SAPs had a negative impact on consumer prices, which hitherto have remained low. Thus, the implementation of SAPs is to bring the consumer prices in line with competitive levels.

The coefficients associated with food deficit area cabinet concentration (*CAB*) had the expected sign in all three cereal equations and were significant at the 10% and 1% levels for maize and wheat respectively, insignificant for rice. The greater the cabinet representtation for food deficit areas, the lower the consumer prices. The strong representation from these areas has been in fact a significant political factor responsible for delays in the full implementation of economic reforms (Lewa and Hubbard, 1996). On the other hand, urban pressure is positively associated with rising consumer prices across the board, lending further support to Kenya's rural biasedness as opposed to an urban bias found in other African countries (ref.).

The predicted weights θ and δ for maize (from equation (10), not reported here) were larger than one and much larger than the corresponding weights for wheat and rice. This result is not surprising, since maize is widely consumed by most Kenyan households and accounts for the lion share of the board's transactions. Pickney (1987) observes that "absence or shortage of maize is equated to government failure." Thus the greater political weight attached to maize production and consumption is a direct result of the more politicized nature of maize pricing. Maize comes first, while wheat and rice are treated secondarily and almost equally.

## VI. Concluding Remarks

Cereal price policy outcomes in Kenya can be viewed as dependent on the relative political weight attached to particular interest groups, conditional on the elasticities of demand and supply, and the assembly and distribution costs of cereals. The cereals marketing board incur account deficits or surpluses reflecting the political strength of the interests groups and its own objectives.

The results for producer prices show that while the geographic concentration of producers significantly increased influenced pricing decisions in the case of maize, Cabinet representation from food deficit regions had a negative influence on all cereal producer price outcomes. Furthermore, the degree of urbanization had a positive effect on cereal producer prices, thus supporting a rural bias hypothesis in the case of Kenya. In fact, the results for consumer prices further supported the findings for producer prices in that Cabinet representation from food deficit areas lowered all consumer prices and that urbanization resulted in higher maize prices, further supporting Kenya's rural bias hypothesis. These domestic factors have a significant political influence and are a challenge for policy reform.

The signing of SAPs had both a decreasing effect on producer prices and an increasing effect on consumer prices as both producer and consumer interest groups were simultaneously politically powerful, resulting in both higher producer and lower consumer prices relative to a free market in the pre-reform period. As a result, the marketing board incurred perpetual deficits that had to be paid by taxpayers. However, this pre-existing political structure is being depoliticized due to the implementation of structural adjustment programs imposed externally by the World Bank and IMF.

In terms of policy implications, marketed based resource allocation is an ideal that all economies should strive to reach. From this study, we demonstrated the gradual erosion of the producer and consumer political powers as a result of espousing economic reforms. It will be an uphill task for the government to justify use of the board to regulate cereals prices to meet the self-sufficiency objective. The policy reform in the cereal sector has helped in reducing the rent seeking avenues and possibly reducing or eliminating the marketing board fiscal deficits. Market based cereal prices will herald better resource allocation in this sector, a result corroborating the findings on earlier studies on fertilizer and maize market liberalization (Omamo and Mose, 2001; Nyoro etal, 1999). However, one should stress the importance of cultivating an enabling environment for the private sector to thrive as liberalization without development of in fastructural and financial facilities to facilitate trade will be futile.

## VII. Notes

[1]It has also been argued that in most African cases, policies that benefit farmers are not instituted as a result of legislators' response to electoral incentives, but rather by decision makers who have property rights in agriculture and who can themselves capture the benefits of a favorable policy environment (Widner, 1994).

[2]Omamo et. al. (2001) and Nyoro et. al. (1999) have analyzed the Kenyan reform process focusing on the agricultural sector. The studies indicate that removal of controls in the inputs (fertilizer) and output markets (maize) has been beneficial to producers and consumers with positive resource allocation efficiency gains. However, both of these studies emphasize the importance of development and existence of supportive infrastructure (road networks, financial institutions, etc) for a successive market liberalization process.

[3]The Board buys all of the supply and is responsible for the entire distribution. To defend domestic prices, the Board handles all external trade, with restrictions of inter-district and across-the-border trade. However, external trade is rarely used unless it is an exceptional year (Schluter, 1984).

[4]This organization historically has been articulate in presenting commercial farmers' issues to the government. This is a united group whose common interest is to improve and protect their incomes by pushing for favorable prices (Bates, 1989). Their small numbers and massive resource base make it cheaper to organize themselves (Peltzman, 1976; Gardner, 1987). This factor will capture the commercial wheat and maize growing of the Rift Valley and Western regions, and the concentrated small-irrigated schemes in the Central Province.

[5]It should be noted that possible efficiency increases reflected in the decreases of $c_i$ are not considered in this article.

[6]The estimated price elasticities were plausible and in the range of previous estimates. The mean price elasticities of demand were estimated at -0.995 for maize, -0.475 for wheat, and -0.256 for rice. The mean price elasticities of supply were estimated at 1.50 for maize, 1.76 for wheat, and 0.45 for rice. See Onyango (1998) for more estimation details.

*Table 1 :* Parameter Estimates for Explaining Prices to Cereal Producers in Kenya, 1963-94

| Variable | Notation | Maize | Wheat | Rice |
|---|---|---|---|---|
| Producer Prices (shillings/ton) | $P_t^s$ | | | |
| Urbanization | $URB_t$ | 0.007 | 0.002* | -0.0002 |
| | | (1.300) | (1.814) | (-1.240) |
| Concentration of Producers | $GEO_t$ | 9.163 | 4.693 | -40.978*** |
| | | (0.836) | (0.382) | (-4.001) |
| Food Deficit Represents | $FDCAP_t$ | -539.100 | -1596.1** | 153.790 |
| | | (-1.183) | (-1.984) | (0.884) |
| Signing of SAPs | $SAP_1$ | -0.132 | -3.347 | -1.775 |
| | | (-0.027) | (-0.162) | (-0.422) |
| Elimination of GMR | $SAP_2$ | -222.33 | -203.93 | -27.827 |
| | | (-4.787) | (-2.507) | (-1.140) |
| Intercept | | -14.157 | -30.228 | 37.100*** |
| | | (-1.033) | (-0.873) | (3.452) |

Note : The number in parentheses are the t-ratios. One, two and three asterisks are used for significance at the 10, 5, and 1 percent levels.

*Table 2 :* Parameter Estimates for Cereal Prices at the Wholesale Level in Kenya, 1963-94

| Variable | Notation | Maize | Wheat | Rice |
|---|---|---|---|---|
| Producer Prices (shillings/ton) | $P_t^s$ | | | |
| Urbanization | $URB_t$ | 0.007 | 0.002* | -0.0002 |
| | | (1.300) | (1.814) | (-1.240) |
| Concentration of Producers | $GEO_t$ | 9.163 | 4.693 | -40.978*** |
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# Analysis of Factors Associated with the Privatization and Commercialization (P and C) of Agricultural Extension Services

By Ajieh Patrick Chuks
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*Abstract -* The study examined the factors associated with the P and C of agricultural extension services. The study was conducted in Delta State, Nigeria. A sample size of 134 extension professionals of the Delta State Agricultural Development Programmed (DTADP) was used for the study. Data for the study were collected through the use of validated questionnaire. Content validation of the research instrument was done by a team of expert in agricultural extension. A pilot test was conducted as part of instrument validation to test for reliability of the research instrument. Data generated by the study were analyzed using the exploratory factor analysis with iteration and varimax rotation. Variables with coefficient of 0.40 or more were regarded as high loading. Results of the study reveal that the three main factors associated with the P and C of agricultural extension services include: unfavourable economic environment, misgivings about private agencies, and government administrative and policy inadequacies. Specific issues highlighting these factors were also identified by the study.

*Keywords : factors, privatization, commercialization, agricultural extension services, extension professionals.*

*GJSFR-D Classification : FOR Code: 070199*


*Strictly as per the compliance and regulations of :*

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*Keywords : factors, privatization, commercialization, agricultural extension services, extension professionals.*

## I. Introduction

Worldwide, the public sector plays a dominant role in the provision of agricultural extension services (Lees, 1990). The public extension system is now seen as outdated, top-down, paternalistic, inflexible, subject to bureaucratic inefficiencies, and therefore unable to cope with the dynamic demands of modern agriculture (Rivera, Zijp and Gary, 2000).The failure of public sector extension has been attributed to a number of factors including poorly motivated staff, a preponderance of non-extension duties, inadequate operational funds, lack of relevant technology, poor planning, centralized management and a general absence of accountability in the public sector (Antholt, 1994). In general, public extension services have consistently failed to deal with the site- specific needs and problems of farmers (Ahmad, 1999).

As a result of the relatively poor performance record of the public extension, many countries are modifying the existing agricultural extension system, so as to meet the current challenges. There is a rapid evolution in the institutional arrangements governing agricultural extension in many parts of the world with a greater emphasis being placed on the P and C of extension services. According to Hassan (2004), the primary reason behind the agricultural extension P and C in several countries was the declining trend in government expenditure for extension. Financial burden have forced governments to make sharp reduction in the budget of public extension programmes (Van den Ban and Hawkins, 1996). Cases vary greatly in scale and in the mechanisms, which governments have used to divest themselves of the burden of financing and providing extension services (Ameur, 1994; Rivera, 1997).

The basic concept of P and C is that farmers have to pay for the services which they receive. This implies that agricultural extension would be run as a profit – oriented enterprise. Whether farmers pay totally or partially, it depends on the extension approach. Farmers may pay full amount or part of the fee. Government or other funding agency could subsidize it partially. Extension provider can be a government or semi-government organisation, private company, non-governmental organisation, and cooperative or farmers organisation. The important point is that the farmer has to bear at least some percentage of the total cost of the extension service and extension service providers are paid for their services. Agencies involved in the P and C depend for their annual budget on consulting fees received from farmers and contractual arrangements with government for the supply of policy information and rural intelligence. According to Hercus (1991), P and C can be a strategy for achieving a positive effect on moving "beyond the farm gate" into an involvement of extension staff in the entire production - processing - transportation - marketing chain. In the same vein, Rivera and Cary (1997) observed that P and C will broaden the focus of extension personnel and make the extension service more responsive to client needs and changing economic and social conditions.

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## II. Features of Privatization and Commercialization of Agricultural Extension Services in Different Countries

Diverse agricultural extension funding and delivery arrangements have been undertaken since the mid-1980s by governments worldwide in the name of "privatization". When agricultural extension is discussed, privatization is used in the broadest sense – of introducing or increasing private sector participation, which does not necessarily imply a transfer of designated state – owned assets to the private sector (Rivera and Cary, 1997). At least three scenarios have been suggested by government and farm organisations with regards to privatization of extension:

1. Public financing by the taxpayer only for the kinds of services of direct concern to the general public;
2. Direct charging for some individuals with direct return (in the form of improved income); and
3. Mixed funding shared between public and private professional association contributions for some services where benefits are shared (Le Gouis, 1991).

These methods of privatization are typical in France, the United Kingdom, and the Netherlands. In France, nearly three- quarters of the total resources for the operation of the system are collected at the farm level through direct payment (voluntary fees from farm organisations such as cooperatives, compulsory fees levied in the form of taxes on a variety of products or land taxes collected by Chambers of Agriculture). The British system promotes direct payment by users without privatization of extension services. The public agency responsible for research and extension, the Agricultural Development and Advisory Service, is responsible for such tasks and relies on government employees to carry out the work (Van den Ban, 2000).

Under the Dutch system, the transfer of responsibility and funding from the public to the private sector has been limited to about half of the extension staff, with the remaining half still budgeted and managed by the Ministry of Agriculture. Van den Ban and Hawkins (1996) suggested different ways in which farmers can contribute to the cost of services under privatised extension services to include: (a) They can pay a fee for each visit an extension agent makes to their farm, which is, also, the way consulting firms are paid in many other branches of industry; (b) A levy can be charged on certain agricultural products from which agricultural research and extension are financed; (c) Costs can be met from membership fees paid to farmers' association; and (d) The extension service can receive a specific portion of the extra income a farmer earns as a result of advice given by the extension agent. Experiences of different countries with regard to privatization of extension services are presented in Table 1.

*Table 1 :* Features of privatization and commercialization of agricultural extension services in selected countries

| Country | Features |
|---|---|
| Britain | The Agricultural Development and Advisory Service of the Ministry of Agriculture and Food charges fees for services of direct benefit to the clients |
| Norway | While the government pays salary, the farmers' circle pays the operational fees (as 50:50 cost sharing agreement). |
| Mexico | Attempting to shift at least half the cost of extension services to farmers' groups in irrigated areas. It is emphasizing cost cutting through privatization |
| Korea and Taiwan | The cooperative (government farmer associations or farmer arrangement) structure of extension has been developed in these far eastern countries |
| Chile | The government provides funds (maximum of 80% of total cost of project) to private technology transfer consultancy firms |
| New Zealand | Private consultants play an important role in agriculture in this industrialized country |
| Canada | Commodity groups fund and control their own extension agronomists. |
| Turkey | Extension cost is shared between farmer groups and the Government through the chambers of Agriculture |
| Colombia | Municipalities pay for all extension services out of local tax revenue. |
| China | Farmers' associations contract technical services from public officials who receive bonuses from the clients |
| Ecuador | Farmers provide labour, land and water, the extension agent provides technical advice and inputs in exchange for a share in the harvest |
| Costa Rica | The government allocates a certain budget to support several basic extension services by private extension staff. |

| | |
|---|---|
| Sri Lanka | A platform for the identification, organisation, financing and quality control of farmer-driven service delivery |
| Kenya | The contracting private firms provide extension advice to the contracted farmers |

*Source : Hassan, S. (2004) Agricultural Extension Privatization: An analysis of Different financing schemes. PP. 932-940*

The most striking feature in the new forms of financial support for extension is the trend to mixed sources of funding, reflecting strategies to gain access to additional sources of funding. In several developing countries, public/private extension coordination is already established. Alternative patterns indicate a fostering of private corporate initiative, encouraging cooperative ventures by farmers, coordinating public-private extension service, and privatising the public system (Wilson, 1991). The need for improved and expanded extension activities, together with a strengthening philosophical view of less government involvement in national economies has led to a number of strategies for changing the way extension services are delivered.

Rivera and Cary (1997) identified extension privatization strategies that have been practiced to include:

(1) *Revitalization:* which involves alterations in structure and programmes as in the United States of America
(2) *Commercialization:* which involves a public agency operating user-pay advisory service as in New Zealand?
(3) *Cost Recovery:* which entails paying a fee for advise which formerly was free of charge as in Mexico and England;
(4) *Voucher Systems:* in which public extension delivery systems have been replaced by vouchers distributed by government services for farmers to use in hiring private extension consultants (as in Chile). Coupons attached to agricultural bank loans, committing a certain percentage of the loan for extension services, have been used in Colombia;
(5) *Gradual privatization:* in which public extension personnel with initial government financial support are transferred to farmer associations. In 1990, the Netherlands utilized the gradual privatization strategy to privatise approximately one-half of its public extension by transferring field extension personnel with initial government financial support to the farmer associations (Le Gouis, 1991). The elements of the extension service responsible for linking research and the privatized extension services, policy preparation, implementation, and promotion and regulatory tasks remained under the aegis of the Ministry of Agriculture. The "privatized" extension service is governed by a board on which farmers' organisations and the government is equally represented (Proost and Roling, 1991).

Other forms of privatization arrangements included: the use of private sector companies, consulting boards funded by the dairy Other forms of privatization arrangements included: the use of private sector companies, consulting boards and non-governmental organizations. For instance, while in France the Chambers of Agriculture and private sector companies provide extension services, the dairy consindustry deliver extension services to the dairy industry in New Zealand. In other cases, non-governmental organizations have been used to supplement public sector extension services, especially in the area of rural development (Amanor and Farrington, 1991). This arrangement has certain advantages for increasing extension coverage and encouraging farmer participation in technology systems, but it also has certain limitation

Rivera and Cary (1997) observed that where the public sector provides extension, the alternative funding arrangements include:

1. General tax-based public funding for agriculture, including funding of agricultural extension services, that is, the traditional public sector mode of funding extension;
2. Commodity tax-based public funding (through cess or parafiscal tax) for example on agricultural commodity such as cocoa or oil palm;
3. Fee-based public funding, in which fees are charged, usually to large farmers for extension services, and
4. Contract-based commercialization of public services, whereby contract-based arrangements are made between farmers and public sector extension services.

Where the private sector provides extension, the alternative funding arrangements include:

1. Government revenue-based vouchers, provided to farmers who then contract private sector agents for extension information provision;
2. Public credit revenue-based coupon schemes attached to agriculture loans, obligating the farmer-borrower to use a percentage of the loan for extension advising purposes;
3. Membership and fee-based, including commodity tax-based funding, whereby farmers pay membership and service fees, and the private organisation (e.g, chamber of agriculture) also receives funds through a public cess or Para fiscal tax charged on agricultural commodities, which funds are then transferred to the private sector organisation; the private sector then provides the extension services-although public sector officials generally sit on the chamber's governing board;

4. Membership fee plus commercial sponsorship by groups of input suppliers, where farmer groups are provided non advisory, educational extension services by a consortium of privately employed consultants with partial financial support from rural sector commercial sponsors-such groups can operate on a large scale, with coordinated extension objectives; and
5. Privatization, whereby provision and, eventually agent salary payments are shifted to a farmers' association or other private entity.

Commercialization of agricultural extension service (CAES) can be viewed from three main perspectives. First, agricultural extension is considered as a commercial product or service, which is exchanged between two parties over required payment. Simply, one party (the extension service providers) acts as sellers and the other party (farmers) acts as buyers. Secondly, it is applied basic economic theory of supply and demand. In this process, agricultural extension service becomes totally a demand-oriented activity. Third, extension service can also be considered as an input such as fertilizer, improved seeds, agro-chemicals, machinery, amongst others which is essential for the commercially oriented farming. As farmers have to pay for other inputs, they have to pay for extension service also.

P and C of agricultural extension services are influenced by several factors. It is therefore imperative that governments and other stakeholders in extension service delivery become aware of these factors which are crucial in deciding about P and C programmes. It is inview of this fact, that this study was conceived to examine the various factors that pose as challenge to effective P and C programme in agricultural extension.

## III. Methodology

The study was carried out in Delta State, Nigeria. Extension professionals of the Delta State Agricultural Development Programme (DTADP) formed the population from which sample was drawn. Extension professionals of the DTADP is composed of 150 extension agents (EAs), 25 block extension agents (BEAs), 25 block extension supervisors (BESs), 12 subject matter specialists (SMSs), 3 zonal extension officers (ZEOs); 3 zonal managers; 10 directors of sub-programmers; 29 heads of component programmes and 1 programme manager (PM). For the purpose of the study, the PM, ZEOs and ZMs were purposively selected because they were few in number. For the others, 50% proportionate random sample was drawn. This sampling procedure gave rise to a total of 134 extension professionals that were used for the study as shown in Table 2.

*Table 2 :* Population and sample composition

| Category of extension professionals | Total no. | No. sampled |
|---|---|---|
| Programme manager (PM) | 1 | 1 |
| Extension agents (EAs) | 150 | 75 |
| Block extension agents (BEAs) | 25 | 13 |
| Block extension supervisors (BESs) | 25 | 13 |
| Subject matter specialists (SMSs) | 12 | 6 |
| Zonal extension officers (ZEOs) | 3 | 3 |
| Zonal managers (ZMs) | 3 | 3 |
| Directors of sub-programmes (DSPs) | 10 | 5 |
| Heads of component programmes (HCPs) | 29 | 15 |
| **Total** | **258** | **134** |

Data for the study were collected through the use of validated questionnaire. Content validation of the research instrument was done by team of experts in agricultural extension. Trained assistants in addition to the researcher collected the data for the study. A pilot test was conducted as part of instrument validation and to test for reliability of instrument. To obtain a quantitative measure of factors that are associated with the P and C of agricultural extension service, a list of 21 constraints was drawn through a review of literature. Responses to the level of importance of these constraints were measured on a 4-point Likert- type scale with values of very important=4; important=3; barely important=2; and not important=1. These responses were then factor analyzed using the principal model with iteration and varimax rotation to ascertain important factors. Variables with coefficient of 0.40 or more were regarded to have high loading.

## IV. Results and Discussion

*a) Factors associated with P and C of agricultural extension services*

Data in Table 3 show the factor analysis of constraints to privatization and commercialization of agricultural extension services. Based on the item loadings, factor 1 was named "unfavourable economic environment. Factor 2 was named "misgivings about

private agencies", while factor 3 was named "government administrative and policy inadequacies". Specific issues highlighting "unfavourable economic environment" as a factor in the implementation of P and C of agricultural extension services include: reluctance on the part of farmers to pay for extension services (0.58), farmers' poor economic background (0.53), difficulty in attaching monetary value to extension services (0.67), unequal access to farm resources (0.65), exploitation by extension service providers (0.58), and corruption and nepotism among extension staff (0.63).

These constraints are critical to the effective implementation of P and C programme. For instance, poor economic background of the farmers stemmed from the fact that majority of them are engaged in subsistence farming using crude implements with low capital outlay and low yielding species of crops and animals which usually results in low income. Similarly, the difficulty in attaching monetary value to extension services has been identified as a crucial factor in P and C. According to Rivera and Cary (1997), the most obvious shortcoming in extension P and C may be the difficulty of collecting user fees and establishing cost-accounting procedures to set charges at appropriate levels.

Specific issues which amplify "misgivings about private agencies" as a factor in the implementation of P and C of agricultural extension services include: fear of job insecurity (0.75), irresponsiveness of extension service providers to clients' needs (0.44), tendency to focus more attention on large-scale farmers thereby neglecting the small-scale farmers (0.65) and poor capacity building of extension staff (0.42). Restructuring in privatized and commercialized enterprises usually brings about the fear of layoffs and job losses among the staff. Similarly, the need to make profit and remain in business may force private extension service providers to focus more attention on the large-scale farmers who are likely to have the resources needed to pay for services. Furthermore, client needs which are not likely to yield profit may be excluded from the services to be provided.

Specific issues highlighting "government administrative and policy inadequacies" as a factor in P and C of agricultural extension services include: administrative and bureaucratic bottlenecks in policy implementation (0.59), political instability (0.60), unfavorable government policies on P and C (0.43), poor linkages between research and extension (0.63), inadequate government legislation to backup P and C programmed (0.64), inadequate government guarantees, regulations and control over extension service providers' excesses and abuses (0.63), and lack of ready market to sell increased farm output as a result of improved extension services (0.60). Delays in bureaucratic procedures usually slow progress in the implementation of government programmes. This is partly derived from the non-preparation of the government for many of the difficulties encountered in programme implementation (Odii, 2001).

According to Obadan and Ayodele (1998), one of the crucial components of P and C programme is the creation of an appropriate regulatory framework that would promote contestable markets and protect public interest. An effective and efficient regulatory framework, in the form of rules, regulations, guarantees or policies including competitive policy or mechanism for monitoring and enforcing compliance with the rules or policies ensures that the owners of privatized enterprises do not trample upon the rights of workers and clients. Furthermore, there is also the need for any P and C programme in agricultural extension to include a guarantee for ready markets to sell farm outputs. This will help build the confidence of farmers in the programme.

*Table 3 :* Analysis of factors associated with and C of agricultural extension services

| S/N. | Constraints | Factor 1 Unfavourable economic environment | Factor 2 Misgivings about private agencies | Factor 3 Govt. administrative and policy inadequacies |
|---|---|---|---|---|
| 1. | Fear of job insecurity among extension staff | - 0.21 | **0.75** | 0.10 |
| 2. | Lack of farmers' interest in extension programmes | 0.31 | - 1.72E – 02 | 0.27 |
| 3. | High risk and uncertainty in agriculture | 0.17 | 0.29 | 0.27 |
| 4. | Insufficiently trained extension personnel | 0.58 | 4.17 | 0.20 |
| 5. | Reluctance on the part of farmers to pay for extension services | **0.58** | 5.95E – 02 | 0.34 |
| 6. | Administrative and bureaucratic bottlenecks in policy implementation | 0.27 | 0.16 | **0.59** |

| | | | | |
|---|---|---|---|---|
| 7. | Farmers' poor economic background | **0.53** | 6.67E – 02 | 0.01 |
| 8. | Difficulty in attaching monetary value to extension services | **0.67** | 1.65E – 02 | 5.30E – 02 |
| 9. | High level of subsistence farming | - 1.12E – 02 | 0.55 | 0.43 |
| 10. | Political instability | 9.57E – 02 | 5.75E – 02 | **0.60** |
| 11. | Unequal access to farm resources | **0.65** | 0.29 | - 3.32E – 02 |
| 12. | Exploitation by extension service providers | **0.58** | 2.73 | 8.90E – 02 |
| 13. | Unfavourable govt. policies on privatization and commercialization | 7.53E – 02 | 0.35 | **0.43** |
| 14. | Irresponsiveness of extension service providers to clients' needs | - 8.50E – 02 | **0.44** | 0.30 |
| 15. | Poor linkages between research and extension | - 0.30 | 0.20 | **0.63** |
| 16. | Inadequate govt. legislation to backup privatization and commercialization programme | 8.47E – 03 | 0.38 | **0.64** |
| 17. | Inadequate govt. guarantees, regulations and control over extension service providers' excesses and abuses | 1.94E – 02 | 0.31 | **0.63** |
| 18. | Tendency to focus more attention on large-scale farmers thereby neglecting the small-scale farmers | 0.21 | **0.65** | 6.65E – 02 |
| 19. | Corruption and nepotism among extension staff | **0.63** | 0.16 | 8.57E – 02 |
| 20. | Poor capacity building of extension staff | 0.35 | **0.42** | - 7.27E – 02 |
| 21. | Lack of ready market to sell increased output as a result of improved extension services | 0.25 | - 4.44E – 02 | **0.60** |

## V. Conclusion

The need for improved and expanded extension activities together with a strengthening philosophical view of less government involvement in national economies has led to the recent emphasis on P and C of agricultural extension services worldwide. P and C do not aim at substituting private sector for public extension services. They essentially aim at a reduction in the role of public sector and an increased role of private initiatives in agricultural extension. Presently, there are different forms of public/private extension coordination in several countries.

Many factors are known to pose as challenge to effective operation of P and C of agricultural extension services. This study identified three main factors that are associated with P and C to include: unfavourable economic environment, misgivings about private agencies and government administrative and policy inadequacies. Specific issues highlighting each of these factors were also identified. These factors are critical to the success of any P and C programme in agricultural extension. The study therefore recommends that adequate attention should be given to these factors before embarking on any form of P and C arrangement.

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# Analysis of Relevance of Agricultural Extension Services on Crop Production in Irepodun Local Government Area of Kwara State, Nigeria

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*Abstract -* The study examined the relevance of agricultural extension services on crop production in Irepodun Local Government Area of Kwara state. Nigeria. Data were collected by using structured interview schedule admistered on, 112 farmers' sampled for the study. Descriptive statistics such as frequency counts, percentages were used for the analysis and T test was used to test the stated hypothesis. Results show that (77.7%) of the respondents were between the age category of 31-50years, while 74.1% were male, 58.9% had no formal education while 40.2% had low level of education. Almost all the respondents were visited by village extension agents while 61.6% of the respondent cultivated farm size of between 1 to 5 hectares, and 73.2% cultivated maize, 70.5% cultivated yam, 67.9% cassava. Respondents indicated relevance of agricultural practices introduced by extension agents. Findings also show that there was no significant difference in land use before and after extension services, but there was significant different in crops yield. There is need for motivation of extension agent through adequate provision of field operation facilities in order to encourage their commitment and dedication to duty.

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# Analysis of Relevance of Agricultural Extension Services on Crop Production in Irepodun Local Government Area of Kwara State, Nigeria

Ayanwuyi, E.[α], Adeola, R. G [σ] & Oyetoro, J. O.[ρ]

*Abstract* - The study examined the relevance of agricultural extension services on crop production in Irepodun Local Government Area of Kwara state. Nigeria. Data were collected by using structured interview schedule admistered on, 112 farmers' sampled for the study. Descriptive statistics such as frequency counts, percentages were used for the analysis and T test was used to test the stated hypothesis. Results show that (77.7%) of the respondents were between the age category of 31-50years, while 74.1% were male, 58.9% had no formal education while 40.2% had low level of education. Almost all the respondents were visited by village extension agents while 61.6% of the respondent cultivated farm size of between 1 to 5 hectares, and 73.2% cultivated maize, 70.5% cultivated yam, 67.9% cassava. Respondents indicated relevance of agricultural practices introduced by extension agents. Findings also show that there was no significant difference in land use before and after extension services, but there was significant different in crops yield. There is need for motivation of extension agent through adequate provision of field operation facilities in order to encourage their commitment and dedication to duty.

## I. Introduction

To improve the agricultural production, some forms of appropriate technologies were necessary. Appropriate technologies (agricultural practices) in this context are defined as the latest scientific and technological developments that have been adjusted to suit the local conditions to the highest possible degree, (FAO, 1996, Oladele and Fawole, 2007). In this regard, farmer involvement in technology development has generated a lot of models through several studies (Byerlee et al, 1989). Technologies has defined as all the methods of production which has been developed in the basis of existing state of scientific knowledge (Roy, 1990, Oladele and Fawole, 2007).The last twenty years have witness great investment in agricultural research and development of new technologies in Nigeria. The national and international research centers have reported significant yield increase in many crops; insects' pest and disease that cause damage to plants, animal and crops have been brought under substantial control. In Nigeria, the extension services system is the most important public service institution with the widest range of responsibilities for agricultural and rural development (Oladele and Fawole, 2007). Agricultural extension workers serve as conduct pipes between research institutes and farmers through the transmission of improved technique of farming that will enable farmers' to increase their productivity in order to meet the increasing food need of the teaming population (Ekpere, 1995). The extension service being the bridging link between the research centers and the farm families, convince farmers through the use of educational methods to accept scientific findings and technological development that are relevant to improve their methods of agricultural practices (Leagen, 2002).

The responsibilities of extension services include transferring problems from the farm and rural home to research centers for solutions. Thus agricultural extension services aims at changing the rural people and train them to make independent decisions and make use of available local resource (Maunder, 2002). It is obvious that continued dissemination of research result to farmers is of utmost important for increasing the present level of agricultural productivity, when farmers are exposed to more and more research findings the better they will be able to improve their yields per acre of land cultivated (ogunfiditimi, 1999). There is an increasing in awareness on the impact of agricultural extesnsion services in the developmental process in relation to food crop production, through voluntary educational programme that serve as a teaching and learning techniques to disseminate useful agricultural information to the farmers in order to influence their knowledge, skills and attitude that assists them in using the technical knowledge gain to solve their own problem (Maunder 2002). Although extension workers need to mastered cultural differences which varies from one locality to another before implementation of any programme which should be based on the need and interest of the people which are closely related to improving their livelihood through increasing farm production and their physical environment (Leagen, 2002).

Agricultural extension services has been identified to be relevant in rapid increase in agricultural production that aims to involve a shift from traditional resources based method to science based method which involves varieties of new cultural practices like use

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of fertilizer, organic manure, pesticides and capital investment inputs which farmers must learn how to use through the education role of extension workers (William, 1999).Specifically the study ; described socio-economic characteristics of the respondents, examine the relevance of farming practices introduced by extension agents to farmers', examine the size of land cultivated before and after the advent of extension agents and examine the crop yield before and after the advent of extension agents. It was hypothesized that there was no significant difference in land cultivated before and after extension services, also there was no significant difference in crop yield before and after extension services.

## II. Methodology

The study was carried out in Irepodun Local Government Area of Kwara State, Nigeria. Multistage Sampling technique was used for the study. The area made up of two extension blocks in which each block made up of eight extension cells. Respondents were randomly selected from four extension cells selected from each extension block, making eight extension cells (Ajase, Oko, Isin, Esie, Arandun, Idofin, Olla and Ekan-Moje) selected for the study. These cells were selected due to farming activities that is the main occupation of the people. Purposive sampling techniques was used to select two communities from each extension cells due to their rural base, making a total of 16 communities selected for the study and seven respondents were randomly selected from each community selected. Thus giving a total of 112 respondents which constitute sample size for the study, a structure interview schedule was used to obtained data from the selected respondents. Both descriptive and inferential statistics was used to analyze the data. The descriptive statistics used include frequency counts and percentages while the inferential statistics employed was T-test.

## II. Results and Discussion

*a) Socio-Economic Profiles of Sampled Respondents*

Table 1revealed that 77.7% of the respondents were between the age group of 31 to 50 years, 12.5% were above 51 years, while 9.8% were below 30years. This implies that majority of the respondents were at their active working age. About 74.1% of the respondents were male and 25.9% were female while 59.8% had no formal education while 40.2% were educated. This implies that below average of the respondents had low level of education .Further in table 1 majority(87.5%) of the respondents had more than 10years as years of farming experience and 95.5% o were visited by village extension agents, 61.6% cultivated farm size of between 1-5 hectares. This implies that extension agents have made its impact in reaching most of the respondents. This findings conform with (Oladosu, 2004) extension services system is the most important public service institution with the widest range of responsibilities for agriculture and rural development

*b) Crops Cultivated*

Results in Table 2 shows that 73.2% of the respondents cultivated maize, 70.5% cultivated yam, 67.9% cultivated cassava, while 40.2%, 32.1% and 21.4% cultivated cowpea vegetables and cocoyam respectively. This agrees with Youdeower and Akinwumi (1999) Edeogbon et al (2008) who stated that most farmers cultivated arable crops in Nigeria.

*c) Relevance of Practices Introduced by Extension Agents*

Table 3 shows that all the respondents indicated the relevance of the practices. Majority (91.1%) of the respondents indicated that improved crop varieties is relevant to them, 87.5% indicated methods of planting as relevant, 85.7% indicated using of agriculture chemicals as relevant, while 81.3% indicated using of machinery and equipment as relevant. Further in the table 77.7% indicated attending of exhibition, workshop ,seminar and methods of crops processing as relevant to them in their farming activities, also 75.9% indicated using of organic manure as relevant, 69.6% indicated using of fertilizer as relevant 69.6% and 67.9% indicated methods of harvesting and methods of crops storage as relevant. These results were in agreement with the findings of Oladele and Fawole (2007) who reported that farmers perceived the relevance of agricultural technologies as the potential to affect the eventual adoption of technologies.

*d) Crops Yield Before and After Extension Services*

Results in table 4revealed that 69.6% (tone) of the respondents indicated 0.05-1.0(tones) as their crop yield for maize before extension service, 66.1% indicated 0.25-1.25(tones) as their crop yield for cassava before extension service while 52.7% indicated 0.1-1.0(tones) as their crop yield for yam before extension service. Furthermore, table 4 shows that 82.1.% indicated 0.1-3.0 (tones) as their crop yield for cassava after extension service, 76.8% of the respondents' indicated 0.1-1.05( tones) as their crop yield for maize after extension service, while 61.6% indicated 0.2-1.5(tones) as their crop yield for yam after extension service. This implies that extension service was relevant to crop production in the study area because there are differences in their crop yield before and after extension services. This agree with William, (1999) who reported that agricultural extension services has been identified to be relevant in rapid increase in agricultural production.

*e) Hypotheses Testing*

T-test results shows that there was no significant difference in the land use before and after

extension services. This finding agrees with that of Omoham (1996) Edeoghon et al (2008) who reported that small farm holdings constitute most of the farming activities in Nigeria. However there was significant difference in crop yield before and after extension services. This is because the agricultural practices introduced by extension agents assisted the farmers to increase their crop production. These results are in agreement with the findings of Akinbile and Odebode (2002) who reported that farmers in Osun State are aware of these agricultural practices introduced by extension agents.

*f) Conclusion and Recommendations*

From the result of the study it was observed that agricultural practices introduced to farmers by extension agents are relevant to their farming activities. It was also discovered that there was no significant difference in land use and there was significant difference in crop yield before and after the advent of extension agents in the study areas. Based on these findings, the following recommendations are proposed: Village extension agents need to be motivated through provision of field operation facilities and better enumeration in order to encourage their commitment and dedication to duty .There should be high subsidy on farm inputs in order to motivate farmers to try and eventually adopt agricultural practices introduced to them and More extension workers need to be employed in order to reduce extension agents to farm families' ratio.

*Table 1 :* Distribution of respondents by socio- economic characteristics

| Characteristics | Frequency | Percentage |
|---|---|---|
| Age | | |
| <30 | 11 | 9.8 |
| 31-40 | 29 | 25.9 |
| 41-50 | 58 | 51.8 |
| 51 and above | 14 | 12.5 |
| Total | 112 | 100.0 |
| Sex | Frequency | Percentage |
| Male | 83 | 74.1 |
| Female | 29 | 25.9 |
| Total | 112 | 100.0 |
| Educational qualification | Frequency | Percentage |
| No formal education | 67 | 59.8 |
| Primary education | 25 | 22.3 |
| Secondary education | 15 | 13.4 |
| Tertiary education | 05 | 4.5 |
| Total | 112 | 100.0 |
| Farming experience (years) | Frequency | Percentage |
| <10 | 14 | 12.5 |
| 11-20 | 20 | 17.9 |
| 21-30 | 41 | 36.6 |
| 31 and Above | 37 | 33.0 |
| Total | 112 | 100.0 |
| Contact with extension agents | Frequency | Percentage |
| Everyday | 02 | 1.8 |
| Twice in a month | 88 | 78.8 |
| Not regular | 11 | 9.8 |
| No visit at all | 05 | 4.5 |
| Total | 112 | 100.0 |
| Farm size (hectare) | Frequency | Percentage |
| 1-5 | 69 | 61.6 |
| 6-10 | 26 | 23.2 |
| 10 and Above | 17 | 15.2 |
| Total | 112 | 100.0 |

*Source : Field Survey 2012*

*Table 2 :* Distribution of respondents by Crops Cultivated

| Crops | Frequency | Percentage |
|---|---|---|
| Yam | 79 | 70.5 |
| Cowpea | 45 | 40.2 |
| Cassava | 76 | 67.9 |
| Cocoyam | 24 | 21.4 |
| Maize | 82 | 73.2 |
| Vegetables | 36 | 32.1 |

*Source : Field Survey 2012*
*Multiple responses

*Table 3 :* Distribution of respondents by practices introduced by extension agents

| Practices | Relevant | Not relevant |
|---|---|---|
| Fertilizer application | 78(69.6) | 34(30.4) |
| Improved crops varieties | 102(91.1) | 06(5.4) |
| Using of machinery and equipment | 91(81.3) | 21(18.8) |
| Using of agricultural chemicals | 96(85.7) | 16(14.3) |
| Attending exhibition workshops and Seminar. | 87(77.7) | 25(22.3) |
| Methods of planting | 98(87.5) | 14(12.5) |
| Methods of harvesting | 78(69.6) | 34(30.4) |
| Methods of crops processing | 87(77.7) | 2(22.3) |
| Methods of crop storage | 76(67.9) | 6(32.1) |
| Using of organic manure | 85(75.9) | 27(24.1) |

*Source : Fielccd survey 2012*
*Multiple responses.

*Table 4 :* Distribution of respondents by crops yield before and after

| Crops* | Yield(tonnes) | Frequency | percentage |
|---|---|---|---|
| Maize | 0.05-1.0 | 78 | 69.6 |
| Cocoyam | 0.03-0.6 | 41 | 36.6 |
| Yam | 0.1-1.0 | 59 | 52.7 |
| Cowpea | 0.05-0.25 | 32 | 28.6 |
| Cassava | 0.25-1.25 | 74 | 66.1 |
| Vegetables | 0.001-0.003 | 29 | 26.0 |
| Crops yield after | Extension service | | |
| Crops* | Yield(tonnes) | Frequency | percentages |
| Maize | 0.1-1.05 | 86 | 76.8 |
| Cocoyam | 0.04-0.13 | 43 | 38.4 |
| Yam | 0.2-1.5 | 69 | 61.6 |
| Cowpea | 0.3-0.75 | 35 | 31.3 |
| Cassava | 0.1-3.0 | 92 | 82.1 |
| Vegetables | 0.004-0.006 | 33 | 29.5. |

*Source : Field survey 2012*
*Multiple responses

*Table 5 :* T-test result shows different between land use before and after extension services

| Advent of extension agents | land difference in mean | | Degree of freedom | Standard Deviation | T |
|---|---|---|---|---|---|
| Before | yam | 3.345 | 48 | 3.397 | -5.743* |
| After | yam | | | | |
| Before | cowpea | 2.413 | 48 | 3.958 | -5.197* |
| After | cowpea | | | | |
| Before | cassava | 4.561 | 48 | 4.100 | -6.142* |
| After | cassava | | | | |
| Before | maize | 1.215 | 48 | 6.533 | -2.018* |
| After | maize | | | | |
| Before | cocoyam | -6.17E-03 | 48 | 3.561 | -0.142 |
| After | cocoyam | | | | |
| Before | vegetable | 3.291 | 48 | 3.762 | -4.562* |
| After | vegetable | | | | |

*Source: Data analysis 2012*
*Significant at (P<0.05)

*Table 6 :* T-test result shows difference between crop yield before and after extension services

| Advent of Extension Agent | Crops yield | Difference in mean | Degree of freedom | Standard Deviation | T |
|---|---|---|---|---|---|
| Before | yam | -1.728 | 48 | 5.194 | 2.732* |
| After | yam | | | | |
| Before | cowpea | 3.951 | 48 | 1.724 | 2.17* |
| After | cowpea | | | | |
| Before | cassava | 4.518 | 48 | 1.354 | 2.883* |
| After | cassava | | | | |
| Before | maize | 8.210 | 48 | 1.232 | 4.916* |
| After | maize | | | | |
| Before | cocoyam | 1.975 | 48 | 1.811 | 0.949 |
| After | cocoyam | | | | |
| Before | vegetable | 5.240 | 48 | 1.205 | 3.461* |
| After | vegetable | | | | |

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- The members can publish paper once. The paper will be sent to two-peer reviewer. The paper will be published after the acceptance of peer reviewers and Editorial Board.

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The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

**(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.**

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Page Size: 8.27" X 11'"

- Left Margin: 0.65
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- Font type of all text should be Swis 721 Lt BT.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, "Abstract" word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be three lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

**You can use your own standard format also.**
**Author Guidelines:**

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

**1. GENERAL**

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

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Complete support for both authors and co-author is provided.

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Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

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Research letters: The letters are small and concise comments on previously published matters.

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The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

**Papers**: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

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(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

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Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

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- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

*Acknowledgements: Please make these as concise as possible.*

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

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**3. Think Like Evaluators:** If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

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**5. Ask your Guides:** If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

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**17. Never use online paper:** If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

**18. Pick a good study spot:** To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

**19. Know what you know:** Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

**20. Use good quality grammar:** Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

**21. Arrangement of information:** Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

**22. Never start in last minute:** Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

**23. Multitasking in research is not good:** Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

**24. Never copy others' work:** Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

**25. Take proper rest and food:** No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

**26. Go for seminars:** Attend seminars if the topic is relevant to your research area. Utilize all your resources.

**27. Refresh your mind after intervals:** Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

**28. Make colleagues:** Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

**29. Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

**30. Think and then print:** When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

**31. Adding unnecessary information:** Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

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**33. Report concluded results:** Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

**34. After conclusion:** Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

## Informal Guidelines of Research Paper Writing

**Key points to remember:**

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

**Final Points:**

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

**General style:**

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

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Mistakes to evade

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- Submitting a manuscript with pages out of sequence

In every sections of your document

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· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

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**Title Page:**

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

**Abstract:**

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

**Introduction:**

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.



- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

**Procedures (Methods and Materials):**

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

**Results:**

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
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- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
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| ***Result*** | Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake | Complete and embarrassed text, difficult to comprehend | Irregular format with wrong facts and figures |
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