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Economic Evaluation and Risk Analysis of Integrated Pest Management (IPM) in Cotton Production in Sindh Pakistan

By Sanaullah Noonari, Ms.Irfana Noor Memon, Ghulam Yasin Kalwar, Maria Pathan, Aamir Ali Marani, Zarmina Memon, Riaz Hussain Jamali & Amber Pathan

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Abstract- Cotton is the important cash crop of Pakistan and a major source of foreign earnings. However cotton crop is facing many problems, such as disease and pest attacks. One way to reduce losses caused by disease and pest attack is the use integrated pest management (IPM) practices. Keeping in view the importance of this technique, the present study analyzed the adoption of IPM along with estimation of risk involved in the adoption process. To estimate the cotton yield, two types of production functions (one for adopter and other for non-adopters) were estimated using the regression analysis. Then estimate of regression models was used further in risk analysis. The results of non-adopters of IPM showed that cost of urea bags, cost of nitro-phosphate bags, cost of herbicide and rainfall were -0.038, 0.00475, 0.301 and 0.164 respectively and all of these significant at 10 percent level.

Keywords: cotton, IPM, herbicide, evaluation, risk, coefficient, hyderabad.

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Economic Evaluation and Risk Analysis of Integrated Pest Management (IPM) in Cotton Production in Sindh Pakistan

Sanaullah Noonari [α], Ms.Irfana Noor Memon [σ], Ghulam Yasin Kalwar [ρ], Maria Pathan [ω], Aamir Ali Marani [¥], Zarmina Memon [§], Riaz Hussain Jamali [χ] & Amber Pathan [ν]

Abstract- Cotton is the important cash crop of Pakistan and a major source of foreign earnings. However cotton crop is facing many problems, such as disease and pest attacks. One way to reduce losses caused by disease and pest attack is the use integrated pest management (IPM) practices. Keeping in view the importance of this technique, the present study analyzed the adoption of IPM along with estimation of risk involved in the adoption process. To estimate the cotton yield, two types of production functions (one for adopter and other for non-adopters) were estimated using the regression analysis. Then estimate of regression models was used further in risk analysis. The results of non-adopters of IPM showed that cost of urea bags, cost of nitro-phosphate bags, cost of herbicide and rainfall were -0.038, 0.00475, 0.301 and 0.164 respectively and all of these significant at 10 percent level. For non-adopters of IPM the coefficient values of seed expenditure, temperature, humidity and spray cost were 0.0035, 0.026,-.0.00093 and 0.00027 respectively. The results of IPM adopters showed that coefficient of temperature, seed expenditure, spray cost, urea cost and rainfall equal to 0.0305,0.100,0.0029,-.000213 and 0.894 respectively and significant at ten percent level. Coefficient values of cost of nitro-phosphate bags, herbicide cost, humidity were 0.00035, 0.100.-0.000671 and -0.000445 respectively.

Keywords: cotton, IPM, herbicide, evaluation, risk, coefficient, hyderabad.

I. Introduction

Economy of Pakistan is semi-industrialized economy that includes agriculture, textile, chemicals, food processing and other industries. However, agriculture is the backbone of Pakistan's economy. It currently contributes 21.4 percent to GDP. Agriculture generates productive employment opportunities for 45 percent of the country's labor force and 60 percent of the rural population depends upon this sector for its livelihood. It has a vital role in ensuring food security, generating overall economic growth, reducing poverty and the transforming towards industrialization. Accelerated public investments are needed to facilitate agricultural growth through high yielding varieties with resistance to biotic and antibiotic stresses, environment-friendly production technologies and availability of reasonably priced inputs in time, dissemination of information, improved infrastructure and markets and education in basic health care. The use of high yielding varieties, irrigation, fertilizers and pesticides has increased crop productivity five-fold in the past five decades. However, growth has been leveling off in the past two decades. Land and water resources are diminishing there is no option but to increase crop productivity per unit area. There is a need to examine how appreciation of scientific tools to raise biological productivity without ecological costs. Some productivity increase can be achieved through the application of modern biotechnology tools in integrated gene management, integrated pest management and efficient post-harvest management. Biotechnology in agriculture and medicine can be a powerful tool to alleviate poverty and improve the livelihoods of the rural poor (GOP, 2014).

To reduce this loss in cotton, farmers use huge amount of pesticides on this crop. About 54% of total pesticides are used only on cotton, leading to higher cost of its production and deterioration in its quality. In addition to this, less expenditure on pesticide would definitely reduce the cost of production. There is great biotic pressure on cotton crop and greatest threat is from insect and pests. Cotton crop is attacked by many insects/pest and mites. It is estimated that about 20-40% loss is occurring annually due to different pests of cotton. This has resulted in increased use of pesticides. These include development of resistance to pesticides by major insect pests, environmental pollution and problems of health hazards and residues in food chain (Mallah *et al.* 2007).

Cotton contributes 29.8 per cent of the Indian agricultural gross domestic product. World's largest cotton cultivation area 9.42 million hectares (25%) is in India, however, India ranks third (18%) in total cotton production in the world. Hybrid cotton occupied about 70 per cent of total cotton area, which is a significant milestone in Indian cotton scenario. Cotton is cultivated in three distinct agro-ecological regions viz., North, Central and South. Out of total, 21 per cent area is under cultivation in North zone which is 100 per cent irrigated and contributes 25 per cent of the production.

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The central zone is predominantly rained and occupies more than 56 per cent of the total area but contributing less than 50 per cent of the total production and hybrid cultivation is dominant in this zone (Khadi, 2005).

Integrated Pest Management (IPM) is a common-sense method that builds on practices that farmers have used for centuries, for example, using varieties resistant to pests, altering time of sowing and harvest, hoeing, removing crop residues and using botanical pesticides (e.g. name and tobacco extracts). The name, IPM, goes back at least to the 1960s, hi 1967, FAO defined IPM as 'a pest management system that, in the context of the associated environment and the population dynamics of the pest species. IPM utilizes all suitable techniques in compatible manner to maintain the pest population at levels below those causing economic; injury. It is seeks to reduce pest populations to economically manageable levels through a combination of cultural control (e.g. crop rotation, inter-cropping), physical controls (hand picking of pests, use of pheromones to trap pests), and less toxic chemical controls. On the other hand, it allows the use of chemical pesticides, even synthetic and toxic ones, when there is a need. IPM techniques are specific to the agro-ecological production conditions.

II. Objectives

a) To investigate the factors effecting the adoption of integrated pest management (IPM).
b) To estimate the cotton production by IPM-adopters and non-adopters.
c) To estimate the risk involved in cotton production for IPM adaptors and non- adopters.
d) To suggest policy recommendation for profitable cotton production.

III. Materials and Methods

The validity, reliability and precision of analytical tool yield scientific results if the study has been rigorously put to scientific methods. A very important and significant thing in conducting any study is to adopt a systematic and appropriate methods and procedures. Then statistical sampling techniques, data collection and application of suitable econometric technique for analyzing data were used. A good presentation of data and dissemination of results leads to successful completion of the study. Without making a right choice for data analysis the impact of study is merely a useless piece of work with no scientific values. The present study was conducted in the rural areas of the' district Hyderabad Sindh in order to measure impact of integrated pest management (IPM) on the cotton yield and the factors affecting the adoption of (IPM).

a) Socio Economic characteristic

Socio-economic characteristics determine the status of an individual. For the purpose of the present study, following indicators of socio-economic characteristics have been used.

b) Educational Status

Education considered as one of the most important factors Which effect the knowledge, attitude and prestige of an individual to accept the new technology such as integrated pest management (IPM) for cotton production. In the present study education means schooling years that have been spent in school or college for the acquisition of knowledge. It is assumed that farmers with higher education adopt new technology rapidly.

c) Farm Size

Farm size has an important effect on the crop production. Larger farm size reduces the variable cost of inputs as well as fixed cost, because of economies of scale.

d) Farming Experience

Farming experience has an importance in the crops production. Experienced farmers have more technical knowledge than non experienced farmers. Farming experience is playing on important role in making efficient use of resources.

e) Nature and source of data

For evaluating the specific objectives designed for the study, required primary data was collected from selected sample farmers by personal interview method with the help of pre-tested and structured schedule. The data collected from the farmers pertained to the agricultural year 2013-14, which include general characteristics of cultivation related to IPM and non-IPM farmers, general information, size of holdings, cropping pattern followed, inputs used, input prices, output obtained, opinions about extent of adoption of IPM practices and reasons for non adoption of IPM practices.

f) Analytical tools and techniques

For assessing quantitatively the objectives and hypothesis outlined for the present study, the following analytical tools and techniques were employed.

Tabular analysis

Functional analysis

The data collected were presented in tabular form to facilitate easy comparison. The technique of tabular presentation was employed for estimating the socio-economic characteristics of sample farmers such as age and education, size of land holding and costs and returns structure and comparison of IPM and non-IPM farmers. Absolute and percentage forms were used for tabulation of the collected data.

g) Functional analysis

i. *Production function analysis*

To study resource productivity in IPM and non-IPM farmers, a modified Cobb- Douglas type of production function was fitted. This was done with a view to determine the extent to which the important resources that have been quantified, explain the variability in the gross returns of the IPM and non-IPM farmers and to determine whether the resources were optimally used in these farmers category.

Heady and Dillon (1963) indicated that the Cobb-Douglas type of function has been the most popular of all possible algebraic forms in the farm firm analysis as it provides comparison, adequate fit, computational feasibility and sufficient degrees of freedom. They further indicated that Cobb-Douglas type of function has the greatest use in diagnostic analysis, reflecting the marginal productivities at mean levels of returns. The general form of the function is Y = axibi where, 'xi' is the variable resource measure, 'y' is the output, 'a' is a constant and 'bi' estimates the extent of relationship between xi and y and when xi is at different magnitudes. The 'b' coefficient also represents the elasticity of production in Cobb-Douglas production function analysis.

This type of function allows for either constant or increasing or decreasing returns to scale. It does not allow for total product curve embracing all the three phases simultaneously. Test was conducted to see if the sum of regression coefficients were significantly different from unity. Functions of the following form were fitted for IPM and non-IPM farmers separately.

$$Y = a\, x_1 b_1 .x_2 b_2 .x_3 b_3 \ldots\ldots\ldots\ldots\ldots x_n b_n$$

On linearization, it becomes

$$\log Y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + \ldots\ldots\ldots\ldots\ldots + b_n \log x_n$$

Production function employed for IPM and non-IPM farmers as a whole is given below.

$$\text{Log}\,(Y) = \log\,(a) + b_1 \log\,(x_1) + b_2 \log\,(x_2) + b_3 \log\,(x_3) + b_4 \log\,(x_4) + b_5 \log\,(x_5) + b_6 \log\,(x_6) + b_7 \log\,(x_7) + e_i$$

Where;

Y = Gross return in rupees/ha

a = Intercept

x_1 = Seed cost/ha

x_2 = Organic manure cost/ha

x_3 = Human labour cost/ha

x_4 = Bullock labour cost/ha

x_5 = Chemical fertilizers cost/ha

x_6 = IPM component/ Plant protection cost/ha

x_7 = Machine labour cost/ha

e_i = Error term

b_i = Elasticity's coefficient of respective inputs and summation of these gives returns to scale

h) Returns to scale

The returns to scale were estimated directly by getting the sum of 'bi' coefficients. The returns will be increasing, constant or diminishing based on whether value of summation of 'b_i' is greater, equal or less than unity, respectively.

i) Structural break in production relation

To identify the structural break, if any, in the production relations with the adoption of IPM technology in production, output elasticity's were estimated by ordinary least square method by fitting log linear regression was run in combination with the IPM and non-IPM farmers. The pooled regression was run in combination with IPM and non-IPM farmers including IPM farmers as dummy variables one for IPM and zero for non-IPM farmers.

The following log linear estimable forms of equations were used for examining the structural break in production relation.

$$\ln y_1 = \ln A_1 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + U_1 \quad \ldots\ldots\ldots \quad (1)$$

$$\ln y_2 = \ln A_2 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + U_i \quad \ldots\ldots\ldots \quad (2)$$

$$\ln y_3 = \ln A_3 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + e_3 d + U_1 \quad \ldots\ldots\ldots \quad (3)$$

Where,

Subscribes 1, 2 and 3 in above equation represent non-adopter, adopter and pooled regression function with IPM as dummy variables, respectively.

$$b_1, b_2, b_3, b_4, b_5, b_6, b_7\ b_1, b_2, b_3, b_4, b_5, b_6, b_7,\ b_1, b_2, b_3, b_4, b_5, b_6, b_7$$

Represent individual output elasticity of respective input variable in equation (1), (2) and (3) 'd' in equation (3) represent dummy variable. If the regression coefficient of dummy variables is significant, then there is structural break in production relations with the adoption of IPM technology.

j) Output decomposition model

For any production function, the total change in output is affected by the change in the factors of production and in the parameters that define the function. This total change in per hectare output is decomposed to reflect on adoption of IPM and the change in input levels. The output decomposition model

developed by Bisaliah (1977) is used in the study, which is depicted below.

$$\ln Y_{IPM} - \ln Y_{NIPM} = [\text{intercept}_{IPM} - \text{intercept}_{NIPM}] + [(b_1 - b_1) \times \ln X_1 \text{ NIPM} + \ldots\ldots\ldots\ldots + (b_7 - b_7) \times \ln X_7 \text{ NIPM}] + [(b_1 (\ln X_1 \text{ IPM} - \ln X_1 \text{ NIPM} + \ldots\ldots\ldots\ldots + (b_7 (\ln X_7 \text{ IPM} - \ln X_7 \text{ NIPM})] \ldots. \quad (5)$$

The decomposition equation (1) is approximately a measure of percentage change in output with the adoption of IPM in the production process. The first bracketed expression of the right hand side is the measure of percentage change in output due to shift in scale parameter (A) of the production function.

k) Concepts related to evaluation of IPM and non-IPM practices

i. *Variable costs*

The variable costs include cost of seed, organic manure, fertilizers, wages of human and bullock labour, plant protection components and interest on operational capital at the rate of 7 percent per annum.

ii. *Interest on working capital*

This was calculated on the entire working cost of the enterprise at the prevailing bank rate interest of 7 percent per annum.

iii. *Fixed costs*

These include depreciation on farm implements and machinery, interest on fixed capital and land revenue. The measurement and definitions of fixed cost components are as follows.

iv. *Interest on fixed capital*

Interest on fixed capital was calculated at 11 percent per annum, which is the prevailing rate of investment credit. The items considered under fixed capital are implements and machinery.

v. *Land revenue*

Actual land revenue paid by the farmers was considered.

vi. *Land rent*

The prevailing land rent for agricultural enterprises were imputed for the sample farmers, since all land holdings were observed to be owner operated.

vii. *Cost of cultivation*

It is the sum of variable costs and fixed costs expressed on per hectare basis.

a) Adopters/ Non-Adopters of IPM respondent

The output decomposition equation used in this study can be written as

l) Gross returns

Gross returns were obtained by multiplying the total product with its unit value.

m) Net returns

Net returns were obtained by deducting the total costs incurred from the gross returns obtained.

n) Benefit cost ratio

Benefit cost ratio was obtained by dividing the gross returns by total cost of cultivation.

IV. Results

The present study was conducted in District Hyderabad of Sindh. From District Hyderabad five UCs were selected as sample area, consisting of Hatri, Moosa Khatrian, Tando ajm, Tando Hyder and Tando Qaisr to estimate the cotton production, and analysis. Data was collected through questionnaire including general information of the IPM adopters / non-IPM adopters like the education of the respondent, total farm size of the respondent and Farming experience of the respondent .The effect of integrated pest management (IPM) technique on cotton production also determined by using the information of respondent Like Urea bags cost, nitro-phosphate bags cost, spray cost, herbicide cost, seed expenditure and temperature, rainfall, humidity level. After collection and analysis of data the following results were obtained.

In results and discussion of the study included the following:

- Percentages of some independent variables
- Analysis of qualitative variables (Logit Regression Analysis)
- Analysis of qualitative variables (Multiple Regression Analysis)
- Forecasting and Risk Analysis

Table 1 : Distributions of respondent according to adopters and non-adopters of Integrated pest management

Integrated Pest Management (IPM)	No. Respondent	Percentage
Non-Adopters	30	50.00
Adopters	30	50.00
Total	60	100.0

Table-1 shows about the study adopters and non-adopters of IPM techniques respondents were taken. In which the 50 percent respondents were non-adopters of IPM and 50 percent respondents were adopters of Integrated Pest Management (IPM) techniques.

b) Socio-economic and demographic characteristics of the farmers

Age, education, size of land holding and source of income are the socio-economic and demographic attributes of the farmers.

i. *Age*

Age is an important factor in determine the behaviors of human being. It indicates the ability to do work and attitude f person toward various social and economic aspect of life.

Table 2 : Distributions of respondent according to their age group in the study area

Age Group	IPM-Adopter		Non-IPM adopters	
	No. Respondent	Percentage	No. Respondent	Percentage
Up to 35	07	23.33	04	13.33
36 to 45	11	36.66	18	60.00
Above 45	12	40.00	08	26.66
Total	30	100.00	30	100.00

Table-2 depicts that 07 adopters and 04 non-adopters farmers belonged to age group up 35 years, while about one-third i.e.11 adopters and less than half i.e. 18 non-adopters farmers belonged to age group 36-45 years. About 12 adopters and 08 non-adopters farmers' belonged to age group above 45 years.

ii. *Education*

Education can be defined as the process of developing knowledge, wisdom and other desirable qualities of mind, character and general competency, epically by the source of formal instruction. It is generally admitted that without education it is pretty difficult to produce good results in very sphere of life. The understanding, inculcation and adoption of new innovation are impossible unless our farming community is educated.

Table 3 : Distributions of the farmers according to their education level

Education Level	IPM-Adopters		Non-IPM adopters	
	No. Respondent	Percentage	No. Respondent	Percentage
Illiterate	5	16.66	4	13.33
Primary-middle	15	50.00	12	40.00
Matric	8	26.66	10	33.33
Collage-University	2	6.66	4	13.33
Total	30	100.00	30	100.00

Table-3 reveals that slightly less than 05 farmers' adopters 04 farmers, non-adopters were illiterate, while about 15 farmer's adopters, 21 farmer's non-adopters were Primary-middle level of education. The 08 farmers' adopters, 10 farmer's non-adopters were matriculation. Only 02 farmers' adopters, 04 farmer's non-adopters were Collage-University education in the study area.

iii. *Family Sizes*

In human context, a family is a group of people affiliated by consanguinity, affinity, or co-residence. In most societies it is the principal institution for the socialization of children. Anthropologists most classify family organization as matriloca (a mother and her children); conjugal (a husband, his wife, and children; also called nuclear family).

Table 4 : Distribution of the farmers according to their family members

Family Members	IPM-Adopters		Non-IPM adopters	
	No. Respondent	Percentage	No. Respondent	Percentage
Below 5	13	43.33	06	20.00
5-8	11	36.66	14	46.66
Above-8	06	20.00	10	33.33
Total	30	100.00	30	100.00

Table-4 shows that 13 farmer's adopters, 06 farmers non-adopters had 5-6 family members, 11 farmers adopters, 14 farmers non-adopters had 7-8 family members, 06 farmers adopters, 10 farmers non-adopters had 9 and above family members in the selected area.

iv. *Marital Status*

Marital status is the condition of being married, unmarried, divorced or widowed. Marriage is a legal contract between people called spouses. In many cultures, marriage is formalized via a wedding ceremony. Widowed this category includes persons who have lost their legally-married spouse through death and who have not remarried. Divorced this category includes persons who have obtained a legal divorce and have not remarried. Single this category includes persons who have never married. It also includes persons whose marriage has been legally annulled who were single before the annulled marriage and who have not remarried.

Table 5 : Distributions of respondents according to marital status in the study area

Marital Status	IPM-Adopters		Non-IPM adopters	
	No. Respondent	Percentage	No. Respondent	Percentage
Single	9	30.00	10	33.33
Married	20	66.66	12	40.00
Divorced	0	0.00	1	3.33
Widow	1	3.33	2	6.66
Total	30	100.00	30	100.00

Table-5 shows that non-adopters there were 30.00% were single marital status, 66.66% were married marital status, and 3.33% were widow. 0.00% was divorced. While in case of non-adopters were 33.33% were single marital status,, 40.00% were married marital status, and 6.66%were widow. Only 3.33% were divorced.

v. *Family Type*

Joint family set-up, the workload is shared among the members, often unequally. The roles of women are often restricted to housewives and this usually involves cooking, cleaning, and organizing for the entire family. They are also responsible in teaching the younger children their mother tongue, manners, and etiquette. Extended family defines a family that extends beyond the nuclear family, consisting of grandparents, aunts, uncles, and cousins all living nearby or in the same household. An example is a married couple that lives with either the husband or the wife's parents. The family changes from nuclear household to extended household. A single-family detached home, also called a single-detached dwelling or separate house is a free-standing residential building.

Table 6 : Distribution of respondents according to family type in the study area

Family Type	IPM-Adopters		Non-IPM adopters	
	No. Respondent	Percentage	No. Respondent	Percentage
Joint	14	46.66	16	53.33
Extended	3	10.00	2	6.66
Single	13	43.33	12	40.00
Total	30	100.00	30	100.00

Table-6 shows that adopters there were 46.66% were joint family system, 10.00% were extended family type and 43.33% were single family type. While in case of non-adopters were 53.33% were joint family system, 6.66% were extended family type and 40.00% were single family type.

vi. *Farmer Status*

A farmer is a person engaged in agriculture, raising living organisms for food or raw materials. A farmer might own the farmed land or might work as a laborer on land owned by others, but in advanced economies, a farmer is usually a farm owner, while employees of the farm are farm workers, farmhands, etc. A tenant farmer is one who resides on and farms land owned by a landlord. Tenant farming is an agricultural production system in which landowners contribute their land and often a measure of operating capital and management; while tenant farmers contribute their labor along with at times varying amounts of capital and management. The rights the tenant has over the land, the form, and measure of the payment varies across systems.

Table 7 : Distributions of respondents according to farmer status in the study area

Farmer status	IPM-Adopters		Non-IPM adopters	
	No. Respondent	Percentage	No. Respondent	Percentage
Owner	14	46.66	16	53.33
Tenant	9	30.00	8	26.66
Owner cum Tenant	7	23.33	6	20.00
Total	30	100.00	30	100.00

Table-7 shows that adopters there were 46.66% were owner ship, 30.00% were tenant farmers and 23.33% were owner cum tenant respondents. While in case of non-adopters were 53.33% were owner ship, 26.66% were tenant farmers, and 20.00% were owner cum tenant respondents.

vii. *Agricultural Experience*

Table 8 : Distribution of the farmers according to their agricultural experience

Agricultural experience(years)	IPM-Adopters		Non-IPM adopters	
	No. Respondent	Percentage	No. Respondent	Percentage
Up to 10	05	16.66	04	13.33
11-20	10	33.33	11	36.66
Above 20	15	50.00	15	50.00
Total	30	100.00	30	100.00

Table-8 reveals that only 05adopters farmers and 04 non-adopters farmers had up to 10 years of agricultural experience, while most of the respondents i.e. 10 farmers adopters and 11 farmers non-adopters had 11-20 years agricultural experience.15 adopters farmers and 15 non-adopters farmers had above 20 years of agricultural experience.

viii. *Farm Size*

A farm is an area of land, or, for aquaculture, lake, river or sea, including various structures, devoted primarily to the practice of producing and managing food (produce, grains, or livestock), fibers and, increasingly, fuel.

Table 9 : Distributions of respondents according to agricultural farm size (acres)

Agricultural Farm Size	IPM-Adopters		Non-IPM adopters	
	No. Respondent	Percentage	No. Respondent	Percentage
Less 5 acres	10	33.33	9	30.00
5-8 acres	8	26.66	7	23.33
8-10 acres	7	23.33	8	26.66
Above 10 acres	5	16.66	6	20.00
Total	30	100.00	30	100.00

Table-9 shows that adopters there were 33.33% were less 5 acres, 26.66% were 5-8 acres, and 23.33% were 8-10 acres farm size. Only 16.66% were above 10 acres farm size while in case of non-adopters were 30.00% were less 5 acres, 23.33were 5-8 acres, 26.66% were 8-10 acres farm size. Only 20.00% were above 10 acres farm size.

c) Logistic Regression Model

From qualitative information obtained from the respondent, correlates of adopters/ non-adopters of IPM were determined by employing probabilistic model "LOGIT".

Table 10 : Hosmer and Lameshow Test Statistics

Chi-Square	Df	Significance level
2.801	8	.946

The non- significance of the Chi-square indicates that the data fit the model well.

Table 11 : Coefficient of independent variables for logistic model

Variables	B	S.E	Wald	Exp(B)
Education	-.160	.238	.453	.852
Farm Size	-.111	.032	12.354	.895*
Farm Experience	1.177	.278	17.948	3.246*
Constant	-5.005	2.414	4.299	.007*

**Shows the significant of Results at 5 percent level.*

The results of Logistic model showed that education of farmers and adoption of integrated pest management (IPM) is negatively related. It is found that with one percent increase in the education of farmers, probability of adopting of integrated pest management (IPM) decreases by .852 percent. Reason for this is due to the fact that educated persons have excellent awareness about the new technology of cotton production such as integrated pest management (IPM) but the traditional farmers mostly not quickly respond to the new techniques such as IPM. There is no significant relationship between level of education and adoption of IPM (Grieshop *et al.* 1988).

The results of Logistic model show that farming experience of farmers and adoption of integrated pest management (IPM) is positively related. It is found that with one percent increase in the farming experience of farmers, probability of adopting of integrated pest management (IPM) increase by 3.246 percent. Reason for this is that as the time passes the farming experience of farmer increase with the time and they can better understand the crop conditions, so that the probability of adopting integrated pest management (IPM) increase with farming experience of farmers. The results of this study are similar to samiee *et al.* (2009) results.

d) Analysis of Quantitative variables

i. *Results of IPM non-adopters*

Table 12 : Estimated coefficient of independent variables in non adopters of IPM Model

Independent Variables	Estimated Coefficient of independent variables	T value	Significance
Constant	-42.57	-1.805	- 0.78
Cost of urea Bags	-0.00389	*3.313	0.002
Cost of Nitro-phosphate Bags	0.00475	*3.579	0.001
Seed Expenditure	0.00356	- 0.907	0.370
Temperature	0.02693	1.628	0.111
Rainfall	0.301	*2.221	0.032
Humidity	0.164	*2.511	0.016
Herbicides Cost	-0.00093	-0.308	0.760
Spray cost	0.00027	0.310	0.758

**Significant at 10 percent level*

R square value of model = 0.397

F value of model =3.372

In this study we have used regression analysis to find out impact of different independent variables (Spray cost, Urea cost, Nitro-phosphate cost, Temperature, Rainfall, Humidity, Seed expenditure, Herbicide cost) on the cotton yield of non adopters of integrated pest management (IPM).

The R squares (R) value of the model is 0.397 indicating that 39 percent variation in cotton yield is explained by the independent variables. The F test statistics value of the model is equal to 3.372 which is highly significant at 5 percent .This implies that the estimated production function used in this study is overall statistically significant.

The results of regression analysis shows that cost of urea bags and cotton production are positively related. It is found that with one rupees increase in cost on urea bags, on the average about 0.0038 mounds /acre increase the cotton yield, keeping all the other inputs constant. Results of the analysis are fairly significant at five percent level. The nitro-phosphate fertilizer was found responsible for the vegetative growth of the plant. The results of this study are consistent with the Churahry *et al.* (2009).The results of our study also shows that non adopters use more fertilizer like urea for increases in cotton yield as compared to adopters of integrated pest management (IPM).

The results of regression analysis shows that cost of nitro-phosphate bags and the yield of cotton crop are positively related. It is found that with one rupees increase in the cost on nitro-phosphate bags, on the average about 0.0047 mounds/acre increase in the output of cotton yield, by keeping all the other inputs constant. The coefficient of the nitro-phosphate cost is significant at ten percent. Reason behind as nitro-

phosphate usage increases the fertility of soil; increase consistently the cotton crop yield. The results of this study are consistent with results of Baklish *et al.* (2005).

The results of regression analysis shows that seed expenditure and the yield of cotton crop are positively related. The Coefficient of seed expenditure is equal to 0.003568 which significant at ten percent level. It is found that with one rupee increase on seed expenditure, led on the average to about 0.00356 mounds/acre increases in the cotton yield, by keeping all the other inputs constant. The positive singe of variables shows that with the more expenditure on cotton seed, cotton yield increase considerably. The expenditure on seed means use of good quality seed and improved methods of sowing. The importance of seed in the cotton production is widely accepted. It has been proved through various studies that the role of seed in the cotton production is very important. The results of this study are very consistent with Chaudhry *et al.* (2009).The coefficient of this variable is no significant at ten percent level.

The result of regression analysis shows that temperature and the yield of cotton crop are positively related. . It is found that one centigrade increase in the temperature, led on an average to about 0.0267(mounds /acre) increase in the cotton yield, by keeping all the other inputs constant. The coefficient of this variable is no significant at ten percent level. Reason for this is cotton crop prepared for picking required high environment temperature. The results of this study are consistent with the results of Schlenker and Roberts (2008).

The results of regression analysis show that rainfall and the yield of cotton crop are positively related. It is found that one unit (mm) increase in rainfall, led on the average to about 0.301 (mounds/acre) increases in the cotton yield, by keeping all the other inputs constant. Results of the analysis are fairly positive. Reason for this is due to the fact that increases in cotton yield associated with increase rainfall because the cotton crop need more water requirement for better yield. The coefficient of these variables is fairly significant at ten percent level. The results of this study are consistent with results of Schlenker and Roberts (2008).

The results of regression analysis show that humidity and the yield of cotton crop are positively related. It is found that one unit increase in environmental level of humidity, led on the average to about 0.164 (mounds/acre) increases in the cotton yield, by keeping all the other inputs constant. Results of the analysis are fairly significant at ten percent.

The result of regression analysis shows that herbicide cost and the yield of cotton crop are negatively related. It is found that one rupees increase in herbicide cost, led on the average to about 0.00093 (mounds/acre) decreases in the cotton yield, by keeping all the Other inputs constant. The results of this study are consistent with the results of Rao *et al.* (2007).

The results of regression analysis shows that cost of spray and the yield of cotton crop are positively related. It is found that one rupees increase in spray cost, led on the average to about 0.000270 (mounds/acre) increases in the cotton yield, by keeping all the other inputs constant. The coefficient of this variable is no significant at ten percent. Results of this study are consistent with the Sigh and Satwinder (2007) results which state that without IPM technology the spray cost increase with the increase in cotton yield.

e) Results of Adopters of IPM (Integrated Pest Management)

Table 13 : Estimated coefficient of Independent Variables of the IPM adopters Model

Independent Variables	Estimated Coefficient of independent variables	T value	Significance
Constant	2.359	0.414	0.681
Temperature	0.0305	* 1.672	0.102
Nitre-phosphate Bags Cost	0.000350	0.488	0.628
Seed Expenditure	0.100	*2.05	0.046
Spray Cost	0.00295	*5.322	0.00
Herbicide cost	-0.000671	-0.308	0.759
Urea Bags Cost	-0.00213	M.844	0.073
Humidity	-0.000445	-0.035	0.972
Rainfall	0.08946	1.882	0.067

** Significant at ten percent level.*

R square value of the model is 0.593 which shows that 59 percent variation in the cotton yield is explained by the independent variables. The F test statistical of the model is 7.458 which is significance and indicate that model is fit for analysis. It implies that production function use in this study is overall statistical significant.

The result of regression analysis for the adopters of integrated pest management (IPM) shows that temperature and the yield of cotton crop are positively related. It is found that one centigrade increase in the temperature, on the average about 0.0305 (mds/acre) increases in the cotton yield, by keeping all the other inputs constant. The temperature

coefficient equal to 0.0305 and it is significant at ten percent level. The results of this study are consistent with results of Schlenker and Roberts (2008).

The results of regression analysis for the adopters of integrated pest management (IPM) shows that cost of nitro-phosphate and the yield of cotton crop are positively related. . It is found that one rupees increase in the cost of nitro-phosphate bag, on the average about 0.000350 (mounds/acre) increase in cotton yield, by keeping all the other inputs constant. The coefficient of this variable is no significance at ten percent level. The results of this study are consistent with results of Bakhsh *et al.* (2005). Reason for this is due to the fact that integrated pest management (IPM) is new technology in the Pakistan and farmers have not awareness about it so they use more chemical methods like more use of urea and nitro-phosphate for the increase in yield level the cotton crop required normal combination of all nutrients for increase in yield level.

The results of regression analysis for the adopters of integrated pest management (IPM) shows that cotton seed expenditure and the yield of cotton crop are positively related. . It is found that one rupees increase in expenditure on seed, on the average about 0.100 (mounds/acre) than increase in the cotton yield, by keeping all the other inputs constant. The results of analysis are fairly significant at ten percent level. The expenditure on seed means use of good quality seed and improved methods of sowing. The importance of seed in the cotton production is widely accepted. It has been proved through various studies that the role of seed in the cotton production is very important. The coefficient of this study is very consistent with Chaudhry *et al.* (2009).

The results of regression analysis for the adopters of integrated pest management (IPM) shows that cost of spray and the yield of cotton crop are positively related. It is found that one rupees increase in the cost on spray, on the average about 0.002953 (mounds/acre) increases in the cotton yield, by keeping all the other inputs constant. The estimated coefficient is fairly significant at ten percent level. The results of this study are consistent with the Sigh *et al.* (2007).

The results of regression analysis for the adopters of integrated pest management (IPM) shows that cost of herbicide and the yield of cotton crop are negatively related. . It is found that one rupees increase in the cost on herbicide, on the average about 0.000671 (mounds/acre) decreases the cotton yield, by keeping the other entire inputs constant. The coefficient of this variable is non-significant at ten percent level. The coefficient of this study is consistent with the result of Hall (1977). They argue that herbicide expenditure can reduced more effectively with adoption of IPM and yield of cotton increased.

i. *Forecasting and Risk Analysis of IPM-Adopters*

The results of regression analysis for the adopters of integrated pest management (IPM) shows that cost of urea bags and the yield of cotton crop are negatively related. It is found that with one rupees increase in the cost on urea bags, on the average about- 0.00213 (mounds/acre) decreases in the cotton yield, by keeping all the other inputs constant. The coefficient of this variable is significant at ten percent level. Reason for this is due to the fact that integrated pest management (IPM) is new technology in the Pakistan and farmers have not awareness about it so they use more chemical methods like more use of urea and nitro-phosphate for the increase in yield level. But cotton crop required normal combination of all nutrients for increase yield level.

The results of regression analysis for the adopters of integrated pest management (IPM) shows that level of humidity in environment and the yield of cotton crop are negatively related. It is found that with one unit increase in the humidity level of environment, on the average about -0.000445 (mounds/acre) decreases the cotton yield, by keeping all the other inputs constant. The estimated coefficient of this variable is no significant at ten percent level.

The result of regression analysis shows that rainfall and the yield of cotton crop are positively related. It is found that with one mille meter (mm) increase in rainfall, on the average about 0.089 (mounds/acre) increases the cotton yield, by keeping the other entire inputs constant. The estimated coefficient of the variable is fairly non-significant at ten percent level. Reason for this is due to the fact that increases in cotton yield associated with increase rainfall because the cotton crop need more water requirement for better yield. The results of this study are consistent with results of Schlenker *et al.* (2008).

R square of the model	= 0.593
F test statistic of the model	=7,458

f) Forecasting and Risk Analysis

Risk involved in every work of the daily life. In crop production risk is also involved and it affects the farmer attitude. In cotton crop production risk also involved because it requires a suitable combination of fertilizer, pesticides ,other inputs and favorable environmental conditions like temperature and rainfall, humidity .The adoption of new technology integrated pest management (IPM) by the farmers have increased the cotton production. The coefficient of variation cotton production was also calculating by using the following formula.

Coefficient of variation = (standard Deviation / Mean Yield of cotton) X 100

Table 14 : Simulated mean cotton yield, min mean yield and max mean yield

Years	Mean Yield	Min. Yield	Max. Yield
2010	38.95	22.23	46.29
2011	39.17	23.17	49.80
2012	39.38	18.40	49.33
2013	39.60	25.81	49.64
2014	39.82	25.56	45.92
2015	40.03	22.76	48.35
2016	40.25	24.57	48.63
2017	40.46	22.26	49.50
2018	40.68	20.96	48.32
2019	40.90	21.93	51.10
2020	41.11	23.01	50.78
2021	41.33	23.82	53.08
2022	41.54	23.28	51.92
2023	41.76	20.20	49.87
2024	41.98	17.30	55.33
2025	42.19	12.04	52.76
2026	42.41	22.62	50.36
2027	42.62	16.90	57.14
2028	42.84	15.07	59.75
2039	43.06	19.33	53.58
2030	43.27	15.40	56.29
2031	43.49	13.94	52.20
2032	43.70	16.29	64.16
2033	43.92	19.04	56.72
2034	44.14	3.105	57.59
2035	44.35	13.48	66.43
2036	44.57	14.46	57.21
2038	45.00	13.25	64.03
2039	45.22	12.11	55.30

Table-14 indicates the stimulated mean cotton yield, minimum and maximum yield of IPM-Adopters. The simulating mean cotton yield was increases as we move in the future. The variation in the yield from the mean values was showing the uncertainty over the time period.

Table 15 : Stimulated mean cotton yield, Standard deviation and Coefficient of variation of IPM-Adopters

Years	Mean Yield	Standard deviation	Coefficient of Variation
2010	38.95	4.35	11.16
2011	39.17	4.88	12.45
2012	39.38	4.77	12.10
2013	39.60	4.85	12.2
2014	39.82	4.35	10.92
2015	40.03	4.76	11.88
2016	40.25	5.03	12.49
2017	40.46	5.50	13.59
2018	40.68	5.85	14.37
2029	40.90	5.72	13.98
2020	41.11	6.18	15.02
2021	41.33	6.21	15.02
2022	41.54	6.44	15.49
2023	41.76	6.04	14.46
2024	41.98	6.75	16.07
2025	42.19	7.19	17.03
2026	42.41	6.36	14.99
2027	42.62	7.69	18.03
2028	42.84	7.69	17.94
2029	43.06	7.30	16.95

2030	43.27	7.66	17.69
2031	43.49	8.25	18.96
2032	43.70	8.35	19.10
2033	43.92	8.36	19.03
2034	44.14	9.15	20.72
2035	44.35	8.81	19.86
2036	44.57	8.81	19.76
2037	44.78	9.43	21.05
2038	45.00	9.77	21.70
2039	45.22	9.59	21.20

Table-15 indicates standard deviation and coefficient of variation of IPM adopters. The coefficient of variation was estimated by using the above formula. The standard deviation increased over the time indicating that uncertain or risk involved increases and the coefficient of variation indicated that forecasted cotton yield fluctuate over the time as we move more and more in the future. The coefficient of variation in table 10 shows that forecasted cotton yield in the near future has smaller coefficient of variation than the far future In other words as the planning horizon increases the coefficient of variation is also increases.

g) Forecasting and Risk Analysis of IPM non-adopters

Table 16 : Stimulate mean cotton yield, Minimum yield and Maximum yield of IPM Non-adopters.

Years	Mean Yield	Min. Yield	Max. Yield
2010	28.19	12.714	34.984
2011	28.44	12.575	37.636
2012	28.68	-15.632	37.37
2013	28.93	13.804	35.437
2014	29.17	13.263	36.477
2015	29.42	8.516	41.678
2016	29.66	8.558	38.821
2017	29.91	7.311	39.514
2018	30.15	9.504	42.410
2029	30.40	5.574	48.566
2020	30.64	9.876	42.008
2021	30.89	7.159	46.028
2022	31.13	7.599	41.555
2023	31.37	7.093	44.589
2024	31.62	4.441	44.666
2025	31.86	8.761	43.395
2026	32.11	9.44	44.048
2027	32.35	3.879	45.611
2028	32.60	2.783	47.708
2029	32.84	5.574	48.566
2030	33.09	1.456	46.847
2031	33.33	2.858	46.145
2032	33.58	8.577	45.948
2033	33.82	4.373	50.768
2034	34.07	2.453	53.297
2035	34.31	4.339	56.693
2036	34.56	6.134	53.167
2037	34.80	3.697	53.579
2038	35.05	5.313	53.742
2039	35.29	3.641	61.120

Table-16 indicates that forecasted mean cotton yield and minimum and maximum yield < IPM non-adopters. The simulating maximum cotton yield in the table was increase as mo^ in the future and minimum cotton yield were decrease around the mean value of the yield. The variation in the yield from the mean values is showing the risk involved over the time.

Table 17 : Stimulate mean cotton yield, Standard deviation and Coefficient of Variation of IPM non-adopters.

Years	Mean Yield	Standard deviation	Coefficient of Variation
2010	28.19	4.931	17.48
2011	28.44	4.974	17.48
2012	28.68	4.743	16.53
2013	28.93	5.143	17.77
2014	29.17	5.505	18.86
2015	29.42	6.603	22.44
2016	29.66	5.754	19.39
2017	29.91	6.710	22.43
2018	30.15	6.394	21.20
2019	30.40	8.909	29.30
2020	30.64	6.337	20.67
2021	30.89	6.800	22.01
2022	31.13	6.870	22.06
2023	31.37	7.072	22.53
2024	31.62	8.041	25.42
2025	31.86	7.448	23.37
2026	32.11	7.398	23.03
2027	32.35	8.293	25.62
2028	32.60	9.155	28.07
2029	32.84	8.909	27.12
2030	33.09	9.204	27.81
2031	33.33	8.794	26.37
2032	33.58	8.414	25.05
2033	33.82	10.059	29,73
2034	34.07	9.963	29.24
2035	3431	11.012	32.08
2036	34.56	10.008	28.95
2037	34.80	10.638	30.56
2038	35.05	10.186	29.05
2039	35.29	11.306	32.03

Table-17 the standard deviation and coefficient of variation of IPM non-adopters *m* presented. As the standard deviation increased over the time consequently the coefficient (variation also increased over the time in the future) .In other words as the planning horizon: increases the coefficient of variation is also increase.

h) Comparison of cotton production in IPM adopters and non-adopters

The mean simulated cotton yield is greater in IPM adopters than non-adopters. Similarly the variation in the mean yield is also smaller in IPM adopters than non-adopters, which is reflected in terms of smaller coefficient of variation in IPM adopters than non-adopters. The smaller coefficient of variation also indicates that less risk is involved in cotton production of those farmers which had adopted IPM cotton production practices than non-adopters.

V. Discussion

The research was conducted in District Hyderabad Sindh. Five UCs were selected as sample area, consisting of Hatri, Moosa Khatrian, Tando ajm, Tando Hyder and Tando Qasir to estimate cotton production, Forecasting and Risk analysis, Factors affecting the integrated pest management (IPM). Data were collected through questionnaires including general in formation of respondents like the Education level of respondents, Farming Experience of respondent. Farm size of respondents for evaluates the factors affecting the adoption of integrated pest management (IPM). Information about the temperature, Humidity level, rainfall level, Urea cost, Nitro-Phosphate cost, Herbicides cost and Spray cost for cotton crop was also obtained. Two types of cotton production were estimate, one for adopter of integrated pest management and other for Non-Adopters of IPM. After collection and analysis of data following results were obtained.

The study adopters and non-adopters of IPM techniques respondents were taken. In which the 50.00 percent respondents were non-adopters of IPM and 50.00 percent respondents were adopters of Integrated Pest Management (IPM) techniques.

Age of the respondent is 07 adopters and 04 non-adopters farmers belonged to age group up 35 years, while about one-third i.e.11 adopters and less than half i.e. 18 non-adopters farmers belonged to age group 36-45 years. About 12 adopters and 08 non-

adopters farmers' belonged to age group above 45 years.

Literacy status of the respondent is slightly less than 05 farmers' adopters 04 farmers, non-adopters were illiterate, while about 15 farmer's adopters, 21 farmer's non-adopters were Primary-middle level of education. The 08 farmers' adopters, 10 farmer's non-adopters were matriculation. Only 02 farmers' adopters, 04 farmer's non-adopters were Collage-University education in the study area.

The family members in the study area 13 farmer's adopters, 06 farmers non-adopters had 5-6 family members, 11 farmers adopters, 14 farmers non-adopters had 7-8 family members, 06 farmers adopters, 10 farmers non-adopters had 9 and above family members in the selected area.

Marital status in non-adopters there were 30.00% were single marital status, 66.66% were married marital status, and 3.33% were widow. 0.00% was divorced. While in case of non-adopters were 33.33% were single marital status,, 40.00% were married marital status, and 6.66%were widow. Only 3.33% were divorced.

Family type in adopters there were 46.66% were joint family system, 10.00% were extended family type and 43.33% were single family type. While in case of non-adopters were 53.33% were joint family system, 6.66% were extended family type and 40.00% were single family type.

The farmer's status in adopters there were 46.66% were owner ship, 30.00% were tenant farmers and 23.33% were owner cum tenant respondents. While in case of non-adopters were 53.33% were owner ship, 26.66% were tenant farmers, and 20.00% were owner cum tenant respondents.

Agricultural Faming experience is very important for better understanding of crop conditions. It is also very important factor that effect the adoption of new techniques. In this study the categories were formed for the respondents on the bases of their fanning experience only 05adopters farmers and 04 non-adopters farmers had up to 10 years of agricultural experience, while most of the respondents i.e. 10 farmers adopters and 11 farmers non-adopters had 11-20 years agricultural experience.15 adopters farmers and 15 non-adopters farmers had above 20 years of agricultural experience.

Farm size in adopters there were 33.33% were less 5 acres, 26.66% were 5-8 acres, and 23.33% were 8-10 acres farm size. Only 16.66% were above 10 acres farm size while in case of non-adopters were 30.00% were less 5 acres, 23.33were 5-8 acres, 26.66% were 8-10 acres farm size. Only 20.00% were above 10 acres farm size.

The results of Logistic model show that education of farmers and adoption of integrated pest management (IPM) is negatively related. It is found that with one percent increase in the education level of farmers, probability of adopting of integrated pest management (IPM) decreases by .852 percent. Reason for this is due to the fact that educated persons are well awareness about the new technique of cotton cultivation such as integrated pest management (IPM) but the traditional farmers mostly not quickly respond the new techniques such as IPM. So that the probability of adopting integrated pest management (IPM) decease with education level of farmers.

In case of the farm size the results of the Logistic model shows that farm size and adopting of integrated pest management (IPM) are negatively related. It is found that with one percent increase in the farm size of farmers, probability of adopting of integrated pest management (IPM) decreases by .855 percent. The results of Logistic model show that farming experience of farmers and adoption of integrated pest management (IPM) is positively related. It is found that with one percent increase in the farming experience of farmers, probability of adopting of integrated pest management (IPM) increase by 3.246 percent.

In this study we have used regression analysis to find out impact of different independent variables (Spray cost, Urea cost, Nitro-phosphate cost, temperature, Rainfall, Humidity, Seed expenditure, Herbicide cost) on the cotton yield of non adopters of integrated pest management (IPM).

The R squares (R^2) value of the IPM-adopters model equal to 0.397 shows that 39 percent variation in cotton yield was due to independent variables. The F test statistic value of the IPM-Adopters model is equal to 3.372 which is highly significant at 0.005 .This implies that the production function used in this study is overall statistically significant.

Results of integrated pest management (IPM) adopters model shows that the seed expenditure, Nitro-Phosphate bags cost, Urea bag cost, and Spray cost were related to the cotton production positively. Herbicide to cost related the cotton production (IPM-Adopters) negatively. The Temperature, Humidity level and Rainfall also related the cotton yield positively. At ten percent level the cost of urea bags, cost of Nitro-Phosphate bags, rainfall and humidity level were significant for IPM-Adopters cotton production model.

For second model on IPM non-adopters the results shows that R square value of the model is 0.593 which shows that 59 percent variation in the cotton yield is explained by the Independent variables. The F test statistic of the IPM non-Adopters model is 7.458 which is significance at 8 degree of freedom and also indicate that model is fit for analysis. It implies that production function use in this study is overall statistical significant.

Results of integrated pest management (IPM) non-Adopters shows that Cost of Nitro-Phosphate bags, seed expenditure, spray cost, Cost of urea bags were positively related with the cotton yield of Non-Adopters.

The Temperature and rainfall were also positively related with cotton yield .The only humidity level of environment and herbicides cost was negatively related with the cotton yield of non-adopters.

Results indicate the simulated mean cotton yield, minimum and maximum yield of IPM-Adopters. The simulating mean cotton yield was increases as we move in the future. The variation in the yield from the mean values is showing the uncertainty over the time period *it* indicates standard deviation and coefficient of variation of IPM adopters .The coefficient of variation was estimated by using the above formula. The standard deviation was increased over the time indicating that uncertain or risk involved increases and the coefficient of variation indicated that forecasted cotton yield fluctuate over the time as we move more in the future. The coefficient of variation shows that forecasted cotton yield in the near future has smaller coefficient of variation than the far future in other words as the planning horizon increases the coefficient of variation is also increases.

Results indicate that forecasted mean cotton yield and minimum and maximum yield of IPM non-adopters. The simulating maximum cotton yield in the table was increase as move in the future and minimum cotton yield were decrease around the mean value of the yield. The variation in the yield from the mean values is showing the risk involved over the time. The standard deviation and coefficient of variation of IPM non-adopters are presented. As the standard deviation increased over the time consequently the coefficient of variation also increased over the time in the future in other words as the planning horizon is increases the coefficient of variation is also increase.

The results of this study show that education of respondents, farming experience of respondents, Farm size of the respondents is factors that affect the adoption of integrated pest management (IPM) technique. The adopters Non-adopters of integrated pest management (IPM) models shows that the adopters are more risk averse as compared the non-adopters of (IPM).The cotton yield of adopters of integrated pest management (IPM) is more as compared to Non-adopters of (IPM).

VI. Conclusions and Recommendations

According the results of this study some suggestion and policy recommendation are given below:

It is concluded that high yield group is more specialized in terms of wheat crop production as compared to medium and low yield groups.

a) It is concluded that fertilizer have a positive impact on yield but the farmers getting low yield were using very less amount of fertilizer because of its high prices.
b) Different factors such as holding size, education, farming experience and farm machinery had positive impact on wheat production or productivity.
c) Education affects the planning and managerial abilities of farmers in different farm operations. It is concluded that highly educated farmers get more wheat yield as compared to less educated.
d) It is concluded that most of farmers belonged to high yield group were large farmers with holding size more than 25 acres.
e) It s concluded that farmers having latest farm machinery getting high yield as compared to those which were less mechanized.

Integrated Pest Management Practices in agriculture has significant potential to reduce burden on scarce resources and can be very handy to transit out of extreme poverty and hunger. These crop cultivation approaches which keep a balance between ecological and economic aspects of farm management can the ensure sustainability of the agriculture sector. Thus they make good sense from public policy perspective. Certain recommendations can be made to address the problems faced by adopters of IPM and for their wide spread dissemination of Integrated Pest Management Practice. Those recommendations are as follows:

1) Comprehensive national policy and institutional framework for environmental management without weaknesses in administrative and implementation capacity should be in place so that efforts to resolve the issue of environmental degradation can be made at national level.
2) Government should make strict rules and regulations about recommended use of fertilizers and pesticides. Non-recommended agro chemical should be strictly prohibited by the fanners and there should not be any confusion about social, political, commercial aims.
3) Farmer training programs should be started for the capacity building of farmers about how to make the efficient use of available resources.
4) Framers should be sensitized about environment degradation and climate change through, media especially electronic media i.e. TV, radio. People should feel that they are equally responsible for the ever increasing atmospheric and ground pollution and we have to save our natural resources for the next generations too.
5) Financial support should be provided to cope with high variable cost problem. Short and long term loans at affordable markup can be provided in this regard. Proper cost-share programs should be designed and conducted to encourage IPM Adoption by smaller farm sizes.
6) Special premium prices should be given to the adopters of better farming practices for their wide spread dissemination.

7) Farmer should maintain the full record of all inputs cost that use in cotton crops for each year so that it can help in comparison of different techniques adopted.
8) Government should facilitate the farmers in the provision of necessary inputs for cotton production so that better quality inputs can help the farmers in exploiting the potential yield.
9) Most famers would prefer less volatile yield to more volatile yield, other thing being equal, Standard deviation measures the volatility of yield around the mean yield. The fanners are risk adverse farmers can increase their yield by taking more risk in the future.

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Household Wealth Status in Botswana: An Asset Based Approach

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Abstract- Wealth has traditionally and commonly been measured using monetary indicators such as income and consumption. This approach has resulted in the production of social protection policies in various countries including Botswana. However, some researchers have debated the adequacy of the two monetary indicators in capturing status of welfare; hence alternative approaches have been proposed to serve this purpose. This paper therefore aimed at comparing wealth status for different households using assets and other household characteristics to compute a household wealth index from the 2011 Botswana population and housing census data. The index was among others, based on household durable assets, quality of housing, water and sanitation and was computed using a technique of Principal Component Analysis (PCA). Results have shown that generally there is better status of wealth among urban districts, (interestingly) female headed households, as well as in households with married heads. Further, education also appears to be an important determinant of asset acquisition.

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David Mmopelwa [α] & Khaufelo Raymond Lekobane [σ]

Abstract- Wealth has traditionally and commonly been measured using monetary indicators such as income and consumption. This approach has resulted in the production of social protection policies in various countries including Botswana. However, some researchers have debated the adequacy of the two monetary indicators in capturing status of welfare; hence alternative approaches have been proposed to serve this purpose. This paper therefore aimed at comparing wealth status for different households using assets and other household characteristics to compute a household wealth index from the 2011 Botswana population and housing census data. The index was among others, based on household durable assets, quality of housing, water and sanitation and was computed using a technique of Principal Component Analysis (PCA). Results have shown that generally there is better status of wealth among urban districts, (interestingly) female headed households, as well as in households with married heads. Further, education also appears to be an important determinant of asset acquisition. Results revealed a positive relation between wealth status and educational level of heads of households. From a policy view point, results suggest a need to broaden issues of consideration in designing programmes for poverty eradication. Thus, there is need to also focus on economic and social forces that contribute to assets inequality, given that sometimes both the policies and programmes for poverty eradication would be based on individuals' ability to accumulate productive assets.

I. Introduction

Wealth has traditionally and commonly been measured using monetary indicators such as income and consumption (Hargreaves et al., 2007). Income is "the amount of money received during a period of time in exchange for labour or services, from the sale of goods or property, or as a profit from financial investments" (O' Donnell et al., 2008; 70). On the other hand, consumption is "the final use of goods and services, excluding the intermediate use of some goods and services in the production of others" (pp, 70). While there could be some differences in defining these two concepts, the approach to use them as welfare indicators has resulted in the production of social protection policies in various countries including Botswana. However, some researchers have debated the adequacy of the two monetary indicators in capturing status of welfare; hence alternative approaches have been proposed to serve this purpose. It has been observed that despite the findings of assets being the underlying determinants of poverty in the developing world, little attention (safe for human capital proxied by education) is given to them, resulting in the objectives to address only income (and/or expenditure) poverty (Sahn and Stifel, 2003).

The use of assets as a welfare indicator has however, not escaped criticism. Some argue that ownership does not capture the issue of assets quality (Falkingham and Namazie, 2002). Thus, the process of collecting data on assets may not differentiate households that own new or old assets, cheap or expensive ones etc. Notwithstanding that, the authors argue that in a number of countries, such traits would not change the overall picture of wealth. Filmer and Scott (2008) make references to the extensive use of asset indices in previous studies. The authors indicate that this index has been used for analysis of poverty change, inequality (in health and education outcomes), and for program targeting and evaluation. While this pattern is observed in the literature, little (or no) evidence exists in Botswana for utilizing assets to inform welfare status. This is despite that the surveys conducted and the previous census collected data on assets. This paper therefore fills this gap. The paper compliments poverty analysis efforts done so far as it extends understanding of multi-dimensions of poverty. Results of this paper are important as they may assist policy makers to identify areas of concern to uplift household wealth, which should facilitate not only the attainment of MDGs but also the country's Vision 2016 aspirations. The rest of the paper is organised as follows. Section II discusses the methodology while section III discusses data source and descriptives. Results are presented and discussed in section IV, and section V concludes.

II. Methodology

a) Computation of an Index

The use of asset/welfare index is common in situations where data on either income or consumption was not collected. This approach is therefore relevant for this paper, with the 2011 population and housing census, which only asked about the source of income. Moreover, "the index captures a dimension of economic status" (Filmer and Scott, 2008; 4) and gives more reflection on long run household wealth (Filmer and Pritchett, 2001). Some of the issues to be considered in computing the index include choice of assets and their

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weights. Several approaches to computing the index exist. One of them is the simple total sum of assets from a dummy variable of whether a particular household owns assets or not (Case, Paxson and Ableidinger, 2004; Montgomery et al., 2000). This approach has been termed an "arbitrary approach" as it assumes equal weights for the different assets (O' Donnell et al., 2008; Vyas and Kumaranayake, 2006). Another approach is the use of statistical techniques which address the issues of weights in the index. The two commonly used techniques are the factor analysis and Principal Component Analysis (PCA). In this paper we computed the wealth index from a technique of PCA, which is a tool used to reduce a number of variables into one. It is mathematically specified as follows:

$$PC_1 = \beta_{11}Y_1 + \beta_{12}Y_2 + \beta_{13}Y_3 + ... + \beta_{1n}Y_n$$

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$$PCm = \beta_{m1}Y_1 + \beta_{m2}Y_2 + \beta_{m3}Y_3 + ... + \beta_{mn}Y_n$$

In the above specification, β_{mn} is the weight for the m^{th} Principal Component (PC) and the n^{th} variable, given set of variables from Y_1 to Y_n. The weights of the PCs are represented by the *eigenvectors* of the correlation matrix. However, if the data is standardized the eigenvectors would be of the co-variance matrix. On the other hand, the variance of the PCs is given by the *eigenvalues* (Vyas and Kumaranayake, 2006). In the output, components are ordered according to their proportion of variation that they explain in the original data; with those in the top positions explaining larger amounts of variation. The index was computed from housing conditions (type of houses, wall, floor, and roof materials), living conditions (water source, toilet facility and energy sources for lighting, cooking and heating) as well as ownership of durable assets (Television, radio, sewing machines, watch etc).

While there is no defined criteria for the choice of assets (Montgomery et al., 2000); ours was influenced by the bearing that the variables might have on the Millennium Development Goals. For instance, source of water, sanitation and flooring material affect hygiene. Source of energy for cooking may affect the environment and respiratory diseases that cause deaths. Some of the variables were in categorical form, which is not suitable for the PCA technique and were therefore converted to binary variables. After computing the wealth index, households were then classified into quintiles. The decision to choose five groups (quintiles) was among others informed by previous empirical work. According to literature, the commonly used cut-off points are classification into quintiles (Gwatkin et al. 2000; Filmer and Pritchett 2001). This is done to differentiate households into socio economic categories; to show wealth status within a population. We used SPSS (Version 18) for analysis.

III. Data Source and Descriptives

The paper used data from the 2011 population and housing census, which had 550944 households. Table A1 in the annex presents descriptive statistics. The fourth column of Table A1 shows the factor score, which is basically the first principal component (weight), used to create a household score (Houweling et al., 2003). A positive score suggests that a variable is associated with a higher economic status (wealth) while the opposite is true for a negative score. Thus, from Table A1, with regard to the type of housing unit, traditional, mixed, movable, shacks and rooms will be associated with lower economic status. The use of mud bricks/blocks or poles and reeds for floor would also reduce household wealth.

The pattern for type of housing unit is dominated by *detached* houses (43%) followed by *rooms* and *traditional house* with 23 percent and 13 percent, respectively. Other types (town house, mixed, flat, shacks and movable) accounted for a share of 10 percent or less. Majority (82%) of households had their walls made out of *conventional bricks/blocks* while the remaining shares were distributed amongst *corrugated iron*, *asbestos*, *wood*, *stones* and *poles* and *reeds*. A larger proportion (65%) had *cement* as a floor material, 22 percent with *floor tiles* and 0.07 percent with *brick/stone*. Roof material is dominated by *corrugated iron* (74%), followed by roof tiles (13%), while the least share was for *concrete* (0.3%).

Regarding water supply, majority (40%) of households had *piped outdoors* while 30 percent had *piped indoors*. Thus, majority appear to be accessing water from improved sources. This pattern was also observed by previous studies (Statistics Botswana, 2011). About 15 percent of households sourced water from *communal taps*. Other water sources including *bouser/tanker*, *well*, *borehole*, and *dam/pan* had a share of less than 10 percent. Those who owned *flush toilet* accounted for a share of about 25 percent followed by those who owned *pit latrines* with 24 percent. However, 18 percent of households shared pit latrines, 5 percent used neighbor`s pit latrines, and 9 percent shared flush toilet. While there is dominance of use of pit latrines, it is promising that the use of flush toilets (whether owned or shared) is also visible. The shares for those who used communal toilet facilities were less than a percent. The above presents a hopeful trend towards the achievement of the Millennium Development Goal 7 of ensuring environmental sustainability. More than half of households used *electricity* as a principal source of energy for lighting while 30 and 11 percent used *paraffin* and *candles* respectively. About 41 percent of households used wood as a source of energy for

cooking followed by 38 percent who used *gas*. The use of wood also dominated sources of energy for heating (48%), followed by electricity with a share of 17 percent.

About 15 percent of households owned van/bakkie; 2 percent owned tractors and 20 percent owned cars. The shares of ownership status for donkey carts and bicycles stood at 12 and 10 percent respectively, while motor bike and boat were each owned by about a percent of households. About 43 percent owned the refrigerator and 5 percent owned sewing machine. Given that these assets have a positive factor score, their ownership implies the likelihood of improved welfare for households. On the other hand, majority (90%) owned cell phones while 11 percent had telephones (landlines). About 61 percent owned radios and 54 percent owned televisions. This pattern presents a positive outcome towards an "informed nation" as these assets are among the primary sources of information.

IV. Results and Discussions

We begin by presenting the welfare status by census district (Table 1). The numbers in brackets are proportions. As can be seen in the table, Gaborone, Francistown, and Orapa districts have larger proportions of households with better status of wealth. The proportions of households increase as we move from the lower (poorest) wealth status to the higher (richest) status. For instance, 0.6 (1.2) percent of households are in the poorest wealth status in Gaborone (Francistown) compared to 45 and 29 percent in the richest status respectively. This pattern is also observed in Lobatse, Selebi Phikwe, Sowa Town and Jwaneng, with some minor variations. These results corroborate findings from previous studies, that these districts had lower poverty incidence compared to others (CSO, 2008; Statistics Botswana, 2013). For instance in 2002/03 poverty incidence stood at 0.076, 0.159, and 0.018 percent for Gaborone, Francistown and Orapa respectively.

The districts of Ngamiland West, Kweneng West, Ngwaketse West, CKGR, and Ghanzi had the highest proportions of households in the poorest status (all over 40%). These results are consistent with those of previous survey by Statistics Botswana (2013) where poverty rates were found to be higher in such districts. Ngwaketse, Ngwaketse West, Mahalapye, Bobonong, Tutume, Ngamiland and Kgalagadi are generally characterized by larger proportions of households in the poorer status of wealth than those in the richer status. For instance, about 49 percent of households in Ngwaketse West are in the poorest status of wealth compared to 7 percent of those in the richest status; while 29 percent of households in Kgalagadi North are in the lower wealth status compared to 13 percent for those in a richer state. We conclude that generally the urban (or city/town) districts are characterized by better wealth status than their rural counterparts. One of the possible explanations for the observed pattern could be employment opportunities found in urban areas and cities/towns. Although there are various modes of assets acquisition (including inheritance), income from employment is likely to improve status of asset ownership.

Table 1 : Wealth Status by Census District

District	Poorest	Second	Middle	Fourth	Richest
Gaborone	448 (0.6)	8692 (11.6)	15049(20.1)	17019 (22.7)	33749(45.0)
Francistown	384(1.2)	5153(16.5)	7333(23.4)	9501(30.4)	8926(28.5)
Lobatse	200(2.2)	1898(20.6)	2438(26.5)	2012(21.8)	2666(28.9)
Selebi Phikwe	281(1.7)	2851(17.8)	3347(20.8)	5097(31.7)	4483(27.9)
Orapa	0(0.0)	1(0.0)	62(1.9)	732(22.2	2497(75.9)
Jwaneng	449(7.6)	281(4.7)	1063(17.9)	1400(23.6)	2747(46.2)
Sowa Town	28(2.4)	44(3.7)	42(3.5)	534(44.8)	543(45.6)
Ngwaketse	7551(24.0)	8503 (27.0)	5947(18.9)	5841(18.6)	3639(11.6)
Barolong	3300(24.0)	5146(37.4)	2389(17.4)	1614(11.7)	1309(9.5)
Ngwaketse West	1725(48.5)	999(28.1)	328(9.2)	264(7.4)	240(6.7)
South East	952(4.0)	2894(12.1)	5689(23.7)	7519(31.3)	6936(28.9)
Kweneng East	8488(12.4)	14158(20.7)	17961(26.3)	17128(25.2)	10504(15.4)
Kweneng West	6948(56.8)	2524(20.6)	907(7.4)	751(6.1)	11012(9.0)
Kgatleng	3427(13.8)	5866(23.5)	5474(22.0)	5622(22.6)	4528(18.2)
Serowe/Palapye	12508(27.1)	9953(21.5)	8974(19.4)	8234(17.8)	6519(14.1)
Mahalapye	8731(29.3)	8227(27.6)	5217(17.5)	4265(14.3)	3359(11.3)
Bobonong	6186(32.3)	5025(26.2)	3607(18.8)	2544(13.3)	1794(9.4)
Boteti	5879(41.7)	2309(16.4)	2527(17.9)	2114(15.0)	1281(9.1)
Tutume	14764(38.5)	9064(23.6)	6658(17.4)	4621(12.0)	3246(8.5)
North East	3001(18.9)	4476(28.2)	3446(21.7)	2800(17.6)	2142(13.5)
Ngamiland East	6262(28.8)	3806(17.5)	4648(21.4)	4263(19.6)	2758(12.7)
Ngamiland West	8413(63.9)	1888(14.3)	1299(9.9)	900(6.8)	664(5.0)
Chobe	1142(16.7)	1030(15.1)	1675(24.5)	1817(26.6)	1166(17.1)

Okavango Delta	191(29.2)	242(36.9)	200(30.5)	21(3.2)	1(0.2)
Ghanzi	4636(40.8)	1731(15.2)	1626(14.3)	1920(16.9)	1442(12.7)
CKGR	10(47.6)	0(0.0)	1(4.8)	2(9.5)	8(38.1)
Kgalagadi South	2682(33.7)	1967(24.7)	1221(15.3)	1076(13.5)	1010(12.7)
Kgalagadi North	1607(29.0)	1444(26.1)	1073(19.4)	682(12.3)	736(13.3)
Source: Author computed from 2011 population and housing census data set					

Figure 1 presents household wealth status by gender of the household heads. Comparatively, the overall picture presented in Figure 1 suggests that female headed households are better off. This pattern is observed up to the fourth category of welfare. About 22 percent of male headed households are in the poorest status of wealth compared to 18 percent of female headed households. However, in the richest category we observe higher proportion of male headed households than that of female headed households. While this is the case, it is also evident that from the second to the richest status of wealth the proportions of female headed households declined while that of male headed households increased.

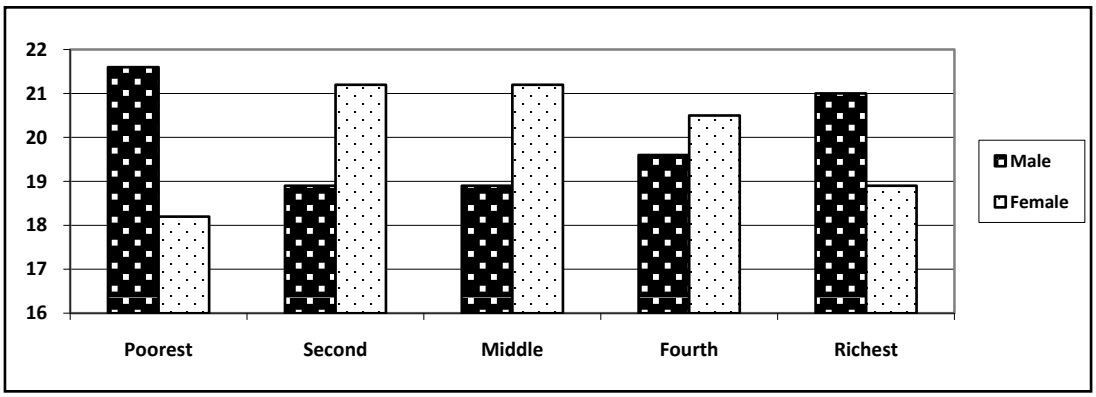

Figure 1 : Share(%) of Wealth Status by Gender of Household Heads

Source : Author computed from 2011 population and housing census data set

Table 2 presents the share of wealth status by marital status of heads of households. Among households with *married* heads, a higher proportion (25.6%) is in the richest category of wealth followed by those in the fourth category (20.7%). The least share of households whose heads are married is accounted for by those in the poorest status of wealth. This may suggest that being married is likely to improve the household status of wealth. Similarly, households whose heads were *never married* are more concentrated in the richest category than in the poorest category. This may not be surprising given that pervious studies found a comparable poverty incidence in households with *married* and *never married* heads (BIDPA, 2010).

There are higher proportions (in the poorest category) of households whose heads are *separated, living together* and *widowed*. As seen in Table 2, 24 percent of households whose couples are living together are in the poorest category of wealth compared to 16 percent of those in the richest category. About 30 percent of households headed by separated heads are in the poorest category compared to 14 percent in the richest category. As for widowed households, the proportions are 24 and 12 percent for poorest and richest categories respectively. The pattern for households with *divorced* heads is interestingly similar to that of households with married and never married heads, safe for the third category of wealth status. This could be argued to be against the expectations as divorce may result in a reduced status of assets ownership.

Table 2 : Share(%) of Wealth Status by Marital Status of Household Heads

Marital Status	Poorest	Second	Third	Fourth	Richest
Married	17.1	18.4	18.2	20.7	25.6
Never Married	18.3	19.5	21.0	21.0	20.1
Living Together	24.3	20.8	20.4	18.8	15.7
Separated	29.8	21.9	18.7	15.4	14.3
Divorced	17.1	19.0	18.0	19.8	26.1
Widowed	23.7	24.9	21.1	17.9	12.4
Source: Author Computed from 2011 population and housing census data set					

Table 3 presents the pattern for wealth status by level of education attained by households' heads. As evident in the table, the status of wealth is positively related to the level of education of the household head.

For instance, about 7 percent of households headed by those who have never been to school are in the richest category of wealth compared to about 40 percent in the poorest category. A similar pattern is observed for households whose heads had *primary* and *secondary* education, who however appear to be faring better than those whose heads had no education. On the other hand, households whose heads had tertiary education are more concentrated in the better status of wealth. In fact the proportions in both the poorest and richest categories are a mirror image of the pattern observed in households with uneducated heads. This could suggest that education might be a determinant of households' wealth status; it may improve acquisition of assets to better the status of household wealth.

Table 3 : Share (%) of Wealth Status by Education Status of Household Heads

Level	Poorest	Second	Third	Fourth	Richest
Never Attended	39.6	24.4	16.5	12.5	7.1
Primary	28.9	27.4	19.4	15.3	9.0
Secondary	24.8	24.4	21.4	17.9	11.5
Non-Formal	14.8	20.1	23.7	22.6	18.8
Tertiary	6.8	11.9	16.3	24.7	40.3

Source: Author Computed from 2011 population and housing census data set

V. Conclusions

This paper assessed welfare status using the index computed from the technique of Principal Component Analysis. To our knowledge this approach has not been done in Botswana. Therefore, it may not be easy to conclusively note whether there has been an improvement or not, in addition to what has been done so far. Therefore this paper may be seen as the baseline against which future progress will be tracked. Results have shown that generally there is better status of wealth among urban districts, female headed households as well as in households with married heads. Further, education also appears to be an important determinant of asset acquisition. Results revealed a positive relation between wealth status and educational level of heads of households.

Results from our analysis suggest that from a policy point of view, there is need to broaden issues of consideration in designing programmes for poverty eradication. Thus, there is need to also focus on economic and social forces that contribute to assets inequality, given that sometimes both the policies and programmes for poverty eradication would be based on individuals' ability to accumulate productive assets. Moreover, the problem of income inequality might be exacerbated by unequal distribution of income generating assets, hence the need for consideration of assets. Although some reports suggest that Botswana is on track to meeting MDG 1 of halving extreme poverty and hunger, such needs to be supplemented by consideration of assets with the view to try to address the multidimensionality of poverty, especially that the target may be seen to have been narrowed to "income' or expenditure as welfare measures.

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Annex

Table A 1 : Descriptive Statistics and Results of the Principal Component Analysis

Variable	Mean	Standard Deviation	Score
Type of Housing Unit			
Traditional	0.1319	0.3384	-0.618
Mixed	0.1000	0.3001	-0.175
Detached	0.4340	0.4956	0.463
Semi Detached	0.0457	0.2089	0.176
Townhouse/terraced	0.0193	0.1375	0.130
Flats/apartments	0.0153	0.1229	0.168
Part of commercial building	0.0014	0.3789	0.003
Movable	0.0070	0.8351	-0.071
Shack	0.0167	0.1282	-0.163
Rooms	0.2286	0.4199	-0.039
Wall Material			
Conventional Bricks/Blocks	0.8150	0.3883	0.677
Mud bricks/blocks	0.0871	0.2820	-0.442
Mud and Poles/Cow dung/thatch reeds	0.0548	0.2276	-0.392
Poles and reeds	0.0100	0.996	-0.152
Corrugated Iron/zinc	0.0216	0.1455	-0.171
Asbestos	0.0028	0.0531	0.004
Wood	0.0040	0.0635	-0.080
Stone	0.0005	0.0221	-0.019
Floor Material			
Cement	0.6471	0.4779	-0.097
Floor tiles	0.2199	0.4142	0.613
Mud	0.0535	0.2250	-0.382
Mud/dung	0.0499	0.2177	-0.379
Wood	0.0019	0.0437	-0.007
Brick/stone	0.0007	0.0261	-0.016
None	0.0235	0.1516	-0.239
Roof Material			
Slate	0.0067	0.0815	0.012
Thatch	0.1113	0.3145	-0.560
Roof Tiles	0.1292	0.3354	0.429
Corrugated Iron	0.7352	0.4412	0.060
Asbestos	0.0091	0.0951	0.090
Concrete	0.0028	0.0527	0.039
Other	0.0057	0.0755	-0.077
Water Supply			
Piped indoors	0.3020	0.4591	0.695
Piped outdoors	0.3990	0.4897	-0.004
Neighbour`s tap	0.0564	0.2307	-0.190
Communal tap	0.1477	0.3548	-0.417
Bouser/tanker	0.0114	0.1062	-0.100
Well	0.0093	0.0958	-0.143

Borehole	0.0491	0.2160	-0.314
River/stream	0.0139	0.1171	-0.172
Dam/pan	0.0072	0.0844	-0.121
Rain water tank	0.0010	0.0316	-0.021
Spring Water	0.0005	0.0230	0.000
Toilet Facility			
Own Flush	0.2524	0.4349	0.657
Own VIP	0.0183	0.1339	-0.008
Own pit latrine	0.2367	0.4251	-0.141
Own dry compost	0.0028	0.0526	-0.063
Shared Flush	0.0860	0.2803	0.197
Shared VIP	0.0143	0.1187	0.005
Shared pit latrine	0.1823	0.3861	-0.039
Shared dry compost	0.0010	0.0321	-0.032
Communal Flush	0.0012	0.0340	0.007
Communal VIP	0.0004	0.0206	-0.017
Communal pit latrine	0.0060	0.0769	-0.060
Communal dry compost	0.0006	0.0249	-0.034
Neighbours` Flush	0.0013	0.0355	-0.014
Neighbours`VIP	0.0020	0.4460	-0.037
Neighbours pit latrine	0.0462	0.2100	-0.212
Neighbour`s compost	0.0003	0.0162	-0.016
Energy for Lighting			
Electricity	0.5324	0.4990	0.808
Petrol	0.0015	0.0388	0.000
Diesel	0.0077	0.0873	-0.108
Solar power	0.0051	0.0709	-0.015
Gas	0.0028	0.0527	0.007
Bio Gas	0.0002	0.0146	-0.003
Wood	0.0356	0.1854	-0.311
Paraffin	0.3002	0.4583	-0.522
Candle	0.1101	0.3130	-0.296
Energy for Cooking			
Electricity	0.1779	0.3824	0.457
Petrol	0.0006	0.0252	0.001
Diesel	0.0009	0.0300	0.011
Solar Power	0.0008	0.0278	0.010
Gas	0.3789	0.4851	0.427
Bio Gas	0.0092	0.0954	0.036
Wood	0.4119	0.4922	-0.768
Paraffin	0.0167	0.1280	-0.062
Cow dung	0.0007	0.0273	-0.013
Coal	0.0004	0.0191	0.004
Crop Waste	0.0002	0.0130	0.010
Charcoal	0.0013	0.0364	0.005
Energy for Heating			
Electricity	0.1675	0.3735	0.533
Petrol	0.0009	0.0303	0.004
Diesel	0.0003	0.0169	0.001
Solar Power	0.0014	0.0369	0.016
Gas	0.0102	0.1005	0.071
Bio Gas	0.0006	0.0236	0.010
Wood	0.4766	0.4995	-0.680
Paraffin	0.0026	0.0506	-0.023
Cow dung	0.0005	0.0217	-0.008
Coal	0.0013	0.0367	0.008
Charcoal	0.0015	0.0392	0.021
Other Assets (durables)			
Van/bakkie	0.1509	0.3579	0.298
Tractor	0.0197	0.1390	0.073

Car	0.1981	0.3986	0.482
Donkey Cart	0.1170	0.3214	-0.246
Bicycle	0.0989	0.2985	-0.007
Mokoro/Boat	0.0065	0.0802	-0.014
Motor Bike	0.0062	0.0787	0.057
Wheel barrow	0.3314	0.4707	-0.014
Sewing Machine	0.0464	0.2104	0.120
Refrigerator	0.4347	0.4957	0.708
Cell phone	0.8973	0.3036	0.406
Telephone	0.1083	0.3108	0.326
Radio	0.6149	0.4866	0.323
Television	0.5409	0.4983	0.723
Laptop	0.1123	0.3157	0.421
Desktop	0.0963	0.2949	0.393
Source: Author Computed from 2011 Population and Housing Census Data Set			

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Divergences of Interest and Relations of Agency: Case of the Cooperative Firms

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Abstract- The agency theory through the model «shareholder is useful to describe the contractual relations between all the speakers and to explain the government of the agricultural cooperatives. However, the agricultural cooperative is a "contracting nexus" which is the place of crossing of several fascinating parts, whose interests can diverge. The need for setting up a system of government company is due to the divergences of interests between the various parts of stakeholders. In this paper we explain this divergences in the case of cooperative firms.

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GJHSS-E Classification : *FOR Code: 149901*

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Keywords: stakeholders, cooperative firms, agency theory.

I. Introduction

The study of the relation between the performance of the firms and the structure of property constitutes a privileged and old topic of the economic literature which finds in particular its origin in the work of Berle and Means [1932][1] and the description of the problems caused by the separation of the functions of property and decision.

The recognition of this separation led in particular to the development of managerales designs of the firm according to which the leaders are supposed to pursue other goals that the maximization of the value of market of the inheritance of the shareholders; this divergence would imply the rupture of the bond between the social function of the private property and the optimal allowance of the resources in the economy.

Indeed, the passage of the firm entrepreneurial at the firm managerial characterized by the separation of the property and management calls into question the nicety of the objective of maximization of the profit continued by the owner.

Nothing excludes that the managers do not manage the company with the objective of maximization of their function of utility. What raises the question of the control of the firm by its owners. This question of the control of the firm is made extreme with the scandals of corruption and abuse of power of certain leaders of great groups. What led to the debate on the "corporate governance"[2]

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[1] Chareaux, G " structure of property, relation of agency, and financial performance " review economic flight 42, 1991.
[2] Charreaux G, the government of the companies. Corporate Governance, Theories and facts, Economica, Paris.

However, the question of the governance of the firms does not relate to only the companies dimensioned out of Stock Exchange or the multinational firms, but all the organizations in which exists a separation between managers and owners.

The agricultural cooperatives constitute, for this reason, a significant example of these organizations. Indeed, in these companies, one notes that the members (peasants), even if they intervene in the management of the co-operative are not always the true decision makers.

This article proposes to answer the two following questions:

- Which are the fascinating parts or "stakeholders" in the co-operatives and primarily in the agricultural cooperatives?
- Which are the conflicts of interest between these fascinating parts and up to what point the co-operative mechanisms contribute to reduce or solve these conflicts?

The paper is organized as follows: Section 2 reviews the cooperative and model "stakeholder". Section 3 analyzes the conflicts of interests and government of cooperatives agricultural. Section 4 presents the resolutions of conflicts in agricultural cooperative.

II. The Cooperative and Model "Stakeholder"

The co-operative can be defined as " an association of people who voluntarily grouped to achieve a common goal by the constitution of a democratically directed company, by providing a quota of the capital necessary and by accepting a right participation in the risks and the fruits of this company to the operation of which the members take an active part " (Vienney C, 1994)[3].

This definition makes it possible to underline three characteristics specific to the co-operative company. Initially, its democratic character, which supposes an equality between the members in the event of vote. What results in the principle "a person, a voice", contrary to the principle "an action or a social share, a voice" in the other types of companies.

[3] QUOTED BY MOCHTARI, H « COPORATE GOVERNANCE, DIVERGENCES OF INTERESTS AND AGENCY RELATIONS » 2004, P.4.

In the present section we will be interested in the characteristics of the agricultural cooperative companies; then, the co-operative: a node of contracts specific; finally, fascinating parts (stakeholders) in the agricultural co-operatives.

a) Characteristics of the co-operative agricultural companies

The agricultural cooperative company shows the following characteristics, which make it possible besides to define it and distinguish it from other shapes of co-operatives:

- It is a "professional body farmers to which those transfer the load from their job satisfaction".
- It is a company with variable capital, which enables him to increase or write-off its capital on simple resolution of the Board of Directors, without joining together an extraordinary general meeting of the associates, as it is the case in the companies with fixed assets;
- It is a partnership, since the consideration of the personality of the associates is a major element. Indeed, it is the consideration which the associates have one for the other which is the determining cause of the creation of the company;
- The law indicates that it is about a juridical specific company. Thus the law of July 27, 1972 precise: the agricultural cooperative companies and their unions form a special category of companies, distinct from the civil companies and commercial companies. They have the legal entity and the full capacity." What confers on this category of company a specific right, an autonomous statute, merging neither with the civil companies, neither with the commercial companies, nor finally with associations.

b) The co-operative: specific nexus of contracts

From an economic point of view, the contract " is an agreement by which two parts begin on their behaviors reciprocal. It is about a bilateral device of coordination."(Brousseau E and Glachant J-M., 2000)[4] the co-operative constitutes a typical example of crossroads of contracts or node of contracts. The co-operatives, perceived by the company law like special, are it at least on two levels. Initially because this grouping "expresses a community of interests between the associates which does not have its equivalent in the traditional companies."

Then, because the creation of the company gives rise to contracts which strongly bind the associates to the co-operative, which results in double quality (associate and co-operator, i.e. taking part in the activity of the company).

Thus, "the constitution of a company is not an end in itself, but an essential tool which frames the contractual relations between a company and its users" (Hérail, 2000). The importance of these relations makes that the operation of the co-operative company requires not only the existence of necessary the affection sociopaths, but also of a affection corporatist (Hérail, 2000) which goes beyond the will to work jointly but means community of interest of the co-operators.

Moreover, the methods of distribution of the surpluses by the mechanism of the rebates whose the members and the equal distribution profit from the capacity depend on the "volume of contractual relations". In other words, they are the economic operations carried out by the co-operator and the company of which he is member which will be used as a basis for calculation of the advantages to grant to the latter. What constitutes a major difference with the traditional private companies.

c) Fascinating parts (stakeholders) in the agricultural co-operatives

Taking into account the reforms as regards right of the co-operatives and especially of the agricultural cooperatives, it is necessary to distinguish several fascinating parts, of which it is difficult to identify in a precise way the interests. Will be considered: associates, administrators, the president, the general manager, employees, co-operative unions.

- *Associates*

Taking into account the legal modifications, the associates can be co-operators (country) or no co-operators. In the first case their activity presents a complementarily with that of the co-operative. Indeed, the activity of the latter can be upstream or downstream from that of the peasant's members. In the first case it is about co-operative of provisioning, the CUMA (co-operative of uses of the farm equipment jointly) or of the CEIA (co-operative of breeding and artificial insemination).

The second case one finds the co-operatives of storage, transformation and marketing. The associate's co-operators bring not only one share of the capital, but are at the origin of part of the activity of the co-operative as suppliers, customers or users (in the case of the CUMA).

- *Administrators*

The administrator is elected by the general meeting of associated and for this reason, represents them for the management and the control of the co-operative. In theory, it "ensures the reality of the capacity of the farmer ".

It takes part, within the framework of the board of directors, the development of the strategy of the company and ensures the effective control of the management of the co-operative. Guarantor of the

[4] QUOTED OPTION.

finality of the potentiality of the company, it constitutes a relay of information between the Board of directors and the whole of the members.

It is advisable to specify that when there are associates not co-operators, certain administrators can be no farmers, which limits their role of intermediary, because very far away from realities of the country world.

- *The president*

The president, a person resulting from the country world is in theory somebody who has a sufficient charisma to federate the wills. He is mobilizing at the same time members and administrators and a incarnation of the co-operative project.

- *General manager*

The general manager holder of competences in management, it works in harmony with the president, in order to carry out the mobilization of the resources (material and human) for the realization of the definite strategy.

- *Employees*

They are related to the co-operative by a contract of employment. So they complete work in accordance with the directives of the head of company. In fact agents of execution have the effect of being in contact with the users, i.e. with the associate's co-operators. What makes it possible to advance that the co-operators and the employees are executants (one more exactly of the Co-executants).

- *Co-operative union*
- *It happens that several co-operatives gather in a union of co-operatives. What can be explained by the following reasons[5]:*

– To face the economic competition by the costs, the regrouping of several co-operatives in union enables them to reach the minimal size, below which, they cannot be maintained on the market;
– The regrouping also allows the co-operatives, and thus to the co-operators, to reinforce their capacity of negotiation and to enter the very competing European market. What a co-operative with it alone is unable to make.

III. Conflicts of Interests and Government of Cooperatives Agricultural

The need for setting up a system of government of company is due to the divergences of interests between the various parts and, in particular the owners and the leaders. Such is the case when the firm is directed by paid managers (or holders of a weak share of its capital).

a) Conflicts between the stakeholders

However, this collective management can run up against the conflicts on the objectives of the co-operative company, especially if one considers the diversity of the fascinating parts. In the event of consensus between the whole of the members on the aims in view, the operation of the company does not pose a problem. In the contrary case, one attends conflicts of interest between the members who can give rise to behaviors prejudicial for the co-operative. Among these conflicts, one can quote:

– The conflicts which occur between co-operators, especially when they are organized in coalitions definitely differentiated by their interests and their references;
– The conflicts which are born between the administrators and the other members.For example, the administrator can seek the maximization of the price of production as a supplier instead of aiming " the optimization of the economic effectiveness of the production as a manager of this one."
– The conflicts which appear between the president and the administrators;
– Conflicts between paid and adherent;
– Conflicts between the co-operative or only some of its members (united) and the co-operative union.

b) The theory of the agency and conflicts between stakeholders

i. *Identification of the relations agency*

Some of the contractual relations in the co-operative can be qualified relations of agencies. In which a part (one or more people) has recourse to the services of another part to achieve decisions on its behalf. It results from it from the conflicts related to the divergence of interests between the fascinating parts of the agricultural cooperative. These conflicts can be qualified conflicts of agency. " the conflicts of agency are of post-contractual nature and find their origin in the asymmetry of information and impossibility of writing complete contracts because of limited rationality and uncertainty"[6].

These conflicts lead the parts to anticipate the risks related to the relations of agency. What results in costs known as of agency, which rise from the measurements taken by the contracting ones to install mechanisms enabling them to be injured (cost of bargaining, cost of monitoring, etc). Concerning the agricultural cooperatives, the relations, between

[5] Deshayes G, 1990., quoted by Mochtari, H " corporate governance, divergences of interests and agency relations ".2004,P4.

[6] Charreaux G (1999), " positive Theory of the agency ", new theories to manage the company of XXIe century, in G Koenig (coordination) page 79.

fascinating parts, quoted previously constitute relations of agency.

They are possible relations between fascinating parts, but which do not imply directly or indirectly the co-operative. For example, relations between customers of the co-operative and some associated for their own interest (these customers can be at the same time customers of associates, on a purely personal basis), relations between paid and trade unions of farm laborers, etc. These relations which do not rise of the co-operative field correspond to the grayed cells.

c) *Relations of agency concerned with the node of contracts*

It is contractual relations in which the co-operative is implied directly: relations of the type RA or ATR Indeed these two categories of relations are concluded in the framework from the co-operative between the latter (or its leader representatives and / or its bodies) and the fascinating parts mentioned. It is thus relations between associates, of the relations of the co-operative with its administrators, his president, his director, etc. However, although concerning the node of contracts, these relations do not constitute all of the relations of agency.

The relations of the type ATR are relations of co-operation which, in the event of conflict, can be sliced by the law or the statutes without too much difficulty. In other words, the margin of freedom of interpretation by the parts is very weak or for which the ' moral' risk is weak. As an example, the work of executants is more easily controllable and, in the event of litigation, the recourse to the jurisdictions makes it possible to take a decision. In addition, the way in which achieves his work is more or less standardized and generally conforms to professional uses. It can be analyzed like a convention, i.e. "an informational screen[7]" which exempts the individuals to wonder each time about the behavior of the other individuals.

Remain the noted relations RA which correspond to situations where a part - the agent - must manage for a part - the main thing. Thus, the relation between associated and administrators are a relation of agency, in the sense that the administrators are supposed to represent the members of the co-operative and to work in their interest. In the same way, the relation between the president and the associates or that between associated and director. But, a fine analysis of these relations of agency shows that they are not located all at the same level. Thus some are the fact of fascinating parts whose interests cannot merge with those of other parts[8] on the other hand, certain groups of stakeholders have several memberships, which illustrate the examples, of relations, hereafter:

- The relation (A) - (D): the interests of associated coincide only fortuitously with those of the general manager;
- The relation (B) - (D): the interests of the administrators coincide only fortuitously with those of the general manager;
- The relation (A) - (B): the interests of the associates coincide completely or partially with those of the administrators;
- The relation (A) - (C): the interests of the associates coincide completely or partially with those of the president;

When the interests are divergent, the relation will be noted X # Y, contrary in the event of convergence, it will be noted X≈Y. the various relations of agencies can be written these two manners:

- A≈ B;
- A≈C;
- B≈C: this relation rises from the two preceding ones since the president is a associate who is member of the board of directors.
- A # D;
- B # D;
- C # F;
- D # F.

In theory, if the management of the co-operative is democratic, the conflicts of agency in the first part are limited, because there is an identity of the interests between the fascinating parts (A≈B, A≈ C, B≈C). In addition, the deliberative bodies (general meeting of associated and board of directors) are able to regulate these conflicts. On the other hand, for the other conflicts of agency, the mechanisms of operation of the co-operative do not make it possible to bring an identity of the interests of the partners. From where need for resorting to mechanisms of government to frame the behaviors of the various fascinating parts. Indeed, such mechanisms can constitute a means to prevent that the co-operative does not escape its member's co-operators.

IV. The Resolution of the Conflicts in Agricultural Cooperative

The present section we will be interested in the resolution of the conflicts between associated in the co-operative agricultural; and thereafter, with the resolution of the conflicts and the mechanisms of control.

a) *The resolution of the conflicts between associated in the agricultural cooperative*

Several means make it possible the co-operative to solve the conflicts which can exist in the event of divergence of interests: legal and professional environment, the agricaltural policy and democratic operation

[7] Gomez P-Y, 1996 « The Corporate Government » Intereditions .
[8] But Does Not Exclude The Possibility Of Identity The Interests.

i. *Legal and professional environment*

By making co-operative a specific company, the law frames their creation, their activity and their organization. So the conflicts being able to emerge in their centre seem, in theory, limited enough.

Thus the rule of capitalism reduces the conflicts related to the division of the benefit between the associate's co-operators. What means that "the objective of the co-operatives is not to make bear fruit the capital of the members, but n the other hand to ensure the latter a service of an obligation of activity, correlatively with the idea of exclusion of any finality of total or personal enrichment." For example, a associate co-operator holding a social share can profit from a rebate, according to his co-operative activity, more significant than that of a associate co-operator holding ten social shares. In the same way the professional environment plays a significant role to limit the conflicts. Indeed, the associates' co-operators set up a group more homogeneous than any group of shareholders of a limited company. This homogeneity covers several dimensions:

- The peasant's co-operators belong the same agricultural activity (for example, cereal, to stockbreeders of bovines...); ·
- Then, they are localized geographically, which generally corresponds to the same "country culture" and to the same vision of their professional identity;
- A community of professional destiny which is translated by real solidarity and behaviors, at the local level, rather near. For example, the acceptance of an innovation or its refusal by a group illustrates this phenomenon well.

ii. *The agricultural policy*

The agricultural policy played a role determining in the French agricultural revolution, especially with the installation of the P.A.C[9]. The latter had as a consequence a standardization of husbandries and imposed to the peasants rules of operation whose adoption conditions the benefit of subsidies. These rules relate at the same time to the volume and the quality of the products, the use of fertilizers, the food of the animals, etc.

Measurements as regards breeding, following the crisis of the " insane cow ", are a perfect example of regulation out of agricultural matter (and medical). Thus, the policy of the authorities, national and European, strongly delimits the framework economic and financial of the agricultural activity, therefore of the activity of the agricultural cooperatives.

iii. *The democratic operation of the agricultural co-operatives*

Berle and In theory, democratic operation, a fundamental idea in the co-operative doctrines constitutes a means which reduces the conflicts in the co-operative company. Initially, the fact that the associate's co-operators, the administrators and the president share the same ethical values constitutes a significant element, which without removing opportunism contributes to reduce it.

Indeed, in a homogeneous group founded on a common ethics, the deviating behaviors are rather weak, because the risk of discredit is great. In addition, the statute of associate authorizes any member to have a right of permanent glance on management. In the same way, its right to information is permanent, which authorizes the criticism of the actions carried out by the company. Combined with the effective role of the assembly in the life of the co-operative, these elements show well that, in theory, democratic operation is a means to reduce the conflicts of interest between associated in this type of company.

b) The resolution of the conflicts and mechanisms of control

They are here two types of conflicts:

- Conflicts between owners (including the administrators and the president) and their " agent " which is the director;
- Conflicts between the director and the other partners.

i. *Conflicts between the owners and the director*

Insofar as the administrators and the president are in situations close to that of the others associated co-operators, the study will be limited to the conflicts between the director and the associates.

The complexity of the co-operative business management requires the recourse to managers. In the agricultural cooperatives, they occupy of the posts of frameworks, but especially of director. The director is in theory a collaborator of the president of the co-operative.

However, in practice, because of its competences, it has a true decision-making power. What can allow him, because of asymmetry of information, to be in position of force, at the same time vis-à-vis the president, with the administrators and the associates.

In such a case, it can become the true holder of the capacity and thus compared to the officers of the company by actions. In the operation of these companies, the real capacity of decision is held by the leaders, holders of information and competences.

However, the behavior of these leaders is limited by the disciplinary mechanisms which the financial markets and the "market of the leaders constitute". If the financial markets do not have any effect on the director of an agricultural cooperative, such is not the case of the market of the leaders (it is about the labor market for the recruitment of the leaders). But

[9] P.A.C.: Common Agricultural Policy

the leader can deploy a strategy of rooting, which "supports that the leaders who have a solid majority of the capital, escape any control and can thus manage from a contrary point of view with the maximization of the value"[10] .

The strategies of rooting of the leaders aim at returning the cost of exit of the dissuasive leader for the associates, which encourages them to maintain it in function.

But, in the case of a co-operative, the behaviors of rooting are certainly possible, but difficult to implement. Initially because, in a co-operative, the associates are co-operators and thus left fascinating the activity of the company, which enables them to exert a power of direct monitoring on the leader. In addition, directing it cannot replace the contractor, because this role is allocated to the members of the co-operative.

Thus, its room for maneuver as regards investment in credits which could be beneficial for him with the detriment of the associates is extremely weak. With this addition the knowledge which the members have likes competence as regards fixing of remunerations, promotion, etc.

Lastly, the co-operative can always set up a system of profit-sharing at the results which could direct the action of the director (and others paid) towards the achievement of the objectives of the co-operators. Thus, various mechanisms contribute to control the behavior of the director of a co-operative and to reduce its discretionary capacity.

ii. *Conflicts between the director and others partners*

The other partners can be suppliers, customers, lenders, etc. Only the relations with the lenders constitute relations of agency. It should be stressed that the co-operatives have recourse, in a more frequent way at organizations of co-operative credit. What means, that they are organizations having the same ethical references as the agricultural cooperatives.

These organizations often have relations with the president of the co-operative, which means indirectly with the member's co-operators, which return the role of the less eminent director.

In addition, even if the true decision maker is the director, the contractual devices on the matter, the practices of the organizations of co-operative credit and the values of reference of the co-operative world reduce the costs of agency. Thus, the agricultural cooperatives appear as organizations whose form of government contributes to reduce the conflicts of agency and thus the costs of agency.

[10] Charreaux, G(1991) « Property Structure , Agency Relation, And Financial Parformance »Economic Review, Flight 42, 1991.

V. Conclusions

The question of the firms' governance does not relate to only the companies dimensioned out of Stock Exchange or the multinational firms, but all the organizations in which exists a separation between managers and owners. The agricultural cooperatives constitute, for this reason, a significant example of these organizations. Indeed, in these companies, one notes that the members (peasants), even if they intervene in the management of the co-operative are not always the true decision makers.

Our objective, primarily treat the divergences of interests in the agricultural cooperatives by taking account of the co-operative mechanisms contributing to reduce where to solve these conflicts. Indeed, the agency theory, through the model "shareholder" is useful to describe the contractual relations between all the speakers and to explain the government of the agricultural cooperatives. However, the agricultural cooperative is a "Contracting nexus" which is the place of crossing of several fascinating parts, whose interests can diverge.

Thereafter, the economic theories of the contract contribute to characterize the relations between these fascinating parts and to propose an interpretation of it.

The conflicts between the associated owners and leaders are limited in the agricultural cooperative: the conflicts between associated co-operators and administrators (including the president) are of a weak range because of the low divergence of interest between the parts (economic identity of situation, even professional culture and homogeneous group).

Then, the conflicts between owners and director (or top executives), the strategies of rooting of the leaders are difficult to implement, for several reasons. Initially, the participation, with the daily newspaper, of associated the activity and the operation of the co-operative, which enables them to supervise the business management.

The activity of monitoring of the administrators and the president, who are also decision makers. Lastly, the director incarne not the function of contractor which returns to associated and with their elected officials.

Lastly, as for the conflicts of interest with the lenders, the latter often belong to the co-operative movement (co-operative banks in particular) and finalize the contracts with the president of the co-operative. In addition, the practices of these organizations and the values shared contribute to reduce the costs of agency.

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Comparative, Contrastive, & Interpretive World Economic Systems: A Logico-Mathematical- Ethical - Scientific - Technological-Globalization (Lmestg) An Aperçu

By Samuel Sarri

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Abstract- *OBJECTIVES—After reviewing this abstract, you shall be empowered to:*

- Define the main properties or features of Feudalism (Fm), Capitalism (Km), Socialism (Sm), Communism (Cm), and Globalization1, 2 Capitalism (Kgm).
- Identify the five (5) chief types of Km, as the domineering, or hegemonic, world system (order, disorder) of economic conduct. Namely: i) Consumption Capitalism (Kcm); ii) Production Capitalism (Kpm); iii) Hybrid, or Mixed, Capitalism (Khm); iv) Family Capitalism (Kfm); and, v) Transition, or Frontier, Capitalism (Ktm).

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- Explain, explicate, or interpret the economic arguments and facts behind the "hows", "whys", and "whens" of systemic change, evolution, and devolution, predicated, in particular, upon such major socio-political, cultural, religious, historical, and economic laws, as the major law of accumulation, or resource reinvesting (or the lack thereof) in engendering economic change (or constancy), positively responsible for inventions, innovations, entrepreneurships, technological breakthroughs as well as economic growth, price stability, factorial employability (especially labor and capital), development, prosperity, and, potentially, global sustainability, a "green world", security, andplanetary peace.
- Delineate the five (5) main characteristics of Km &Kgm.
- Utilize the crucial notion of production possibility curve (PPC), production possibility Frontier (PPF), or production possibility engineering (PPE) to illustrate the underlying themes of scarcity, opportunity cost, incentives, equilibrium, and more—raisons d'être of that, how, why, when, and where individuals, organizations, nations, and the globe make the choicesthey do, viz., Economics being the Science & Art of Rational, Behavioral, and Neuro-Economic choosing!
- Have a working economic epistemology (knowledge) of the following concepts, notions, terms, and words. Hence:

System, foundations, dynamics, goals or ends-in-view, system icinter section, internal forces (constraints), and external forces.
** System thinking, intra-dimensions, inter-dimensions.
** Markets, marketing, and marketology (the LMESTG of markets).
** Consumer sovereignty or consumer kingdom.
** Markets efficiency, efficacy, cost-effectiveness, or optimization.
** Paradigm (intra-, inter-), laisser-faire, minimax, and maximin.
** Externalities—negative, positive, zero- or neutral.
** Internalization, externalization, or neutralization.
** Law of accumulation.
** Market failures, shortcomings, or imperfections.
** Lobbying, logrolling, and public choice theory (PCT).
** Nation-State, Government activism, interventionism, *dirigism*, welfare state capitalism, state capitalist monopolism (SCM).
** Selfishness, greed, self-interest, invisible hand (IH), "visiblehand (VH)." Laisser-faire, Laisser-aller.
** Physiocracy, Mercantilism, Classicism (Liberalism, Marxism), Neo-Classicism, Keyensianism, Economic Darwinism, Institutionalism, Supply-Siders, Chicago Boys & Monetarists, Neo-Marxism, Structura-lism, Paris School ofEconomics Existentialism, Eclecticism orSystem Convergence, Globalism, Hyper Globalism, Hypo-Globalism, Anti-Globalism.
** Enclosure Movement, Birth of Nations, Economic Metamorphoses, Protestant Ethic.
** Hegemonism (Hegemony), Colonialism, Imperialism. Neo-Imperialism,
** Specialization, Comparative Advantage (Absolute, Relative, Intra-/Inter-
** Islamic Economics Paradigm, IEP
* Rethinking Economics & Globalization System Economics

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I. The Concepts of a 'System' in General & 'Economic System' Inparticular

a) A System, in general

As mentioned, *ab initio,* in both of our required books, Microeconomics Essentials & Globalization, a Socratic Methodology (SM), a System Thinking (ST), or, more precisely, a Logico-Mathematical-Ethical-Scientific-Technologic-Globalization (LMESTG) approach will be embarked upon to dialectically *delineate, diagnose*, *problem-solve, and apply* our system microeconomic thinking to individual consumers, producers, firms, individual government entities (federal, state, local), world institutions (World Bank, WB; International Monetary Fund, IMF; World Trade Organization, WTO; World Health Organization, WHO; International Labor Organization, ILO; and hundreds more), philanthropies, non-government

organizations, and so forth. So, what is this concept of a "system" (non-system), anyhow?

Etymologically, the word system emanates from the Greek term *συστηυα* and, later on, from the Latin term *systēma*, which both reflect the idea of an aggregate (a set, a collection, an ensemble) whole composed of numerous ingredients, or parts, that interact with one another, statically and dynamically, in an op[en or a closed manner. Schematically, thus:

CONTEXT

A SYSTEM F ➔➔D

N

IF EF

CONFINES

Broadly, a system is composed of five (5) major elements ceteris paribus, CP or residual variables, or epsilon, ω. Namely:i) foundations, F (anatomy, structure, …); ii) dynamics, D (movements, regularities, …);iii) functions, N (goals, ends-in-view, …); iv) internal forces, IF, or impediments; and, v) external forces, EF, or constraints, spacio-temporally. Symbolically, a system or S equates with, thus:

$$S = F + D + N + IF + EF + \omega$$

Moreover, systemic thinking, or system analysis, or ST may apply à la Aristotle (384-322 BCE) 1 to theoretic sciences (e.g., logic, pure mathematics, metaphysics, etc.), practical sciences (morality, economics, politics, law, etc.), and productive sciences (engineering, tool-making, etc. Alternatively, ST applies to virtually all knowledge, or epistemology (including our subject matter, Microeconomics), including, but not limited to: systems science, systems modeling, systems technology, cybernetics, thermodynamics, systems law, systems politics, systems medicine and health care, systems geopolitics, and so forth.

b) An Economic System, in particular

As described prior, an Economic System, ES is an interplay of F, D, N, IF, EF, and ω2. Essentially, Liberal and neo-liberal (from the founding fathers of Capital Thought, Adam Smith (1723-1790), JS Mill (1806-1873), David Ricardo (1772-1823) and more 3all the way to present proponents, define an ES as a dynamic interplay of supply (production), demand (consumption), and market distribution, logistics, or clearance (equilibria, disequilibria) of goods, services, e-goods, e-services as well as the allocation (apportionment) of resources (labor, land, capital, entrepreneurship) in a society (national, regional, international, and/or global. It should be borne in mind, however, that many a current economist (especially, in Western Europe, Africa, the Middle East, Latin American, Asia, and to a some small extent in North America) refers to

Economics as Political Economy (French, *L'Economie Politique;* German, *Politischen Economie*; Spanish, Italian, Portuguese, *Economia Politica*; Chinese (simplified), *Zhèngzhijīngjii*; Japanese, *Seiji keizai-gaku*; Korean, *Jeongchig-yeongjehag*; Scientific Arabic, *Al Iqtissad Assiyassi*; etc.), viz., the inherent interface between economics, politics, law (and even history, sociology, anthropology, psychology, …) and how and why their underlying institutions (all in a broader hypersystem1) cause their emergence and development in traditional (feudal or agrarian or rural), capitalist, socialist, communist, eclectic or convergent, and global scenes of production, consumption, and distribution of goods, services, e-goods (cyber, mobile, digital,…), and/or e-services. Other sub- or related-issues include, but not limited to, economic information and IT, risk management and engineering 2, transactional theory, property rights, the lemon problem, labor economics and unions, creative destruction, static and dynamic efficiencies, feminist capitalism, gender discrimination, globalization, and innumerable other institutionally- and evolutionarily-orientated themes.

At the other end of Classicism, one must observe the incredible, revolutionary paradigm of brilliant economist, Karl Marx (1818-1883). Marx defines an ES, e.g., Capitalism as a "doomed" system, predicate on a structural contradiction amongst those who '*really'* own the *means of production*, MOP (the workers or the *prolétariat*) and those who '*alienate*' the workers from their MOP, the non-workers, the capitalists (the *bourgeoïsie).* The result is an "unequal" *rapport of production* between these two classes—the proletariat, which after Smith, and particularly Ricardo, Marx developed his theory of *labor value,* according to which only labor determines the production and outcome-process of goods and services. Marx dubs this economic system the *mode of economic production* (means of production + social rapports of production). In other words, through the alienating (or estranging) behavior of the bourgeoisie, workers are subject to an "expropriation", termed a *surplus value, SV.* This SV/[constant crystallized labor (say, machinery) + an Î actual living labor] shall tend to "destroy" the capitalist system, from within, and morph it unto a socialist, then a communist economic system. In Marx's own terminology, it ensues, thus:

> The communist disdain to conceal their views and aims…they openly declare that their ends can be attained only by the forcible overthrow of all existing relations. Let the ruling classes tremble…the proletarians have nothing to lose but their chains. They have the world to win. (*Communist Manifesto*)

Evidently, the systemic Marxian theorizing is powerful and challenging, as it spreads across the globe, especially throughout the former Soviet Union and its ex-Council for Mutual Economic Assistance, COMECON (1949-1991) that comprised numerous countries, specially from Eastern Europe, as a systemic economic response to the Western Europe's Organization for European Economic Cooperation or the European Union, EU today. And, as *partially* sound the Marxist system, it failed to predict the Capitalist resiliency, in light of the 20th and early 21st centuries' improvements and developments, including worldwide benefits to workers, pension and retirement systems (IRAs, 401 (k), social security, equity participation, unions, the *Great Society*in the USA, Mixed Capitalism, and the Economic Welfare States of Europe (and to some extent, in many countries of Africa, the Middle East & North Africa or MENA, Asia, and Latin America).

In a nutshell, an ES is an ensemble of systematic (not systemic), or methodical, algorithms, procedures, and regulatory mechanisms and routines aiming at achieving a particular activity (ies) to perform a production (distribution, consumption, …) function and/or solve a specific problem (*problematics*). In the words of businessdictionary.com (BDC), it ensues, thus:

> [An economic, or business, system] is an organized, purposeful structure that consists of interrelated and interdependent elements (components, entities, factors, members, parts, etc.). These elements continually influence one another (directly or indirectly) to maintain their activity and the existence of the system, in order to achieve the goal of the system.

BDC continues, thusforth:

> All systems have (a) inputs, outputs, and feedback Mechanisms, (b) maintain an internal steady-state (called homeos-tasis)despite a changing external environment, © display properties that are different than whole (called emergent properties) but are not possessed by any of the individual elements, and (d) have boundaries that are usually defined by the system observer…Although different types of systems (from a cell to the human body, soap bubbles to [micro-/macro-/meso-/cyber-] galaxies, ant colonies to nations) look very different on the surface, they have remarkable similarities. At the basic level, systems are divided into two categories: (1) Closed systems: theoretical systems that do not interact with the environment and are not influenced by its surroundings…(a sealed jar). (2) Open systems: real world systems whose boundaries allow exchanges of energy, material and information with the larger external environment or system in which they exist…(a company).

II. Feudalism, FM, or the Systemic Antidote to Capitalism, km

The word, or adjective (predicate, epithet, etc.), '*feudal'* originates, variably, in Latin, Arabic, German, and French. The father of our Discipline/Science, Adam Smith, coined the dyad "feudal system," in his notorious book, Wealth of Nations (WN), from the Latin root *feodum*1, as the antidote, or opposite, or logical contrary, to the Capitalist System. Precisely, Fm was the domineering economic and socio-political system of Medieval (Middle Ages, 9th-15th centuries) Europe 1. Nobility, the Clergy, and the Peasantry are its three (3) interactive, cultural, economic, and political properties, or defined descriptions, with the lords and priests as the hegemonic (domineering, tyrannical) top and the peasants, or serfs, at the bottom.

Exactly, two major feudalistic obstacles stopped any economic and socio-political progress 2. First, Fm disallowed profit-making or material acquisitions. If you were a merchant, or a trader, during said-epoch, and you attempted to make profit on your capital investment, you may, then, be subject to fines, imprisonment, or outright execution. In fact, even in this country, as early as in 1639, Boston, MA, records show that innumerable traders were by the dark, ecclesiastic (church) forces merely for the "crime" of making profits on their capital, acquired merchandises, and/or commercial investments! Additionally, banking was considered *usury,* thus, "against" the Scriptures, though, done fairly capitalistically, it would have boosted savings, accumulation of capital or investing and reinvesting, and, ultimately, triggered growth and economic development. Hence, it might have, earlier, decreased, or eradicated, economic stagnation, constancy (almost no economic changes for some 1000 years), famine, and poverty. Alternatively, the basic laws of Km, barring exploitation and alienation, including, but not limited, to the laws of incentives, accumulation, innovations, inventions, and breakthroughs might have manifested historically early, provoking thereby the collapse of FM, inception of an early Renaissance (from French the *rebirth* of Classic philosophy, science, economic development, and information and technological revolutions. Second, Fm intolerably held the medieval *status quo* in all its customs, traditions, mores, fanaticism, hyper-religiosity, uncritical thinking and doing, and theological extremism. For instance, over in Valence, France, in 1540, more than 70 merchants were hanged for the "sin" of importing calico cloth.

To sum up, only *physiocratic*(land ownership), *mercantile* (gold and silver stored in the cellars of nobility and church as well as tariffs and import restrictions), and *religious indoctrination*views and beliefs counted; therefore, ruled. Philosophico-scientifically, economically and politically, we awaited

the inception of Humanism, Neo-Skepticism, Baconian (Francis Bacon: 1561-1626) Scientism, Hobbesianism (Thomas Hobbes: 1588-1679), Rationalism (Rene Descartes: 1596-1650; Baruch Spinoza: 1632-1677; and, G.W. von Leibniz: 1646-1716), Empiricism (John Locke: 1632-1704; George Berkeley: 1685-1753; and, David Hume: 1711-1776), Critical Philosophy (Immanuel Kant: 1724-1804), the Enlightenment, etc., 1, before corroborating the birth of modern capitalistic ideas and actions, or praxis, as well as the emergence of modern Km.

Capitalism, Km, or the Market Economy, or the Free Enterprise System: Genesis, Evolution, Typology, Traits, & Resilience

Genesis & Evolution—The Enclosure Movement; Adam Smith

a) The Enclosure Movement, EM

This economic and socio-political metamorphosis was doomed to self-destruct, just as predicted throughout Dialectical (Thesis-Anti-Thesis-Synthesis, and so on ad infinitum) Thought or Philosophy, from Socrates through Plato to Hegel, Marx, and so forth. Basically, during the 15th& 16th centuries, European feudal nobility began asking their peasantry (serfs, slaves) to morph their lands from small crops production to raising sheep, thus, producing sheep for the potential enormous demand of wool. Precisely, the lord of the manor would seek the monarchy's military assistance and vacate serfs from their land, with force or violence if necessary, generally with 24 hours or brutally randomly. Disinherited serfs would roam around and start to riot against the feudal establishment. In one particular uprising, some 3,500 peasants were slaughtered. And, another horrible enclosure happened in 1820, when the Duchess of Southerland violently de-possessed 15,000 small farming families of their property, therefore, enclosed 794,000 acres to graze 130,000 sheep! As a result, the EN indirectly engendered a large population of *surplus* workers, manufacturing thereby, at subsistence wages, a large outputs of wool products. The sustenance wages led to huge economic profit surplus accumulation by the emergent new capitalist class, in turn, reinvesting these surplus values to provoke monumental economic industrial growth, over in Europe and abroad.

b) The Birth of Nation-States

With the genesis of industrial, or manufacturing, capitalism, European monarchies ushered in and consolidated centralized powers, thereby encouraging the emerging industrial class to take risks, at home and abroad (British East Indies, Dutch East Indies,…); develop colonies over in Africa, Asia, and South America; and, establish a single currency (the British pound, the French Franc, …), a single national language, and a dominant power-state or nation-state, responsible for protecting the property rights of the new capitalist class through the enforcement of private, individual and corporate, laws and the creation of a central and regional judiciary (courts) system. Exactly, this new nation-state 1 began in 1592 (Globalization capitalism or Kgm, as G1 all through 1800; then, as G2, from 1801 to 2000; and, then, G3 from 2001 to the present) with the exploratory voyages of Christopher Columbus, financed by Queen Isabella of Spain and Sir Francis Drake, funded by Queen Elizabeth of England.

c) Protestant Ethic & Its Developments

With the Renaissance 1, particularly Humanism (Da Vinci, Angelo, Pico, …), Skepticism & Neo-Skepticism (Machiavelli, Montaigne, Pascal,…), Reformism (Luther, Calvin, Erasmus,…), and Scientism (Bacon, Hobbes,…) rational, empirical, and critical philosophies began developing and with them Economics, Politics, Sociology, and such, circumventing thereby the two archaic concepts and practices of Fm or the pre-capitalist régime (French for system, establishment, status quo, politico-economic order,…), viz., tradition and the command of the state. Specifically, during the Middle Ages, Europe was dominated by the absolute co-authority, frequently irrational and brutal, of the monarchy and church. Alternatively, the Roman pope and monarchs exerted total control over people and their resources, always questioning and even executing risk takers, businesses, and entrepreneurs. Profit-making (the cornerstone of Km), banking, private initiative, accumulation, etc., were considered "sins against providence or God." Nonetheless, the new Protestant philosophy and ethics (see, also, 20th century, great sociologist Max Weber) transcended such intellectual darkness, replacing the old, stagnant ideas with such novel concepts as using one's God-given talents to produce goods and services, inventing and developing, as a consequence, the Earth and its people, including wealth creation, risk management, capital accumulation, and the like. Now, adequate wealth becomes a blessing, and, with a little irony, rich people are viewed as saintly.

III. Capitalistic Laws, Regularities, and Typology

- *Accumulation or Profit-Reinvestments, Tech Invention, Innovation, Breakthroughs, and the Monumental Growth of Capitalism*

Indeed, the Law of Accumulation (LoA) is sine qua none to galvanizing the interactive processes and outcomes of any mode of production, distribution, and exchange of information, energy, and resources. The small entrepreneur MUST reinvest a portion of their profits, thus, plowing it back, or reinvesting it, into their production cycle to grow their material and service foundation, boost their economic dynamics, and achieve their well-designed, engineered, and realized

economic goals. Mr. Walton plowed back all of his profits into Wal-Mart (WMT), the ginormous global conglomerate of today! So, virtually did/does Ed Lowe, Henry Ford, Bill Gate, Warren Buffer, Slim Carlos, Steve Job, and hundreds, or thousands, more! And, along with continual, scientific and technologic, inventions, innovations, and quantitative-qualitative breakthroughs, local and global societies reap the fruits—growth, development, globalization, and, hopefully ethically, planetary sustainability, prosperity, security, and peace.

- *Self-Interest*

IbnTaymiya, IbnKhaldoun, Adam Smith, David Ricardo, Karl Marx, Alfred Marshall, and other world social and economic thinkers ALL viewed the Law of Self-Interest (LoS), as an inherent, evolutionary attribute of human self-motivation, work and self-discipline, and, ultimately, wealth creation for the initiator producer, consumer, or investor and society at large. For nobody will look for the interest of another but oneself. Alternatively, the old adage goes, thus: "no one will scratch your back except your own hand!" And, please one should not confuse this socio-psychologico-economic law of human nature with one's selfishness, greed, or the like. Even at the age of 74 or so, Sam Walton, continued working not just to create more wealth, but to promote his own self-development, social ethics, charitable inclinations, positive mental attitude, and participating in a greater, global good.

If I am 21 and begin investing $100/month, at, say, 10% average annualized return per annum, there exists a high probability that by the time I am 51 I shall become a millionaire ceteris paribus. In shorty, I am motivated in mission, vision, capitalist culture, and work beliefs, or self-interest, in enhancing my wealth creation position. And, in so doing, à la Smith, and with the assistance of an Invisible Hand, a world summumbonnum (a global collective good) shall obtain. Correspondingly, new products and services, technologies, information, epistemologies, and scientific discoveries, worldwide, while everyone is working the same, shall materialize.

- *Market Efficiency, Optimization, or Zero-Waste Management*

Another fundamental law of Km is the readiness, willingness, and ability to be efficient, optimum, or minimize the costs (explicit and opportunity) of scarce resources of nature, labor, capital, time, talent, technology, scientific manifestations, information, time-space continua, and energy. That is, because of another underlying law, termed competition. Markets of goods and services are unforgiving should one not constantly enhance the quantity and quality of outputs to engender profits, which, in turn, are reinvested to relentlessly expand the systems and subsystems of production, logistics, distribution, consumption, investing, accumulation, and economic renewals ad infinitum. Succesful entrepreneurs, producers, consumers, investors, and every microeconomic player, globally, are those who embark on calculated (LMESTG) risks, minimize costs and maximize competitive scarce profits (the minimax theorem), and maximize their utility while minimizing/eliminating their disutility (the maximin theorem.) Within this sum of minimax and maximin, the capitalist law/outcome of laisser-faire obtains, provided the other engines of polity, society, and culture are consistently interactive with the capitalist mechanisms of the economy.

- *Consumer Sovereignty or Consumer Kingdom*

Simply put, it is the demand that engenders the supply contra the Say's law, which proposes the reverse. Exactly, if the consumer is not lured to XYZ product, service, information, knowledge, or what have you, then the producer will be literally kicked out of the marketplace of ideas, products, services, etc. Namely, the consumer is queen, king, or is the one who dictates whether firm ABC, or output XYZ, shall stay or die out. Essentially, if the consumer decides, having a limited budget and other constraints, to stop shopping at Wal-Mart, Target, Apple, or Harvard, then these entities will simply vanish. "It is the consumer, stupid!"

- *Market Failures & the Role of The Capitalist Governments*

The free market-based system logically produces its own limitations, and, à la Marx, may lead to its own exacerbated contradictions, especially between the proletariat and the bourgeoisie, and, ultimately its own self-destruction. Without delving into the voluminous Marxian dialectics of the capitalist mode of production, liberal "bourgeois" economists classify the failures of capitalism onto three. First, the lack of pure and perfect competition causes produced goods and services to be inefficient; thus, non-competitive and resource wasteful. Impure and unnatural monopolies will ensue; absurd and unethical business conduct shall result; and, technological and economic development will remain unchanged or stagnant (see the Great Recession of 2007-2009 and its global, attendant negative consequences). Second, the ree market may fail due to externalities—economic external effects (negative, positive, or neutral) that impact a non-involved, local or global, transactionalist. For instance, take the case of negative externalities (pollution, noise, deforestation, …). A neighbor is burning his old car tires and you are adversely impacted by the noxious carbon and burnt fuels. The cost to society is much higher than the benefits received by the neighbor air polluter. Succinctly, the culprit must absorb the costs ("cost internalization") only if, and when, the proper ecologic law enforcement intervenes, viz., the market will not do it for you! Third, the free market operations fail when it is unable, non-ready, and unable to supply public goods

and services: education, justice, national security, public infrastructure (dams, bridges, street lights, …), environmental protection, a green world, and world security and peace.

The US Federal Government followed the dictates of Adam Smith when it broke up Rockefeller's trust, Standard Oil, in 1914 and other rubber barons, by introducing thereby Anti-Trust Laws (Sherman Act, FCC, Clayton, etc.) Here, in Southern Nevada, for instance, the federal government (US Bureau of Reclamation) built the Hoover Dam, starting in 1931, with a Commission Date of 1936-1961, at $49 million and with inflation at $833 million, based on the Colorado River, to control flood, provide irrigation water, and produce hydroelectric power to Nevada, Arizona, and California.

In a nutshell, said-laws are crucial to the colossal growth of Km, in its differing types of Consumption, Production, Mixed, Family, and Frontier (subject of another paper), globally, and integratedly, of course.

IV. Socialism & Communism

First, the Socialist Mode of Production, or simply, Socialism, Sm, is that system of production, consumption, exchange, and logistics that zeroes in upon the means of production being the ownership of the community, society, or the national government. Equivalently, SM an economic system in which property and forces (means) of production are collectively owned and/or controlled. Decision-making is in the hands of society, the community, or the national government. Namely, the government will make all economic decisions, in lieu of private individuals in a capitalist system.

Notice, moreover, that SM may be: i) a *Plan Sm*; or, ii) a *Market Sm*. The former entails that allocative, distributive, and engineering (technical) bureaus, or functions, are determined, or commanded, by a central authority. The latter implies that while the means of production are owned by the national government, their affectation obtains, somewhat, through the market laws, or regularities, of demand and supply.

Indeed, one of the chief contributions of Karl Marx, main founder of the modern Socialist Economic Thought, is his Dialectics of Economic Evolution. Essentially, Marx argues that every economic system, save for pure communism (which is viewed as a theoretic reference), is in a process of constant change. The Capitalist Mode of Production, CMP, of 1776 would be enormously different in 1876 and virtually radically different in 2014. Marx, further, predicted that all capitalist countries would eventually metamorphose onto a Socialist, or, even, a Communist physiognomy, albeit history judged him wrong.

Nonetheless, it is epistemically and practically misleading, today, to classify the domineering world economic systems as capitalist per se. A more accurate LMEST-G-like description would be *Hybrid*, or *Mixed, Km.* For instance, presently, only about 25-30% of the US output is government expenditures. In France, Sweden, or the UK it is estimated at approximately 40-50%. Only in Cuba, the public sector holds close to 100% of the real output or GDP.

Second, Communism, Cm, is merely a theoretical framework, whether à la Marx, Engels, or both. Exactly, Marx, in his diagnosis of 'Scientific Cm,' nomologically deduces that, ultimately, even Sm may morph onto an *Utpia-like* system whereby coercion, in all its forms, will cease to exist; the proletariat (the community) will unite and be in charge; bourgeois morality will disappear; and, all people shall become free and unchained. In Marx's own parlance, under this 'final' stage of economic evolution, there will ensue the maxim; hence:

> "From each according to their ability and to each according to their needs."

Precisely, at this stage, dubbed *matured Cm,* machines will do most, if not all, the work. Therefore, people will attain the material goods they desire. People will, then, live in harmony, viz., free of the rule of any government or despot. Alas, most economists, from all ideological bents, view Cm as a 'fanciful utopia.' People, today, when they refer to the few existing communist regimes (Cuba, North Korea) as well as those of the ex-USSR, COMECON, and, somewhat, current China, they are pointing to totalitarian political structures or régimes.

V. The Islamic Economics Paradigm, IEP

Demographically, economically, and socio-politically diverse, the Muslim World, today, is represented in 200 plus countries (60% in Asia, 20% in the Middle East & North Africa (MENA), and 20% in Africa, Europe, North America, and Latin America). Namely, ¼ of the world population, or 1 world citizen out of 4, currently, is, or relates to, Islam—all ethnicities; the Arab Muslims account for 1/5 the total only! Besides, some Arabs may be Christian, Jewish, Atheist, and so forth!! In a word, the Islamic World Economy is a global force to interact with, whether in terms of global trade, finance, forex, development, sustainability, prosperity, international peace, and more.

Exactly, during the Islamic Golden Age (about the 8th to the 13th centuries), philosophy, mathematics, sciences, the arts, and economics , politics, and jurisprudence/law flourished. Specifically, after the prophet's death, this new universal faith expanded to englobe most the Middle East, the Mediterranean, North Africa and Southern Europe, and a large geographic

mass of Asia. And, during the reign of notorious Abbassid dynasty leader (khalifa or lieutenant of God/Allah, 786-809 CE), Harunar-Rachid, Dar Hikma (House of Wisdom) was born and with itar-Rachid generously summoned thinkers, mathematicians, translators, physicians, and artists to compile and render all world knowledge (Greek, Persian, Roman,…) onto Classical (Formal) Arabic. Alas, such a prodigious corpus of epistemology, natural and social sciences (Economics, Political Economy, Legal Economy or Shari'a), and humanities and the arts was disintegrated, broken apart, or collapsed due, in large part, to the Mongol invasions, the Sack of Baghdad (1258), and, candidly, the internal intellectual laziness and divisiveness from within the Islamic world itself. Alas, nowadays, most of the Islamic nations are aspiring to an Islamic Renaissance and anthropo-economic adaptions to develop their human and natural resources, skills, and talent.

Classical Islam (based on the Qur'an and Hadith (Prophet's Sayings)), the bedrock for such a world paradigm, is predicated upon some pioneering Economics concepts and laws. Among these are the laws of demand and supply, elasticity, urbanization, growth, development, fairness and equity, *zakat* (Aumns, tithing, mandatory phalinthropy); *Gharar* (interdiction of chance, gambl; ing); *Riba* or usury; *U'rf*; and, especially, Shari'a (Islamic Economics Law & Jurisprudence—be it Sunni, Shi'', and various competing economic (*Iqtissadi*) and socio-political and legal sub-paradigmos or schools (Maliki, Hanafi, Hanbali, Shafi', etc.). Some pioneer Islamic Economists are, thus. First, Al Ghazali (1058-1111), a prolific writer (some 100 books plus) viewed Economics as linked to philosophy and theology, in general, and politics, law, psychology, history, geography, sociology, and anthropology, in particular. His diagnoses of market equilibria/disequilibria and elasticity have a modern ring to them. As a result, one may place him as the father of the Ghazali – Ricardo – Marx – Marshall - Samuelson-Friedman Theorem. Second, IbnTaymiyyah (1263-1328), a founding logician and economist, whom inspired, further, the law of supply-and-demand, as well as the laws of natural market, arguing, for example, therefore:

> If desire for a good increases while its availability decreases, its price rises. On the other hand, if availability of the good increases and the desire for it decreases, the price comes down.

One may dub this law the Taymiyyah-Smith-Ricardo-Marshall Theorem. Third, andprobably the most comprehensive economist, sociologist, historologist, and politicologist is the Tunisian, world scholar Ibn Khaldun (1332-1406). His notorious Muqaddemah (Prolegomena) and Kitab al-Ibar (History of the World) contain innumerable, original Economics principles and regularities. Amongst these are: population growth, human capital, technological expansion, money and exchange, prosperity, profit sharing dialectics, taxation, and, even, supply-side economics. Thus, the Khaldun-Ricardo-Marx-Keynes-Laffer Theorem.

Take, for instance, IbnKhaldun's Economic Growth Theory. He maintains, thus:

When civilization (population, U'mran, Sukkan) increases, the available labor again increases. In turn, luxury again increases in correspondence with the increasing profit, and the increasing profit, and the customs and needs of luxury increase. Crafts are created to obtain luxury products. The value realized from them increases, and, as a result, profits are again multiplied in the town.

This great, pioneer Economics and Socio-Politics, Islamic thinker, IbnKhaludn, diagnoses the full economics circular flow, mesoeconomically, stating thereby; hence:

> [with economic development] [p]roduction there is thriving even more than before. Abd so it goes with the second and third increases. All the additional labor serves luxury and wealth, in contrast to the original labor that served the necessity of life.

It ensues that some 5 to 6 centuries, prior to Western Economics Classicists, both liberal (Smith, Riocardo, Say, Quesnay, Bastiat, Malthus, and more) and socialist (St. Simon, Fourier, Owen, Proudhon, Marx, Engels, Lasalle, …, as well as Keynesians, Monetaristis, Supply Siders, Evolutionists, etc., Muslim economists envisioned and illustrated numerous Economics Laws and Approaches , within Microeconomics, Macroeconomics, and Globalization Economics.

In a nutshell, to LMESTG-like compare, contrast, and interpret amongst worldwide paradigms, one need, ab initio, to simply define and characterize each system separately; then, it ensues its heterogeinities with the others. Precisely, in employing the standards, predicates, levels, and virtues of logic (clarity, consistency, quantity, quality, time, space, relationships, advanced critical thinking, integrity, humility, to name a few), mathematics (symbolic logic, set theory, calculi,…), ethics (teleology, deontology, axiology, prima facie duties, reflective moral equilibria, casuistry, feminist ethics, …), science (problematics, hypotheses, modeling, predictions, theorizing, feedbacking, forward backing), technology (applied logical and empirical knowledge, inventions, innovations, revolutions,…), and globalization (G 1.0, G2.0, and G.3 and beyond, along with the corresponding economics, trade, finance, and forex statics and dynamics) ONE will easily infer that an Ecclectic Economics Thought & Practice, worldwide, is long overdue. It, indeed, implies Rethinking the

Economics Discipline—in its logic, epistemology, ethics, metaphysics, and aesthetics. This shall be the subject of my future books on Globalization Comparative Economic Systems—New World Philosophy & Practice.

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Pugnacious Reformation or "Civil War"? A Reconsideration of the American Civil War

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Abstract- Civil war in its generic outlook implies a war between citizens of the same nation or a war within a nation. This article is a reflection on the American civil war in its origins, nature, scope and aftermath. The thesis in the paper conflicts with the label (American Civil War) given to the violent upheaval that featured between the Southern and Northern states of America in the 1860s. It posits that the label emanated from a facile outlook;that a more in-depth and critical analysis of the occurrence will occasion the birth of a healthierdepiction of the event. The paper therefore, clinches within the premises of the aforementioned that the label- American Civil War is a misnomer; it suggests that a more befitting term could be 'American Pugnacious.

Keywords: *America, civil war, pugnacious reformation, economy.*

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Pugnacious Reformation or "Civil War"? A Reconsideration of the American Civil War

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Abstract- Civil war in its generic outlook implies a war between citizens of the same nation or a war within a nation. This article is a reflection on the American civil war in its origins, nature, scope and aftermath. The thesis in the paper conflicts with the label (American Civil War) given to the violent upheaval that featured between the Southern and Northern states of America in the 1860s. It posits that the label emanated from a facile outlook;that a more in-depth and critical analysis of the occurrence will occasion the birth of a healthierdepiction of the event. The paper therefore, clinches within the premises of the aforementioned that the label- American Civil War is a misnomer; it suggests that a more befitting term could be 'American Pugnacious.

Keywords: America, civil war, pugnacious reformation, economy.

I. Introduction

The sixth decade of the nineteenth century marked a period of violent revolution in the American society; it was the period that witnessed what has been commonly referred to as the American Civil War. In broad terms, civil war could be described as an armed conflict causing more than one thousand deaths, challenging the sovereignty of an internationally recognized state, occurring within the recognized boundaries of that state, involving the state as one of the principal combatants, including rebels with the ability to mount an organized opposition and involving parties concerned with the prospect of living together in the same political unit after the end of the war.[1]

Events of such have been a reoccurring experience in global history. The American situation between 1861 and 1865 was not a deviation from this description, it thus reveals why the American Civil War was also regarded as the war between states. The American Civil War was indeed a key event in the history of America.It occasioned grave mayhem and outrageous scourge in the American human and societal civilization.

The war was set on stage when the confederates' army attacked Fort Sumter on12th April, 1861 and it was brought to an end on 9th April, 1865 when General Lee surrendered to General Grant of the Union Army at Appomattox Court House. The war was in all regards the first modern war with an unprecedented scope; it has been widely regarded as the first total war in global history as a result of the entanglement of all factions of the society. George Brown and David Shi share a similar view when they argued that:

> *The civil war was not neatly self-contained; it was a total war, fought not solely by professional armies but by and against whole societies, farms became battlefields, cities were transformed into armed encampments, and homes were commandeered for field hospitals… was modern in that much killings was distant, impersonal and mechanical.*[2]

Fundamentally, it must be stated that the American Civil War was a combating and pugnacious contact or armed conflict between the seceding American Confederate States of the South which was made up of the eleven slave states of the South and the North which housed the American federal polity; it represented the Union of the American states.

Thepaper attempts a review of the label (American Civil War) accorded to the socio-political challenge that bedevilled the American civilization betwixt 1961 and 1965. The paper is presented thus: First, it tries to survey the socio-political and economic formation of Americabefore the war, this constitutes the background to the war; second, it examines the aftermaths of the war in restructuring the American geo-political, economic and socio-cultural character; third, it attempts an economic discourse on the war. Finally, it concludes the paper by summarizing the key thesis of the article.

II. American Civilization before the War

The American society had developed structures and institutions of political, economic social and cultural relevance to sustain the existence of its civilization before the occurrence of the civil war. After all, the American Civil War (1861-1865) could not have erupted as a result of compatibility, consonance or convenience. Indeed, its occurrence could be associated to dynamic complexities.

Slavery constituted an intricate factor in the occurrence of the American Civil War. The institution of slavery was inherent in the origin of the American state; traceably, the 1945 annexation of Texas during the epoch of 'Manifest Destiny' welded slavery with the American system. The South had a slave oriented

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economy and social formation which was incessantly attacked and condemned by the abolitionist of the North of which majority were adherents of the republican party. To the white South this strategy trampled their Constitutional rights.[3]Thisgradually gave rise to a perturbed relationship between the Americans of the South and the North sides. In addition the slavery issue heightened the instability of American political formation as the differences between the Republican and Democratic Party became more seemingly irreconcilable.

The proliferation of anti-slavery sentiments in the North and among pious republicans as well as the southern low representation in the federal structure coupled with the radical chauvinism of African Americans following the Fugitive Slave Act of 1850 signalled daunting threats to the Southerners. On the other hand, the Northerners were sensitive to the increasing power of the federal government which could undermine sacredness of property rights in the future. This was another channel in the American formation that engendered regional tension.

Noticeable as slavery and the popular quest for the protection of States' rights in the American formation before the Civil war was sectionalism. In this context, sectionalism refers to the different economies, social structure, customs and political values of the North and South.[4] It was profound in the economic and religious fabric of the people; the South had an agrarian and slavery economic orientation, whilst the North had an industrial economy. This economic variation between the North and the South partly cumulated in the Civil War. In the religious sphere, the ideological disparity between the North and South over the slavery issue led to the division of dominant religious affiliations, i.e. the Catholic and the Presbyterian religious denomination in the South and the North.

The emergence of Abraham Lincoln as the president of the United States of America in November 1860 after defeating John C. Breckinridge who was the Southern presidential candidate further aggravated the fragility of the American political, economic and socio-cultural formation. Meanwhile, the policies of Lincoln been a republican, was anti-slavery which resulted in the secession of the South from the union of American states to form the Confederate State of America under the auspice of Jefferson Davis who functioned as the president of the confederacy. Notably, this action of secession was regarded as a rebellion to the federal polity and was utterly condemned. An attempt to reverse this was a forward march into war.

Thus far, the foregoing have been able to look into the origin, nature and scope of the American civil war, it therefore reveals that the civil war was engendered by the slavery question, antagonistic nationalism, property rights' and sectionalism among others. Apart from the aforementioned, it is apparent that economic dynamism and complexities was a fundamental underpinning influence to the eventuality of the Civil War. Hence, the contradictions in the American civilization before the civil war coupled with the quest to preserve the union of the American states resulted in the American Civil War.

III. Aftermaths of the 'American Civil War'

A war which historians have described as a total war and the first modern war in global history must have occasioned myriad of consequences on virtually all spheres of the American civilization. After all, Harold Faulkner attested to this when he advanced that "its effects upon our industrial, financial, and commercial history were profound".[5] The point of contention here is;what were the consequences of the American civil war? How relevant werethe consequence of the American Civil War to the reformation of the American civilization? This section will engage in tackling these questions.

The first visible and physical consequence of the American Civil Wars was massive death and widespread destruction of properties. The mortality rate was extremely high without the number of injured personalities on both factions. It is important to mention that the physical destruction during the war was pervasive. In the South, Places like Charleston and Richmond suffered a huge loss of plantation labour system and investment in slave whilst in the North, the destruction of public and private properties was prevalent. Importantly, the condition of the war was outrageous such that people died more as a result of infections and illness than on the war front.
According to Davidson, et al.:

> *Approximately 620,000 men on both sides lost their lives… In material terms, the conflict cost an estimated $20 billion, more than 11 times the total amount spent by the federal government from 1789 to 1861.*[6]

This further reveals that the economy of America after the war was battered as a result of the heavy four year war. The war recorded about 1,030,000 casualties. It adversely affected the American economy, specifically the wealth of the South, whereby income per person in the south dropped to less than 40% to that of North which lasted until well into the 20th century.[7]

Consequent on the defeat of the South, partly as a result of the statesmanship of Abraham Lincoln which eventually brought an end to the 'American Civil War'; it holds relevance to quickly make known that President Abraham Lincoln was assassinated by a southerner recalled to be christened John Booth perhaps in retaliation for his anti-southern policies on April 14, 1862 at Ford's Theatre in Washington barely six days after the war ended. Therefore, it is convenient to

assert that Abraham Lincoln was sacrificed for the peace, unity and reformation of the American states.

The union of the states was preserved, the nation was reunited and the southern states were not allowed to secede. In fact, the war wiped out the union's philosophy and ideology of voluntary confederacy which reserved the rights for states to secede and form a stronger federal union which still exists till date.

It is interesting to note that the 'American Civil War' brought an end to the institution of slavery in the American society. The Emancipation Proclamation of 1863 and the Thirteen Amendments of 1865 led to the entire abolition of slavery everywhere in America and its territories, the slaves were set loose, which led to the organic union of the African-Americans. As many as 3.5million blacks were freed from the clutches of slavery during the Civil War.[8] Consequently, African-Americans began to achieve equality, but not without pugnacious obstacles. In a way, African-Americans were allowed access to education in the South but with unequal school system; they were given the right to vote and to contest election at diminutive political levels. Albeit still reflecting some traces of social cum racial discrimination; on the long run, job opportunities began to improve for them in the South as well as the commencement of robust inter-racial relationships and marriages. It must be sated that all this were achieved through the formation of Civil Rights Organisation to chant the course for African-Americans total liberation in America. Indeed, these were important social alterations that positioned a sect of the society from being a mere property of another to a status of social equality. The socket of argument at this juncture is that the armed combat between the Northern and Southern state of America occasioned vital modifications in the American social formation.

The establishment of the Freedman's Bureau in 1865;the Bureau was a government agency saddled with the responsibility of allocating works, supplies and abandoned as well as confiscated Southern lands among freed African-Americans. In addition to this, the agency was to deliver health care, educational and judicial services by putting up medical clinics, schools for academic study amidst other amenities that would better the existence of African-Americans in the United States. The Freedman's Bureau worked with educated former slaves and northern churches and charities to open up more than 4,300 schools in the South.[9]

Industrialism was a remarkable social change that was instigated by the war. Here, the point is that like other reformation that accompanied the war, it stimulated indigenous industrialization. Industrialism began as a result of the increase in wartime production and the development of new technologies. During and after the war, national industries in flour milling, meat packing, clothing, shoe manufacture and machinery making emerged in the American society. Mention must be made of the new innovation and inventions of weapons and munitions to develop and expand military utilization capacities. Thomas Cochran complemented this when he wrote that:

> *Colourful business development in the North-adoption of new machines, the quick spread of war contracting, boost given to profits by inflation, and the creation of a group of war millionaires-makes the war years seem not only a period of rapid economic change but also one that created important forces for future growth.*[10]

However, the reconstruction programme which was aimed at making America to recover its loss during the war also aided industrial development. Therefore, it is apt to posit that the Civil War was a reformation process in itself while the reconstruction era emerged afterward to be one of its inextricable products.

In the political sphere, the war dramatically changed the balance of power in the American society. The South as a result of its abundant economic loss and military defeat lost it varied influence in the political firmament of America. Also, the war led to the decline of the American Democratic Party while the Republican Party rose to dominance in American politics. It shouldbe inscribed in mind that the victory of the Union army signalled the triumph of nationalism as the victory was partly as a result of the support of the African-Americans.

The 'American Civil War' reformed the military machinery of America and chanted a new course in the military history of America. Innovations and inventions as to warfare methods and ammunitions as mentioned earlier were informed by the technological and industrial advancement that was witnessed in the North shortly before and during the war. These developments in the military circle give rise to the use of rifles and rifled artillery as well as the adoption of revolutionized tactics and strategies of warfare. The trench warfare method was implemented on war fields; in addition the union adopted the strategy of attacking the civilian population of the South.

Victory on the side of the Union Army in the war opened up the South to military occupation and strict surveillance. The South was partitioned into military provinces and was placed under military control and authority. The Southern states were then mandated to reapply for admission into the United State of American after fulfilling certain conditions. The militarization of the South was to supress tendencies of further rebellion in the area until 1877. All these were pugnacious but reformatory in view of the advances it staged up from the pre-existing American civilization.

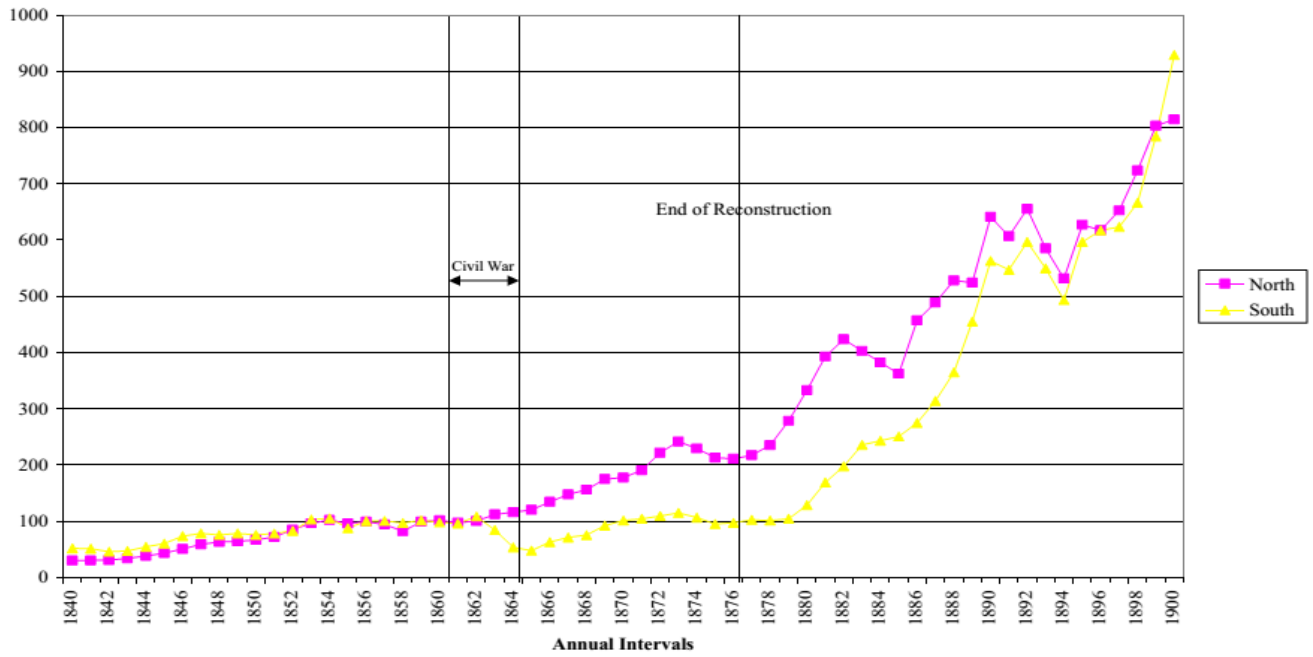
The war was a springboard for societal humanitarianism in America. The establishment of the American Red Cross and other altruistic social clusters. Here, it is important to make mention of Clara Baston who was a staunch republican who went to the battle

field with the union soldiers to deliver medical care to them when injured. It was the activities of this valiant feminine character that instigated the establishment of the American Red Cross. Clara Bast on is widely regarded as the founder of the American Red Cross.

It must also be mentioned within the premises of the above that, after the Civil War, women confronted new responsibilities and enjoyed new occupational duties. The thrust here is that, prior to the war, the female folks were restricted to domestic obligations rather than public works, however, after the Civil War, women began to involve in public affairs such as politics, health delivery services, and military services among others.

The American Civil War is one of the reforming politico-economic events in the history of America. This view has been polished by some notable Americaneconomic historians of the twentieth century. Charles Beard and Mary Beard in their view referred to the civil war as the Second American Revolution.[11] Here, it is important to state that the position of Beard is conditioned on the reformation that accompanied the Civil War. They furthered by publishing thatthe so-called Civil War - was a social war, ending in the unquestioned establishment of a new power in the government, making vast changes, arrangement of classes, in the accumulation and distribution of wealth, in the course of industrial development, and in the constitution inherited from the Fathers.[12]By implication the term 'so-called Civil War' used by Beard is a sentiment of the inaptness of the term 'American Civil War'.

In a similar vein, Louis Hacker posited that the Civil War signalled the triumph of industrial capitalism in America.[13]At this time, the thrust of Hacker's argument is that the civil war was in itself the emergence and dominance of the capitalist mode of production in America. Arising from this is that, the economic clout American is globally recognized for is an offshoot of the Civil War, since the economic splendour of America is the handmaid of its capitalist economy.



Source: Joseph Davis and Marc D. Weidenmier[14](nd.)

Figure 1: Northern and Southern Industrial Production, 1840-1900 (1859/60=100)

The above is a graphical illustration of the industrial production (economy) of the Northern and Southern state of America; it will further be of benefit to this analysis. The chart presents four distinct periods with extension to the period before andafter the 'American Civil War',spreading from 1840 to 1900; the periods are; The Pre-war years (1840- 60), The Inter -war years (1861- 65) as well as the Recovery years (1865-76), and Beyond Recovery years (1877- 1900) which are both identified as the end of reconstruction in the graph. The graphic representation reveals that the economy of America during the war was considerably higher than what it was prior to the war especially in the North, while the economy deflation in the South was for obvious factors as noted earlier. Also, the termination of the Civil War in 1865 occasioned a progressive growth and development in the economy of the North and South alike which continued up to 1900.

Therefore, it could be deduced that; American had a rapid recovery from the Civil War, in about fifteen years American had already recovered from the war. On this basis, arguably, the war was needed for certain

reformation in the American society and to ensure this reformation, the war broke-out. Hence, the commencement of the war was the beginning of the desired reformation.

IV. Conclusion

The label Civil War is a misnomer. In thereal sense, the Southern states of America did not galvanizeaninsurgence; the secession of the South was a pure demonstration of the American foundational ideology of self-determination and equality. However, most cases of CivilWars are engendered by the quest of belligerentsto gain control of the central polity. It is instructive that the term *Civil War*in its origin could be better traced to seventeenth centuryEngland, a period that witnessed a bellicose confrontation between the loyalist and allies of King Charles the First on the one hand and Oliver Cromwell and his parliamentarian supporters on the other hand for political supremacy. In the case of the 'American Civil War', Donald Miller observes that,

> *The South had no designs on the federal government of the North, headquartered in Washington, D. C. It did not want to run that government. The breakaway Southern States asserted their independence, like the American colonies did from Britain eighty-five years before, formed their own Confederate States of America and placed their seat of government in Richmond, Virginia.*[15]

Nevertheless, on the basis of the rationale that the aftermath of an eventultimately outlives its causes, events such as the 'AmericanCivil War' should be christened in context of its transforming outcomes which have added almost exhaustive reformation to the American system. Even though the era that followed it was regarded as the era of reconstruction, it is undisputable that the idea of reconstruction was an inspiration of the truculent interaction between both sides.

On the whole, the American civil War (1861-1865) was a significant event in the history of America as it reformed the nation's political institution, economy and values. It must be stressed that the war was followed by twelve years of reconstruction which occasioned the debate of the fate of the African-American in America and the reconstruction of the nation in an attempt to define the new shape for its union. However, it goes without stating that the Civil War which was recorded as the bloodiest and most destructive war in the history of America also stimulated industrial advancement, political transformation, social equality and development which have placed America in a position of primacy globally in contemporary times. Therefore, within the above premises, it is convenient to opine that the concept of *Civil War* in its description is incongruous; a healthier depiction could be America Pugnacious Reformation.

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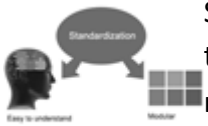

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2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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- 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
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

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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.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
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
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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