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Highlights

Game Meat Quality

Hand-Dug Wells in Ibadan

Southern Guinea Savanna

Crop and Livestock Productivity

Discovering Thoughts, Inventing Future

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Impact of Gender and Age on Game Meat Quality

By Reka Stefan, I. Bud, M. Botha & Daniela Ladoşi

Abstract - The environmental conditions become more "civilized" during the time and implicit less favorable in general for the game. It came into sight some trace regarding the qualitative and also the quantitative regress of the products and subproducts from this domain. The analysis of the causal relations of the determinant factors and of the game population dynamic during the years showed that the actual situation is a consequence of some complex releasers factors (biotic and atrophic factors). We named the following from these factors: the environmental conditions of the game (climate, relief, temperature, humidity, the shelter, and the quit of this), the specie, the age, the gender of the game, the game fatten, the feed supplement, the stress before slaughter, the type of the used arms, electrocution of the game or other methods witch the game became unconsciously. Another category of factors refers to the treatment conditions after slaughter, respectively: the time to disembowel the game, the removal of the males' testicles, the cooling and the correct manipulation during transportation of the game carcass, and the adequate storage of these carcasses for aging. In this paper we present some of these factors: age and gender which affect the game meat quality. In this paper we describe the influence of gender and the age on game meat quality. The results of the experiences showed that the male's carcasses have higher contents in muscular and osseous tissue, comparative to the female's carcasses. The female's carcasses have higher contents in fat and conjunctive tissue, comparative to male's carcasses. Also, these results point out that younger game have a soft meat, comparative to the adult game meat.

Keywords : game meat, quality, age, gender.

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IMPACT OF GENDER AND AGE ON GAME MEAT QUALITY

Strictly as per the compliance and regulations of :

Impact of Gender and Age on Game Meat Quality

Reka Stefan [α], I. Bud [σ], M. Botha [ρ] & Daniela Ladoşi [ω]

Abstract - The environmental conditions become more "civilized" during the time and implicit less favorable in general for the game. It came into sight some trace regarding the qualitative and also the quantitative regress of the products and subproducts from this domain. The analysis of the causal relations of the determinant factors and of the game population dynamic during the years showed that the actual situation is a consequence of some complex releasers factors (biotic and atrophic factors). We named the following from these factors: the environmental conditions of the game (climate, relief, temperature, humidity, the shelter, and the quit of this), the specie, the age, the gender of the game, the game fatten, the feed supplement, the stress before slaughter, the type of the used arms, electrocution of the game or other methods witch the game became unconsciously. Another category of factors refers to the treatment conditions after slaughter, respectively: the time to disembowel the game, the removal of the males' testicles, the cooling and the correct manipulation during transportation of the game carcass, and the adequate storage of these carcasses for aging. In this paper we present some of these factors: age and gender which affect the game meat quality. In this paper we describe the influence of gender and the age on game meat quality. The results of the experiences showed that the male's carcasses have higher contents in muscular and osseous tissue, comparative to the female's carcasses. The female's carcasses have higher contents in fat and conjunctive tissue, comparative to male's carcasses. Also, these results point out that younger game have a soft meat, comparative to the adult game meat.

Keywords : game meat, quality, age, gender.

I. Introduction

The physical and geographical conditions specify to Harghita district has favored some pedogenetical process, which determined the apparition of some different types of soils. These physical and geographical conditions assure adequate development of some game species (bear, wild boar, and deer). Cinegetic administration point of view, Harghita district is divided in 66 hunting territories. In present these hunting territories include the following species: common buck - 1278 examples, deer-690 examples, chamois-60 examples, bear-271 examples, wild boar-441 examples, partridge-465 examples, grouse-552 examples, wolf - 53 examples, rabbit-1195 examples, and lynx-56 examples (Miercurea-Ciuc Silvic Direction).

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The total forest surface in Harghita district represents 231494 ha, and it is situated exclusively in the mountain area, excepting the south-west region which belongs to the hill region. From the total forest surface, 212905 ha (93%) belongs to Romsilva, and 15709 ha (7%) belongs to private persons.

The forest is constituted preponderant by resinous species, 73% from the total forest surface, and the deciduous species represents only 27% (Miercurea-Ciuc Silvic Direction).

The buck has gain the quality of emblem of Romanian hunting, like a food source, one hand and for his imposing trophy, one the other hand.

For majority of the hunters the deer remains the main hunting specie.

In this paper we present some of the factors, which affecting game meat quality: the age and gender of the animals. The aim of this paper is to compare the differences between the carcasses of males and females, and also, between the carcasses compositions of the adult and the younger animals.

II. Material and Methods

The results which were processing statistically proceed from the personal experiences, based on some results from the forest administration of Harghita district, and also from literatures. We made qualitative and quantitative analysis of the game meat. The game proceeded from Harghita district, and all the animals were slaughtered according to meat industry standard. In present, the results of statistics point out high variation of the game effectives, during the time, with alarming decrease of some species, for this reason we appreciated that is opportune to study these aspects. Are many responsible reasons for the effectives decrease, which can be diminish this decrease.

In this paper we approach the following aspects: the influence of age and gender towards to game meat quality.

III. Results and Discussions

The environmental conditions become more "civilized" during the time and implicit less favorable in general for the game. It came into sight some trace regarding the qualitative and also the quantitative regress of the products and subproducts from this domain.

The analysis of the causal relations of the determinant factors and of the game population dynamic during the years showed that the actual situation is a consequence of some complex releasers factors (biotic and atrophic factors). We named the following from these factors: the environmental conditions of the game (climate, relief, temperature, humidity, the shelter, and the quit of this), the specie, the age, the gender of the game, the game fatten, the feed supplement, the stress before slaughter, the type of the used arms, electrocution of the game or other methods witch the game became unconsciously. Another category of factors refers to the treatment conditions after slaughter, respectively: the time to disembowel the game, the removal of the males' testicles, the cooling and the correct manipulation during transportation of the game carcass, and the adequate storage of these carcasses for aging. Follow-up we will describe some of these factors.

The game meat quality is influenced by the gender of the animals. In the case of males, the first step after slaughtering is representing by the remove of the testicles because these can imprint a strange taste to the meat.

The following table presents some differences between deer males and females carcasses:

Table 1 : Differences between deer males and females carcasses (Reka Stefan, 2007)

Carcass compositions	Male	Female	Differences %
Muscular tissue, %	60.51 ± 0.43	56.64 ± 0.97	3.87
Osseous tissue, %	18.37 ± 0.81	15.98 ± 0.84	2.39
Fat tissue, %	6.21 ± 0.19	9.46 ± 0.09	-3.25
Intermuscular fat tissue, %	2.23 ± 0.35	3.28 ± 0.09	-1.05
Conjunctive tissue, %	11.8 ± 0.26	13.87 ± 0.02	-2.07

This table shows that there are some differences between the males and females carcasses. In the case of the males, the percent of muscular tissue is higher than in female's cases, and this tissue represent 60.51 ± 0.43 from the total carcass weight. In the case of the females, the percent of the muscular tissue is 56.64 ± 0.97, the difference between females and males carcasses is 3.87.

In the males case the osseous tissue percent is 18.37 ± 0.81 from the total carcass weight. In the females case this percent is 15.98 ± 0.84, and the difference is 2.39. There are also significant differences between the fat percent of males, comparative to female's carcasses.

Also, the difference between the percent of conjunctive tissue of the two genders is 2.07, in the favor of females.

Another factor which affects the game meat quality is the age of the animal. The younger have a soft meat, comparative to the meat of the adult animals, at it is showed in the following table:

Table 2 : Chemical composition of the different game meat species, depending on age (Reka Stefan, 2007)

Game species	Water, %	Protein %	Fat, %	Minerals, %	Dry substance, %
Adult deer	75.2	20.9	2.8	1.1	24.8
Young deer	79.8	17.7	1.8	0.7	20.2
Adult wild boar	72.09	20.5	6.4	1.01	27.91
Young wild boar	78.9	16.3	4.3	0.5	21.1
Adult bear	75.9	19.7	3.3	1.1	24.01
Young bear	79.5	17.4	2.5	0.6	20.5

This table shows that there are some differences between the adult game animals and the younger. The meat of the younger is soft, with a higher water percent comparative to the adult game meat. Also, the adult game meat has a higher protein, minerals and fat percent, comparative to the younger game meat. It is necessary to aging the both types of game meat for being softly.

IV. Conclusions

The analysis of the causal relations of the determinant factors and of the game population dynamic during the years showed that the actual situation is a consequence of some complex releasers factors (biotic and atrophic factors). The main conclusions are the following:

1. The game meat quality is influenced by the gender of the animals. In the case of males, the first step after slaughtering is representing by the remove of the testicles because these can imprint a strange taste to the meat. In the case of the males, the percent of muscular tissue is higher than in female's cases, and this tissue represent 60.51 ± 0.43 from the total carcass weight. In the case of the females,

the percent of the muscular tissue is 56.64 ± 0.97, the difference between females and males carcasses is 3.87. In the males case the osseous tissue percent is 18.37 ± 0.81 from the total carcass weight. In the females case this percent is 15.98 ± 0.84, and the difference is 2.39. There are also significant differences between the fat percent of males, comparative to female's carcasses. Also, the difference between the percent of conjunctive tissue of the two genders is 2.07, in the favor of females.

2. Another factor which affects the game meat quality is the age of the animal. The younger have a soft meat, comparative to the meat of the adult animals. The meat of the younger has a higher water percent comparative to the adult game meat. Also, the adult game meat has a higher protein, minerals and fat percent, comparative to the younger game meat. It is necessary to aging the both types game meat for being softly.

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Physical and Chemical Characteristics of Forest Soil in Southern Guinea Savanna of Nigeria

By Unanaonwi, Okpo Esio, & Chinevu, Christian Nnaemeka
Federal University, Nigeria

Abstract - Most studies on soil characteristics have been centered on suitability for agricultural production and once a soil does not support crop production it is referred to as poor, unproductive, and finally abandoned. Such soil can be very useful for forest crop plantation. This study was designed to investigate characteristics and describe the forest soil in Ombi, southern Guinea savanna of Nigeria. Soil samples were collected randomly from three locations around the engineering department of Nasarawa State Polytechnic Lafia, at depth of 0-30cm. Samples (1kg each) were taken in plastics bags to the laboratory for studies. Physical and chemical properties were analyzed according to standard procedures. Results show that sand had the highest % in soil of the area (74.96). Bulk densities were within the same range (1.68; 1.77 and 1.78g/cm^3) for sand, silt and clay respectively. Sand had the highest porosity (37.7%) while clay had the least (31.6%). Aggregate stability was least for sand (9.74%) and highest for clay (56.82%). Soil reaction was neutral (7.05); nitrogen and CEC were 1.6 and 12.3 Cmol kg^{-1} among others, while organic carbon was 4.82g/kg^{-1}. The soil is described as light and falls under sandy loam. Forest plantation establishment will be worthwhile.

Keywords : forest soil; southern guinea savanna; sandy loam; forest plantation.

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PHYSICAL AND CHEMICAL CHARACTERISTICS OF FOREST SOIL IN SOUTHERN GUINEA SAVANNA OF NIGERIA

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Unanaonwi, Okpo Esio [α], & Chinevu, Christian Nnaemeka [σ]

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Keywords : forest soil; southern guinea savanna; sandy loam; forest plantation.

I. Introduction

Soil characteristics are made up of two properties namely physical and chemical and will usually behave according to the proportion and organization of these properties. Moreso, the proportion and percentage of the chemical and physical properties of a soil determines the use a soil is put into. Soils are made up of four basic components: minerals, air, water, and organic matter. In most soils, minerals represent around 45% of the total volume, water and air about 25% each, and from 2% to 5% organic matter (REZAEI et al. 2009). The mineral portion consists of three distinct particle sizes classified as sand, silt, or clay (BUOL, 1990; RETALLACK, 2008). Sand is the largest particle that can be considered soil. Sand is largely quartz, though other minerals are also present. Quartz contains no plant nutrients, and sand cannot hold nutrients as it is easily leached by rainfall or irrigation. Silt particles are much smaller than sand, but like sand, silt is primarily quartz (MILFORD et al. 2001).

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The smallest of all soil particles is clay. Clays are quite different from sand or silt, and most types of clay contain appreciable amounts of plant nutrients. Clay has a large surface area resulting from the plate-like shape of the individual particles. Sandy soils are less productive than silts, while soils containing clay are the most productive and use fertilizers most effectively (RETALLACK, 2008).

Although farmers, ranchers, foresters, micro-biologists, etc think of soil differently for different purposes, understanding soils and managing them well are essential to human welfare (UNANAONWI, 2009^{C}).

a) Soil Texture

Soil texture refers to the relative proportions of sand, silt, and clay (MICHAEL, 2009) and a loam soil contain these three types of soil particles in roughly equal proportions. A sandy loam is a mixture containing a larger amount of sand and a smaller amount of clay, while a clay loam contains a larger amount of clay and a smaller amount of sand (JAMES, 2008).

b) Soil Structure

Another soil characteristic is soil structure. Structure refers to the clumping together or aggregation of sand, silt, and clay particles into larger secondary clusters (JANET, 2008; VORONEY, 2006). Soil structure is developed through the action of soil biota such as microbes and earthworms. This biota creates openings for water and air penetration and secretes glues and sugars which bind silt and clay particles together to form aggregates (MICHEAL, 2009). Microorganisms help open up compacted soils so roots can more easily penetrate the soil. Good soil structure is apparent when the soil crumbles easily. This is an indication that the sand, silt, and clay particles are aggregated into granules or crumbs. Both texture and structure determine pore space for air and water circulation, erosion resistance, looseness, ease of tillage, and root penetration (ASA, 2005). Soil texture is related to minerals in the soil and changes little with agricultural activities. Soil structure on the other hand can be improved or destroyed readily by choice and timing of farming practices. (BROWN, 2003). Soil structure affects aeration, water movement, conduction of heat, resistance to erosion and plant root growth. Water has the strongest effect on soil structure due to its solution and precipitation of minerals and its effect on plant growth.

Soil structure often gives clues to its texture, organic matter content, biological activity, past soil evolution, human use, and the chemical and mineralogical conditions under which the soil formed (JAMES, 2008; BAKER and ELDERSHAW, 1993).

c) Soil Organic Matter

Soil organic matter is the component of soil derived from all biological sources-whether living or nonliving. Soil organic matter is a vital indicator of soil health because of its impact on a variety of soil functions and properties. It provides the energy source for micro-organisms in the soil, is a reservoir of nutrients (especially N, P & S) and improves the structural stability, water holding capacity and pH buffering capacity of the soil (LINE-KELLY, 1994).

d) Soil Chemical Properties

The chemistry of soil determines the availability of nutrients, the health of microbial populations, and its physical properties. In addition, soil chemistry also determines its corrosivity, stability, and ability to absorb pollutants and to filter water. It is the surface chemistry of clays and humus colloids that determines soil's chemical properties. The very high specific surface area of colloids gives soil its great ability to hold and release cations in what is referred to as cation exchange. Cation-exchange capacity (CEC) is the amount of exchangeable cations per unit weight of dry soil and is expressed in terms of milliequivalents of hydrogen ion per 100 grams of soil.

A colloid is a small, insoluble, non-diffusible particle larger than a molecule but small enough to remain suspended in a fluid medium without settling. Most soils contain organic colloidal particles as well as the inorganic colloidal particles of clays (SOILS, 1957). There are over 72 minerals elements present in the soil which are referred to as plant nutrients and are classed as major and minor. They are very essential for plants growth and development. Some of the major elements include carbon, nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, manganese, iron, zinc, copper, boron, and molybdenum (IUSS, 2007)

e) Soil Physical Properties

The physical properties of soils, in order of decreasing importance, are texture, structure, density, porosity, consistency, temperature, color, and resistivity. These determine the aeration of the soil and the ability of water to infiltrate and to be held in the soil. Soil texture is determined by the relative proportion of the three kinds of soil particles, called soil "separates": sand, silt, and clay. Soil density, particularly bulk density, is a measure of soil compaction. Soil porosity consists of the part of the soil volume occupied by air and water. Consistency is the ability of soil to stick together. Soil temperature and colour are self-defining. Resistivity refers to the resistance to conduction of electric currents and affects the rate of corrosion of metal and concrete structures. The properties of the identifiable layers in a particular soil profile may differ (SOILS, 1977).

Soil components larger than 2.0 mm are classed as rock and gravel and are removed before determining the percentages of the remaining components and the texture class of the soil. For example, a sandy loam soil with 20% gravel would be called gravely sandy loam. When the organic component of a soil is substantial, the soil is called organic soil rather than mineral soil. A soil is called organic if:

a) Mineral fraction is 0% clay and organic matter is 20% or more
b) Mineral fraction is 0% to 50% clay and organic matter is between 20% to 30%
c) Mineral fraction is 50% or more clay and organic matter 30% or more (SOILS, 1977).

Studies on soil characteristics are many a time centered on suitability for agricultural production and once a soil does not support crop production it is referred to as poor, unproductive and degraded. Such soil is usually abandoned. There are other uses that soils could be put into if they are found to be unsuitable for a particular use, thus soil would not be left to lay waste. It is by studying the soil characteristics that would enable right decisions on what types of crop a particular soil can support. This study aims at determining the chemical and physical properties, and as well describes the soil of Ombi 1, Lafia, in the southern Guinea savanna of Nigeria.

II. Materials and Methods

a) Study Area

The study area is Ombi 1 in Lafia North Development Area of Nasarawa State. Nigeria (08.33'N, 08.32'E and 175m high). Mean annual rainfall in the area is 1132mm, minimum and maximum temperature range between 24.8° C and 33°C respectively. The major occupation in the area is farming and the soil is an Oxisol (ferrasol).

b) Soil Sampling

Soil samples were collected from three locations around the engineering department of Nasarawa State Polytechnic at depth of 0-15cm (top soil). Samples (1kg each) were taken in plastics bags to the laboratory and air dried for studies.

c) Laboratory Analysis

The Soil properties that were analyzed are: Acidity (pH); EC (Electrical conductivity; Nitrogen(N); Phosphorus(P); Potassium(K); Sodium(Na); Calcium (Ca); Magnesium(Mg); Hydrogen(H); Aluminum(Al); Cation Exchange Capacity(CEC); Organic Carbon(OC); Sand; Silt and Clay.

d) Physical Properties

Particle size distribution was determined by the hydrometer method as described by ASA (2005). Size distribution of aggregates was measured by wet sieving through a series of sieve (2.0, 1.0, 0.5, 0.25mm). Bulk density was determined by core method and total porosity was calculated assuming a particle density of 2.65g/cm^3.

e) Chemical Properties

Soil pH was measured in water (1:1-ratio) using pH meter. Organic carbon content in the sample was determined by WALKLEY and BLACK (1934) wet-oxidation method. Total nitrogen was determined by the Micro-Kjeldhal digestion-distillation method (BREMNER, 1965). Cation exchange capacity (CEC) was determined by saturating 10g of soil with normal natural ammonium acetate solution, washing out the excess ammonium with methanol and subsequently distillation the absorbed ammonium into boric solution. The distillate was titrated against standard hydrochloric acid. The exchangeable cations were extracted with 1M ammonium acetate solution. The extract was then analyzed for calcium (Ca) and magnesium (Mg) by EDTA titration method, and for potassium K and sodium Na, by flame photometer. Available phosphorus was determined using the Bray No.1 method (BRAY and KURTZ, 1945). Total Aluminum was determined by the method of LIU (2001). Total potassium was determined by flame photometry.

f) Laboratory and Statistical Analyses

Laboratory analysis was carried out at the Department of Soil Science, Federal University of Agriculture Markudi, Nigeria. Descriptive statistics was used to describe the Laboratory results.

III. Results

Table 1 : Laboratory result of physical properties of soil (0-15cm) in Ombi Area

Particle	%/g of soil	Bulk density(g/cm^3)	%porosity	%Aggregate stability
Sand	74.96	1.68	37.7	9.74
Silt	8.0	1.77	33.2	27.51
Clay	17.04	1.78	31.6	56.82

Result shows that sand has the highest particle size distribution in 1g of soil (74.96%) while clay particle occupied 17.04%/g of soil and the least being silt whose content is 8%/g of soil. Bulk densities of the three particles were within the same range but silt was higher than sand by 0.9 and clay higher than silt by 0.10. Aggregate stability was highest for clay and least for sand.

Table 2 : Laboratory result of chemical properties of soil (0-15cm) in Ombi Area

Chemical property	Unit	Amount
Acidity (pH)	(1:1) H_2O	7.05
Electrical conductivity (EC)	Ms m $^{-1}$	812.0
Nitrogen (N)	Cmol kg $^{-1}$	1.60
Phosphorus (P)	Cmol kg $^{-1}$	2.60
Potassium (K)	Cmol kg $^{-1}$	0.95
Sodium (Na)	Cmol kg $^{-1}$	1.64
Calcium (Ca)	Cmol kg $^{-1}$	12
Magnesium (Mg)	Cmol kg $^{-1}$	3.81
Hydrogen (H)	Cmol kg $^{-1}$	3.60
Aluminum (Al)	Cmol kg $^{-1}$	0.70
Cation Exchange Capacity (CEC)	Cmol kg $^{-1}$	12.3
Organic Carbon (OC)	g kg $^{-1}$	4.82

IV. Discussion

a) Physical Properties

The structure and texture of the soil represents the physical properties. Physical property of a soil plays an important role in soil fertility because the amount and sizes of soil particles determine the porosity and bulk density which account for nutrients retention or leaching of nutrients. Result of the study (Table 1) indicated that sand has the highest percentage (74. 96%) composition in a 1g of soil taken from the study area followed by clay particle with 17.04%. The size distribution directly influences the porosity which is highest for sand as is expected because sand is the most porous of the soil particles. Sand has no ability to retain water and good water retention capacity of the soil is an important factor in soil fertility. Clay has the least % porosity meaning that it has the highest capacity to retain water. This also is one of the reasons why clay particle is referred to as the nutrient storehouse. The high water holding capacity of clay makes it more stable (56.82%) than other particles. It is that high stability that enables it to hold nutrient cations for nutrient exchange in the soil for plant uptake. It implies that the higher the clay content of a soil, the higher the cation exchange capacity and the higher the fertility of the soil.

b) Soil Description

Heavy and light are commonly used to describe soils. They refer to the easy of tillage, and not to soil weight. Heavy soils are commonly finer soils, which require more horse power because the higher clay content makes them stickier. Light soils have a higher percentage of sand (coarse texture), stick together less, and require less muscle to till. Result of the study (Table 1) has shown that soil of Ombi area of Lafia is light.

c) Soil Chemical Properties

Chemical properties of soil are made up of elements which are referred to as nutrients in plant nutrition. These elements affect yield of forest trees in one way or the other. These elements are divided into macro and micro nutrients. The macro-nutrients are required in large amount by plants for optimum growth and yield while the micro-nutrients are required in small quantity by crop.

d) Acidity

In relation to yield, soil acidity is the power house for plant nutrients (ASA, 1971). Soil acidity results to complex change in the soil, such as increase in toxic levels of aluminum, inhibition of microbial processes, reduction of the cation exchange capacity and reduced availability of soil phosphorus. The inability of crops to utilize water effectively and take up sufficient quantities of nutrients is often the most visible problem with soil acidity. Acids soils are deficient of key macro nutrients such as calcium, magnesium and potassium. High soil acidity therefore will result into decrease in root growth and will therefore not favour tuber crops. Laboratory results (Table 2) shows that Ombi soil has acidity level of 7.05 indicating that the soil is not acidic but neutral. The result shows an increase acidity level of 0.85 from that of the Northern Guinea savanna of Nigeria (UNANAONWI, 2011). The fact that the major crops cultivated in the area are tubers, as in other parts of Nasarawa State, further supports this result.

e) Nitrogen

Soil nitrogen for the study area is 1.60 Cmol kg^{-1}. UNANAONWI (2011) reported 1.45 Cmol kg^{-1} for the Northern Guinea savanna of Nigeria. Nitrogen accounts for up to 3% of all plant compounds. It is the most abused and misused production input in growing crops. The key to reducing nitrogen growing costs is to reduce nitrogen losses. The present nitrogen recommendations in most growing situations are based upon experience and are usually in excess of specific plant requirements. Nitrogen losses come about by reduced aeration and higher compaction in soil. Nitrates can be lost by being converted to gaseous nitrogen by anaerobic soil microorganisms in soils. The losses from gasification will be more on heavy soils than on light-textured soils. Leaching losses of nitrogen will be higher on light soils.

Excess amounts of nitrogen can destroy soil humus and tilth. When excessive nitrogen is present in the soil, microorganisms will multiply by attacking the carbonaceous humus that is more accessible than randomly distributed crop residue. By breaking down humus for their carbon needs, soil microbes can deplete the humus reserve in soil. This depletion reduces the stable humus aggregates that are vital to tilth and aeration of a healthy soil and will subsequently affect crop yield. Crop requires nitrogen for formation of tuber, seed and healthy crop stand.

f) Phosphorus

Laboratory result shows that 1 kilogram of soil in the study area has 2.60 Cmol of Phosphorus. When phosphorus intake is deficient, plants will produce red and purple leaf colors and exhibit stunted root and top growth. Most synthetic phosphate fertilizers, when added to the soil, undergo a degree of phosphate fixation with other soil elements. The degree of fixation depends upon the chemical nature of the soil. High sodium levels reduce phosphorus availability. Bio-organic phosphates are chelated in organic complexes and designed to favour microbiological activity that converts phosphorus to a more available form for crop use, thereby, preventing losses by fixation.

g) Potassium

Plants contain an average of about 3% potassium as a part of plant tissue. Potassium is essential in the translocation of vital sugars in plant structures, strengthening plant stalks. Conventional fertilizers such as muriate of potash or potassium chloride are salts and contain chloride just as table salt (sodium chloride) does. Plants use potassium as the element K^+ ion and its availability depends upon its position within the soil and relationship to clay, humus and soil water. A clay particle is a strong magnet in comparison to sand, silt and humus. Clay soils hold potassium very tightly and resist leaching. This characteristic makes it more difficult to recover potassium from clay soils. Soil aeration and healthy, balanced aerobic microbial activity are essential for making potassium available to plant. Soil of the area in this study has 0.95 Cmol kg^{-1} potassium.

h) Calcium

Soil calcium level in the study area is 12 Cmol kg^{-1}. Calcium is often called the prince of nutrients because the soil colloid has to have a great saturation of calcium for plant uptake. It accounts for about 2% of plant tissue. Calcium is used to make calcium pectate, a sturdy building material component of cell walls. Calcium deficiency causes stunted roots and stress symptoms in new leaves and discoloration and distortion of plant growth. It may be the single most important soil and plant element. However, UNANAONWI (2011) reported a significant negative correlation between calcium and gum yield in soil of the northern guinea savanna of Nigeria.

i) Magnesium

Chlorophyll molecule is built around a single atom of magnesium, which accounts for about 1% of plant tissue. Magnesium deficiency causes poor photosynthesis that restricts plant growth and vitality. Soil of Ombi has magnesium value of 3.81 Cmol kg $^{-1}$.

j) Cation Exchange Capacity

Table 2. Shows that CEC in soil of the study area was 12.3 Cmol kg $^{-1}$. The cation exchange capacity is a value given in soil analysis report to indicate its capacity to hold cation nutrients. It is determined by amounts of clay and humus that are present in a soil. These two colloidal substances are essentially the cation warehouse or reservoir of the soil and are very important because they improve the nutrient and water holding capacity of the soil. Sandy soils with little organic matter have a low CEC, but clay soils with high levels of organic matter, would have a much greater capacity to hold cations. A soil with low CEC has little or no clay or humus content. It cannot hold much water or cation nutrients and therefore, forest crop would not grow well in them.

k) Organic Carbon

Result indicated that the organic carbon content of soil in Ombi is 4.82 g kg $^{-1}$. Soil organic carbon is directly related to soil fertility in that it is the organic carbon present in soil that is eventually converted to nitrate for plant uptake (UNANAONWI, 2009[b]). This implies that the more the organic carbon contents of a soil, the more the nitrogen content of the soil, and the more fertile the soil will be.

V. Conclusion

The aim of this study was to determine the chemical and physical properties and to describe the soil of Ombi area. The investigation has shown from laboratory analysis that some of the trace elements such as Boron, Zinc, Copper and Ion were not present in the soil of the area. Sand has the highest percentage in the soil of the area while silt was the lowest. Soil of the area can be described as light with its higher % of sand. Soil of the area is good for the cultivation of tuber crops as is presently the case in the area, because of its low or neutral soil reaction. Forest trees would therefore thrive well. Plantation establishment of tree crops is recommended.

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Keywords : crop and livestock production, pakistan, productivity, provinces, TFP.

GJSFR-D Classification : FOR Code: 620501p, 860703

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Abstract - Combined data on crops and livestock were used to examine productivity growth rates for the period 1980-81 to 2009-10 for four provinces, namely Punjab, Sindh, Khyber Pakhtunkhawa (KP) and Balochistan of Pakistan,. The analysis revealed that economic infrastructure and the development of human capital had important implications for the growth of combined Total Factor Productivity (TFP). However, the benefits of growth are not evenly distributed across various provinces. The irrigation infrastructure is the most effective in triggering the growth of combined TFP in Punjab as compared with the rest. Road development and nutrition benefited Punjab's producers in a disproportionate way than those in other provinces. The benefits of literacy and medical facilities are spatially well spread and motivate TFP growth across most of the provinces. Extension activities for crops and research for livestock reflected positive impact on combined TFP. The trend in crop research variable is, however, negative, which needs to be carefully interpreted as its implications for TFP growth are obtainable with time lag. The situation in other provinces contrasts with that in Punjab as it has long benefited from research and extension for crops, while it is yet to be accomplished in the others. The relationship of combined TFP and tractor is mixed as it is a substitute for livestock and a complement for crops. Finally, animal health care positively impacted upon the combined TFP.

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I. Introduction

The agricultural sector in Pakistan comprises both crop and livestock industries in its four provinces, namely Punjab, Sindh, Khyber Pakhtunkhwa (KP) and Balochistan. Growth in Total Factor Productivity (TFP) in both sets of sectors is a vital consideration for planners and policy makers (Govt. of Pakistan, 2009, 2010d and 2011). In the post-independence era, a pragmatic approach for development of Pakistan's crop sector initiated in 1960s with the in-coming of green revolution technologies. Later in 1980s, several dimensions added to the Pakistan's agrarian economy, such as mechanical cultivation replaced bullock farming, arable land per capita was reduced and the livestock industries emerged as a major source of livelihood. It is noteworthy that the contribution of livestock to agriculture's value added in GDP increased from 28% in 1980-81 to 53% in 2009-10 (Govt. of Pakistan, 1981 and 2010c).

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Ellahi, *et al.* (2010 and 2012) conducted two separate studies on TFP for crops (1980-81 to 2005-06) and livestock (1980-81 to 2008-09), from where it transpired that TFP for the former was much higher than the latter. Although both industries are subject to vagaries of nature, but growth in livestock industries is observed to be relatively more stable, impressive and sustainable as compared with crops (Govt. of Pakistan, 2010c). However, there are evidences (Ellahi, *et al.*, 2010 and 2012) that the varying resource endowments across the country lead to uneven distribution in growth of crop-livestock combined TFP across the four provinces. This requires that estimates of combined TFP be carried out to assist the planning machinery for undertaking an integrated development plan for the overall agricultural sector. Further, crop and livestock enterprises are complementary to each other as fodders and crop byproducts, such as straw from wheat, rice and gram and sugarcane tops are used as feed for livestock. Therefore, the participation of spatial entities in this growth process needs to be ascertained and tested in the light of empirical results and other factors operating in the overall economy.

Most spatio-temporal studies of TFP growth in Pakistan related to crops. Examples are Ellahi (2007), Ellahi, *et al.* (2009, 2009a and 2010), Ali (2000 and 2005), Murgai, *et al.* (2001), Khan (1994 and 1997), Ali and Velasco (1994), Rosegrant and Evenson (1993), Azam, *et al.* (1991) and Wizarat (1981). A similar study was carried out by Ellahi, *et al.* (2012) for the fast-growing livestock sector.

II. Materials and Methods

a) Method of Analysis

Several methods have been used to measure TFP in Pakistan. They include non-parametric linear programming (Ellahi, 2007; Ellahi *et al.,* 2009a, 2009b; Wizarat, 1981), index number methods (Azam *et al.*, 1991, Ellahi, 2007, Ellahi *et al.,* 2009a, 2009b, 2010 and 2012, Rosegrant and Evenson, 1993; Khan, 1997; Ho and Arif, 2004; Ellahi, 2007), and stochastic frontier analysis (Ahmad, 2003). The consideration of crops and livestock and time periods covered in various studies are different, ranging from 1953-54 to 1978-79 for Pakistan agriculture as a whole (Azam *et al.*, 1991), the period 1956-85 for the crop sectors in Pakistan and India (Rosegrant and Evenson, 1993), the period from 1960 to 1996 (Khan, 1997), from 1980-81 to 2005-06

(Ellahi, 2007; Ellahi *et al.,* 2009a, 2009b and 2010) and 1980-81 to 2008-09 (Ellahi, 2012). Ali and Byerlee (2002) used data on 33 crops and eight livestock products in all irrigated districts of Punjab. Ellahi *et al.* (2010 and 2012) considered 17 crop and 11 livestock products, respectively.

The spatio-temporal combined TFP analysis of crop and livestock production in Pakistan is proposed to be carried out for 30 years from 1980-81 to 2009-10. A two-stage analysis of the combined TFP change at the provincial level is undertaken using aggregate data for the four provinces. In the first stage, changes in TFP indices are to be measured, which is accomplished by using annual data on quantities and prices of crop and livestock inputs and outputs. In the second stage, following Rosegrant and Evenson (1993), the combined TFP index is regressed on determinants using a pooled model for all four provinces. Intercept dummies and spatial interaction variables are proposed to be included for Sindh, KP and Balochistan, with Punjab treated as the base.

Obtaining data on the determinants of TFP change proved to be challenging and some of the variables are proxies. The quantity of water, in million acre feet (MAF), obtained from tubewell and canal sources may capture the effects of hydrological developments on crop and fodder production and growth of grasses in the grazing lands. Road density (road length per thousand of rural population) is used to capture the effects of transport infrastructure for marketing of crop and livestock products. Research and extension (R&E) inputs, separately for crop and livestock, are measured from data on provincial expenditure in these services, to capture the effects of increased crop output, improved feeds, disease control and better animal health. The number of tractors per cultivated hectare may depict the level of mechanical technology as a replacement for bullocks in each province. The literacy rate, nutritional status and medical facilities represent human capital. Finally, product of the proportion of cases disposed of in the High Court and Supreme Court represents confidence of farmers in protection of the legitimate rights.

b) Index Method

The chain-linked Törnqvist TFP index (Törnqvist, 1936 in Coelli *et al.*, 2005) was selected to measure TFP change in livestock industries. This method was used in most previous studies of TFP growth and requires the aggregation of inputs and outputs into single indices using weights based on cost and revenue shares, respectively. In order to define the Törnqvist index, the input-output quantities and their respective shares in the total cost and total revenue, respectively, need to be defined. The rationale for selection of the Törnqvist TFP index is provided by Ellahi *et al.* (2010).

Coelli *et al.* (2005) defined the Törnqvist output quantity index in multiplicative form as:

$$Q_{st}^{T} = \prod_{m=1}^{M}\left[\frac{q_{mt}}{q_{ms}}\right]^{\frac{\omega_{ms}+\omega_{mt}}{2}} \tag{1}$$

where q_{ms} is the m-th output quantity in the base period, s, q_{mt} is the m-th output quantity in the current period t, and ω_{ms} and ω_{mt} are the revenue shares of output m in periods s and t, respectively. Following a similar procedure, Coelli et *al.* (2005) defined the Törnqvist input quantity index in its multiplicative form as:

$$\prod_{n=1}^{N}\left[\frac{x_{nt}}{x_{ns}}\right]^{(\omega_{nt}+\omega_{ns})/2} \tag{2}$$

where x_{ns} is the n-th input quantity in the base period, s, x_{nt} is the n-th input quantity in the current period, t, and ω_{ns} and ω_{nt} are the cost shares of input n in periods s and t, respectively. The average annual change in the Törnqvist TFP index was measured using these output and input quantity indices and following the standard procedure as detailed, for example, by Murgai *et al.* (2001).

c) Data Compilation

As mentioned above, the requisite data for crops and fruits were collected by Ellahi (2007) and Ellahi *et al.* (2010) for 26 years (1980-81 to 2005-06). These data were extended for another 4 years, i.e. up to 2009-10 and some other crops, such as sorghum, millet, barley and green fodders were included, while on the input side bullock draught power was added to data on fertilizer, irrigation, plant protection and labour used in Ellahi *et al.* (2010). The data series on livestock (Ellahi *et al.*, 2012) were extended accordingly so that analysis of the combined TFP may be undertaken consistently for the study period considered in this study.

Aggregate data for crops and livestock were collected on prices and quantities of crops (wheat, rice (coarse and fine), sugarcane, cotton, maize, sorghum, millets, barley, fodders, potato, onions, gram, pulses, special oilseeds, sugar beet, tobacco, almonds, apricots, bananas, citrus, dates, guava and mango), milk, draught power, beef, mutton, poultry meat, eggs, hides, skins and wool, and on the inputs used in the production of crop and livestock outputs. Annual input-output data and those for market prices for both crop and livestock at the country level are available in the *Economic Survey* (Govt. of Pakistan, 2010c), the *Agriculture Statistics of Pakistan* (Govt. of Pakistan, 2010a), the *Pakistan Statistical Year Book* (Govt. of Pakistan, 2010h) and the *Monthly Statistical Bulletin* (Govt. of Pakistan, 2010g). The marketing of sugarcane, sugar beet and special oilseeds is institutionally carried out by the sugar industry and Ghee Corporation, respectively. Therefore, market prices are not available and support/indicative prices announced by the government were used. The support prices for sugar beet and special oilseeds were discontinued in 1990-91 and 1999-2000, respectively. The former is exclusively grown in KP and extension in its prices was based on those for sugarcane and the same for the latter were extended on the basis of past trend.

The national data on livestock were apportioned into provinces using the ratios of different types of stock obtained from data provided in the *Livestock Censuses of 1976, 1986, 1996 and 2006* (Govt. of Pakistan, 1978, 1988, 1998 and 2008). Data on inputs include milk for off-springs, green fodders, crop byproducts, concentrates, manufactured feeds, grains and a variety of feeds for poultry, animal health care, medical treatment and human labour used for livestock activities. Several crop byproducts are used for feed in livestock industries, i.e. straw from wheat, rice and gram, stalks from maize, millets and sorghum and tops from sugarcane. Their annual values in current prices are provided in the *Agriculture Statistics of Pakistan* (Govt. of Pakistan, 2010a) for country as a whole. The provincial apportionment was undertaken in accordance with spatial share in total value of the main output.

The basic sources of data on the agricultural labour are the *Population Censuses of Pakistan 1981 and 1998* (Govt. of Pakistan, 1984 and 2002) and the annual series of the *Labour Force Surveys* (Govt. of Pakistan, 2010f). These data, published in the *Economic Survey* (Govt. of Pakistan, 2010c), are for the country as a whole and relate to crops and livestock. Annual farm wages for casual labour used in the agriculture sector and wages for unskilled labour in the metropolitan areas are available in the *Monthly Statistical Bulletin* (Govt. of Pakistan, 2010g) and in the *Economic Survey* (Govt. of Pakistan, 2010c), respectively. Various issues regarding farm labour and wages thereof, for the period 1980-81 to 2005-06, are discussed by Ellahi (2007), whose method was followed to obtain and extend labour used for crops and livestock and wages thereof up to 2009-10.

For the econometric analysis, data on road density are obtainable from the Provincial *Development Statistics* (Govts. of Punjab, Sindh, KP and Balochistan, 2010c). Data on population and literacy for the years 1981 and 1998 are available in the *Population Censuses of Pakistan 1981 and 1998* (Govt. of Pakistan, 1984, 2002), while those for the remaining study years are obtained from the *Labour Force Surveys* (Govt. of Pakistan, 2010f). Data on irrigation, obtained from the *Agriculture Statistics of Pakistan* (Govt. of Pakistan, 2010a), is comprised of water volume in MAF delivered by the canals and tubewells separately.

Expenditures on R&E for crops and livestock are comprised of development and recurring accounts incurred by the provincial and federal governments. Each provincial government makes expenditure on R&E from the development account until an activity is completed and thereafter the recurring expenditure is sanctioned. At the federal level, the pattern and type of budget allocation is same and its main organizations are the former Food & Agriculture and Livestock Divisions and Pakistan Agricultural Research Council. The latter has components for both crops and livestock. The collection of all these data is a gigantic task. On the provincial side, these data are consistently available in Govt. of Punjab (2010a and 2010b), while these are partially so for Govt. of Sindh (2010a and 2010b), Govt. of KP (2010a, 2010b and 2010d) Govt. of Balochistan (2010a and 2010b) and Govt. of Pakistan (1992). Data for Sindh, KP and Balochistan were estimated in two steps, i.e. the ratio of their partially available information with those for Punjab was obtained first. Then, for the deficient years, a product of the said ratio and data for Punjab were used to estimate those for the remaining provinces.

Annual R & E data for crops and livestock are inconsistently published for the study period by Govt. of Pakistan (2010b). For instance, crop and livestock data (considered for the extension component) were available for the years up to 1997-98; thereafter, they were combined with the overall agricultural R&E data. Data for years after 1997-98 were obtained by using the proportionate share of crops and livestock, in value added, in total agricultural R&E in 1997-98. Data on research expenditure are available for the whole of agriculture. The crop and livestock portions were obtained using the method applied for the extension component. Ultimately, the federal data were apportioned among the four provinces in the light of their respective shares in the total R&E budgets and added to their respective accounts to construct the overall R&E variables for crops and livestock. Thereafter, the estimates were converted into real values by using the GDP deflator with 1980-81 as the base (Govt. of Pakistan, 2010c). Variables on treatment reflecting animal health were taken from the Govts. of Punjab, Sindh, KP and Balochistan (2010c).

A moving average of the crop and livestock output variables need to be used to reduce the exaggerated effects of drought, floods and good seasons on crop output and for ample fodders and free of epidemics. These factors do not operate at a regular interval. However, a period of two years was considered appropriate to smooth out fluctuations in the combined TFP.

III. Results and Efiscussion

a) Estimates of TFP Change

The empirical results of average annual growth rates in combined TFP using Törnqvist indices are presented in Table I for the whole study period and for two sub-periods, namely 1980-81 to 1994-95 and 1995-

96 to 2009-10. Indices are also depicted graphically for Punjab, Sindh and KP in Fig. 1 and for Balochistan in Fig. 2. The trend in combined TFP for Balochistan is portrayed separately because its production pattern, especially that of crops (Ellahi *et al.* 2010), was substantially different from rest of provinces over the study period. As seen from Table I, Balochistan's combined TFP change per annum, for the entire study period, is about four times higher than that for the rest all provinces exhibiting about 1% average annual change.

Table I : Province-wise annual rates of change in TFP

Province Period	Punjab % p.a.	Sindh % p.a.	KP % p.a.	Balochistan % p.a.
1980-81 to 2009-10	0.83	1.05	1.27	4.01
1980-81 to 1994-95	0.87	0.64	1.66	7.25
1995-96 to 2009-10	0.41	0.94	-0.25	-2.67

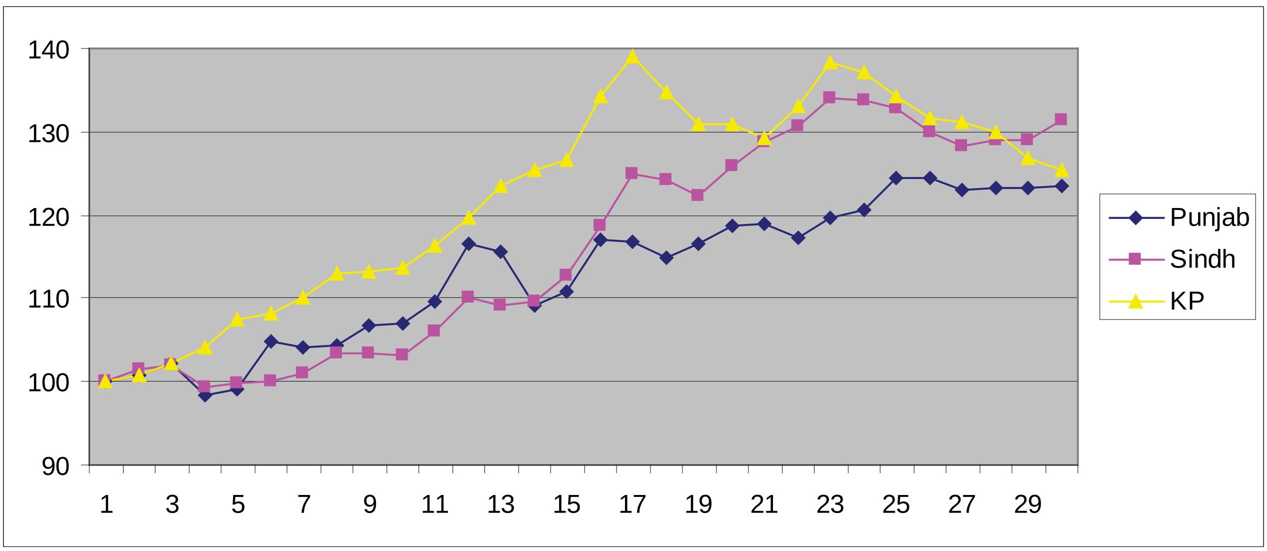

Figure 1 : Annual TFP Indices in Punjab, Sindh and KP, 1980-81 – 2009-10 (1980-81 = 100) for Crop-Livestock Industries Combined

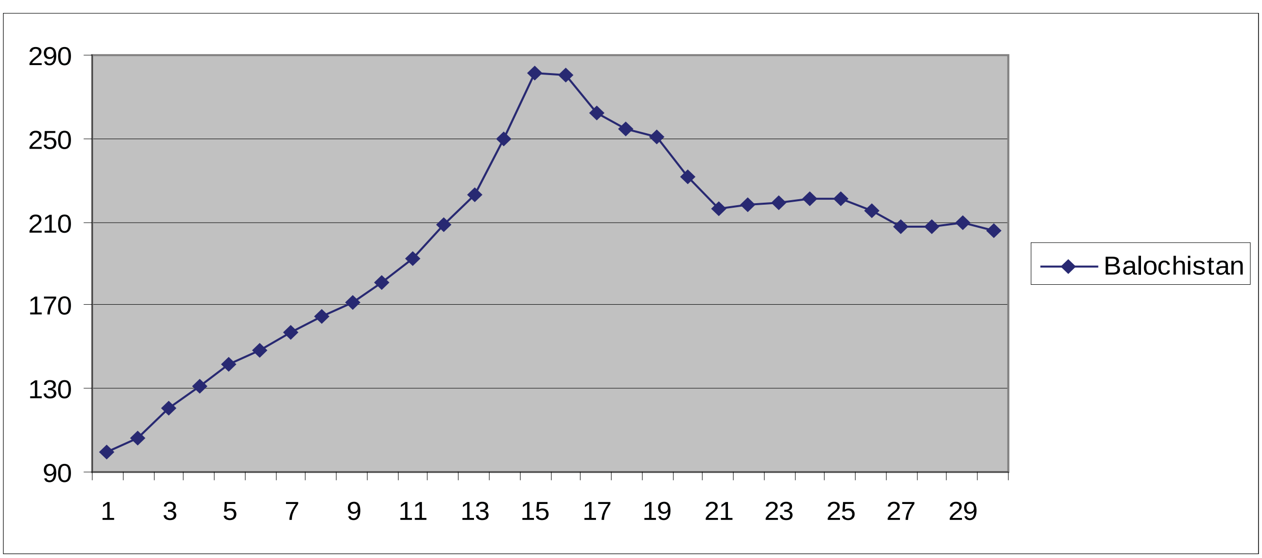

Figure 2 : Annual TFP Indices in Balochistan, 1980-81 – 2009-10 (1980-81 = 100) for Crop-Livestock Industries Combined

The results depicted in Figure I exhibit that the growth rate in the combined TFP for the entire study period and for Punjab, Sindh and KP was almost the same and stood at about 1% per annum. These estimates are lower than those for crop production (Ellahi *et al*., 2010, Ali and Byerlee, 2004 and World Bank, 2007) and higher than those for livestock (Ellahi *et al*., 2010). Further, KP scored the highest with an estimated 1.27% growth in the combined TFP per annum implying that crop and livestock activities, taken together, in KP is more efficient than that in Punjab and Sindh. The producers in Balochistan achieved the highest combined TFP growth rate of 4.01% per annum for the entire study period, but was well below producers in other provinces in the beginning of the study period. This phenomenon is attributed to additional canal water provided to Balochistan in the beginning of 1990s (Abbasi *et al*., 2012), which gave a boost to crop output (Ellahi, 2007).

These average annual TFP growth rates for the whole study period hide some major inter-temporal variations. During the first sub-period from 1980-81 to 1994-95, the combined TFP growth rate was consistently high in all provinces, except Sindh (Fig. 1). It was especially high in Balochistan where farmers achieved high productivity gains of 7.25% per annum. But the rate took a downturn in that province in the second time period (1995-96 to 2009-10), i.e. it retarded at an average annual rate -2.67% per annum (Fig. 2). A slight downturn of -0.25% per annum was recorded in KP as well. The combined TFP growth, in Punjab, dropped from 0.87% to 0.41% per annum compound, i.e. about one half, while the same in Sindh went up annually from 0.64% to 0.94% on an average. In the second time period, Sindh showed the highest TFP growth rate at 0.94%. The drop in the combined TFP growth rate in Punjab, KP and Balochistan in the second time period coincided with a reduction in beef and mutton production (Ellahi *et al*., 2012).

b) Changes in the Determinants of TFP

The rates of change in the determinants of combined TFP, along with *t*-ratios, are provided in Table II. All provinces experienced significantly positive trends in their tubewell networks: the growth was somewhat weak in KP. Its growth was higher in Punjab and Balochistan than in Sindh and KP. It is noteworthy, in Sindh, that water is not mined from below the ground where it is brackish; rather, it is generally canal water that has to be lifted mechanically. Sindh and KP experienced a substantial decline in the canal network, while it showed increasing trend in Punjab and Balochistan. As said above, tubewells in Sindh draw water from canal and lead to reduction in surface water supply.

Table II : Rates of change in determinants of combined TFP in provinces

Variables	Punjab % p.a.	Sindh % p.a.	KP % p.a.	Balochistan % p.a.
Tubewell network	2.093 (19.2)***	1.636 (7.4) ***	0.153 (1.0)	2.171 (11.0)***
Canal network	1.455 (37.4)***	-0.136 (-1.4) ***	-0.962 (-11.3)***	2.326 (15.9)***
Road network	3.691 (22.6)***	-1.043 (-2.6) **	1.2 (17.9)***	-2.204 (8.7)***
Nutritional status	1.385 (14.2)***	0.964 (10.0) ***	5.201 (23.5)***	2.333 (13.2)***
Literacy rate	6.490 (16.5)***	3.977 (25.7) ***	5.269 (22.568)***	7.785 (17.3)***
Medical services	1.068 (10.6)***	-1.845 (-9.2) ***	0.239 (4.4)***	1.482 (8.8)***
Legal services	1.838 (4.1)***	0.246 (0.5)	0.639 (0.9)	2.478 (2.7)***
Extension services (Livestock)	-2.930 (-8.4)***	-3.201 (-7.3) ***	-8.632 (-21.7)***	-0.081 (-0.1)
Research services (Livestock)	2.153 (4.8)***	-1.789 (-2.2) **	3.959 (10.3)***	-0.758 (-1.8)*
Extension services (Crops)	-2.765 (-5.5)***	-4.319 (-4.8) ***	-0.148 (-0.2)	-2.662 (-6.9)
Research services (Crops)	1.627 (3.5)***	-1.161 (-3.3) ***	-1.563 (-3.2)***	-0.701 (-3.5)***

Mechanization	1.405 (4.9)***	-0.158 (-0.4)	0.101 (0.4)	1.589 (5.2)***
Animal health	0.837 (8.0)***	6.748 (11.9) ***	3.475 (13.5)***	0.698 (1.4)

Notes: Figures in parenthesis are t-ratios. ***, ** and * denote statistically significant at the 1%, 5% and 10% levels, respectively, on the basis of a two-tail test.

Investment in human capital was boosted through the *Seventh and Eighth Five Year Plans (1988-1993 and 1993-1998)* (Govt. of Pakistan, 1987, 1994). Thus, all provinces exhibited generally positive trends in the literacy rate, nutritional status and medical services for human beings, and animal health services through treatment and vaccination. Growth in legal services was considerable in Punjab and Balochistan, while it was negligible in the rest. In respect of animal health (number of livestock treated), Balochistan excelled of all provinces, while the same in Punjab was negligible and statistically insignificant at the 10% level. Conversely, extension services for both livestock and crops declined in all provinces except Balochistan, where change is negligible. Research services for livestock increased in Punjab and KP but declined in Sindh and Balochistan. Research services for crops went up in Punjab and declined in the rest. Mechanization increased substantially and significantly in Punjab and Balochistan but did not change significantly in Sindh and KP. The road network per unit of crop and livestock output deteriorated in Sindh and Balochistan, but improved significantly in the other two provinces.

c) Estimates of Impacts of Determinants on TFP

Following Rosegrant and Evenson (1993), the combined TFP index was regressed against the above referred determinants in a log-linear way. The data were found to be suffering from heteroskedasticity problem, which was remedied by using the appropriate model of the econometric software, namely, EViews 6. The parameter estimates, representing elasticities, for the combined TFP for the four provinces are set out in Table III. The base elasticity (parameter) estimates are for Punjab and those for the other provinces were obtained by adding the interaction dummy estimates to the base and testing the difference from zero. Considerable differences for elasticity estimates and direction of change in the determinants are observed and explained below.

Table III : Model estimates for the determinants of TFP for Livestock

Variables	Coefficient	Standard error	z-statistic	*p*-value
Constant	-0.728	0.61	-1.19	0.23
Sindh dummy	-0.272	0.70	-0.39	0.70
KP dummy	1.59	0.65	2.43**	0.02
Balochistan dummy	4.063	2.09	1.96**	0.05
Tubewells (T)	0.008	0.08	0.11	0.92
Canals (C)	0.286	0.09	3.04***	0.00
Roads (RD)	0.037	0.03	1.19	0.23
Nutritional status (N)	0.357	0.10	3.41***	0.00
Literacy rate (L)	-0.048	0.02	-2.09**	0.04
Medical facilities (MF)	0.222	0.13	1.66*	0.10
Judicial services (J)	-0.051	0.01	-4.92***	0.00
Extension services for Livestock (E_L)	-0.219	0.03	-7.18***	0.00
Research services for Livestock (RS_L)	0.040	0.01	3.41***	0.00
Extension services for Crops (E_C)	0.247	0.04	5.90***	0.00
Research services for Crops (RS_C)	-0.098	0.03	-2.89***	0.00
Mechanization (ME)	0.009	0.04	0.25	0.80
Animal Health (AH)	0.006	0.02	0.24	0.81
Sindh*T	-0.061	0.09	-0.68	0.50
Sindh*C	-0.304	0.12	-2.59***	0.01
Sindh*RD	-0.118	0.03	-3.64***	0.00
Sindh*N	-0.311	0.12	-2.70***	0.01
Sindh*L	0.300	0.04	7.72***	0.00
Sindh*MF	-0.118	0.14	-0.87	0.38

Sindh*J	0.028	0.01	2.59***	0.01
Sindh*E_L	0.092	0.03	2.77***	0.01
Sindh*RS_L	-0.046	0.02	-2.45***	0.01
Sindh*E_C	-0.186	0.04	-4.36***	0.00
Sindh*RS_C	0.129	0.04	3.29***	0.00
Sindh*ME	-0.069	0.04	-1.63*	0.10
Sindh*AH	0.045	0.03	1.75*	0.08
KP*T	0.159	0.09	1.80*	0.07
KP*C	-0.170	0.13	-1.34	0.18
KP*RD	-0.077	0.05	-1.66*	0.01
KP*N	0.123	0.20	0.62	0.54
KP*L	-0.015	0.04	-0.38	0.70
KP*MF	-0.643	0.15	-4.17***	0.00
KP*J	0.051	0.01	4.83***	0.00
KP*E_L	0.258	0.04	7.15***	0.00
KP*RS_L	-0.016	0.02	-0.99	0.32
KP*E_C	-0.348	0.05	-7.56***	0.00
KP*RS_C	0.108	0.04	3.03***	0.00
KP*ME	0.054	0.04	1.27	0.20
KP*AH	0.039	0.05	0.80	0.42
KP*AV	-0.043	0.12	-0.36	0.72
Balochistan*T	0.077	0.19	0.41	0.68
Balochistan*C	-0.256	0.09	-2.98***	0.00
Balochistan*RD	-0.032	0.21	-0.15	0.88
Balochistan*N	0.204	0.07	2.83***	0.00
Balochistan*L	-0.760	0.20	-3.77***	0.00
Balochistan*MF	0.226	0.03	8.01***	0.00
Balochistan*J	0.376	0.06	6.26***	0.00
Balochistan*E_L	-0.085	0.07	-1.17	0.24
Balochistan*RS_L	-0.386	0.08	-4.91***	0.00
Balochistan*E_C	-0.108	0.23	-0.46	0.65
Balochistan*RS_C	0.316	0.18	1.74*	0.08
Balochistan*ME	-0.017	0.06	-0.30	0.77
Balochistan*AH	0.102	0.61	1.19	0.15

Note: *** significant at the 1 per cent level, ** significant at the 5 per cent level, * significant at the 10 per cent level on the basis of a two-tail test. R^2 = 0.97, Adjusted R^2 = 0.95 and DW statistic = 1.52.

The R^2 measuring overall goodness of fit is 0.97, showing that the model is well fitted to the data set used for the analytical purpose. The base coefficient estimate for intercept is less than zero and statistically insignificant (at the 10% level), which compares well with that reported by Ellahi *et al.* (2012). The same for Sindh is further low and those for KP and Balochistan are positive and statistically significant at the 5% level. It may be noted that in view of varying agro-climatic conditions, the pattern of livelihood in KP and Balochistan is different from that in Punjab and Sindh and the said results truly represent the inherent phenomenon in crop and livestock activities.

The base coefficient estimates for water resource development (T and C) bear positive signs as expected and that for tubewell is insignificant and close to zero, which may be attributed to spurious correlation between the said irrigation variables. The estimates on interaction dummies for water-scarce KP and Balochistan are above the base showing the need for tubewell water to irrigate crops and fruit trees. The estimate on C is significant at the 1% level and the same with interaction dummies for the rest of provinces are below the base showing that canal system in Punjab is better developed and impacting positively on the combined TFP as reported by Ellahi *et al.* (2010).

The base elasticity estimates for road infrastructure (RD) and nutrition (N) are positive and the latter is statistically significant at the 1% level, while a converse of this is true for Sindh where the coefficient estimates for the interaction variables are statistically significant at 1% level. These results are in line with the temporal change in RD as seen from Table II. In KP and Balochistan road variable bears negative sign, while nutrition coefficient estimate is above the base estimates. In Punjab, a 1% increase in roads leads to about 0.04% increase in the combined crop-livestock TFP, while the effect of N is many times higher than that created by RD. The general tendency noted with respect to both N and RD is in line with those reported by Ellahi *et al.* (2010) in respect of TFP for crop production in the four provinces.

Literacy and medical facilities (L and MF) contribute positively in Punjab, but the estimate on both are statistically insignificant at 10% level), which is true for Sindh and KP as well but for literacy only. Interaction dummies with L and MF for Balochistan, being negative is consistent with expectations that its population is well spread (Ellahi *et al*., 2010) and has the lowest access to these facilities as compared with the rest. Further, crop-livestock activities do not require literacy whose annual growth is the highest in Balochistan (Table II) but is negatively associated with the combined TFP. The impact of judicial services (J) for the combined TFP, as seen from coefficients on the base is negative and significant at 1% level and converse of this is true for the rest of provinces as seen for the interaction dummies. These results are consistent with those reported by Ellahi *et al.* (2010). It is noteworthy that in KP and Balochistan, a traditional system called *Jerga* (a jury comprising tribal heads) is effectively used for the settlement of disputes among the parties concerned. Thus, crop-livestock producers are more confident about their legitimate rights in KP and Balochistan as compared with those in Punjab.

As seen from Table II, public expenses incurred on extension services on livestock and crops generally retarded in most of provinces. However, extension activities in Punjab for crop sector (E_C) are well developed than those for livestock (E_L), which is reflected in positive and strong impact of the former on combined TFP, while a converse holds for the latter, i.e. E_L. On the other hand, in view of strongly uprising livestock industry a great deal of research efforts (RS_L) are being made which is reflected in strongly positive impact on the base coefficient estimate. The trend in crop research (RS_C) variable is significantly negative, which is consistent with results reported by Ellahi *et al.* (2010) and in contrast with the inferences drawn by Rosegrant and Evenson (1993). This observation need to be carefully interpreted because implications of research expenses for combined TFP growth are obtainable with a considerable time lag (Ali, 2005). Also, the results presented by Kiani *et al.* (2008) highlight the lagged relationship between expenses on RS_C and combined TFP growth and lend support to results presented in this study. The situation with respect to expenses on RS_C for the remaining provinces of Sindh, KP and Balochistan contrasts with that in Punjab and accord with the conclusions drawn by Rosegrant and Evenson (1993). As seen from Table III, the coefficient estimates for the rest all are above the base estimates for Punjab and generally significant at the 1% level. There seems a plausible explanation for this inference. Punjab has long benefited from RS_C and E_C in crop production (Heisey, 1990 and Byerlee, 1993), while it is yet to be accomplished in the other provinces and the said efforts are yielding good payoffs. Further, technological spillovers across provinces should have been achievable (Ellahi *et al.,* 2010) to boost agricultural output in Sindh, KP and Balochistan.

The base and other coefficient estimates for mechanical technology (ME) are generally insignificant at the 5% level. The base estimate and interaction dummy for KP bear positive and those for Sindh and Balochistan have negative signs. As per economic logic, it is expected that ME and TFP for livestock, comprising animal draught power, are substitutes as they replace each other, while ME and TFP for crops are complements. Therefore, the relationship of the combined TFP and ME is expected to be mixed as it is observed. The coefficient estimates for animal health (AH) for Punjab and others, though generally insignificant at the 5% level, have a positive impact on the combined TFP.

IV. Conclusion

The empirical analysis revealed that the development of irrigation and other economic infrastructure and policies for development of human capital had important implications for the growth of combined TFP. However, the benefits of growth are not evenly distributed across various provinces over the study period. The log-linear model used to decompose the combined TFP is well fitted to the data set used for analytical purposes.

The irrigation infrastructure is the most effective in triggering the growth of combined TFP in Punjab as compared with the rest of provinces. Road development and nutrition benefited producers in Punjab in a disproportionate way than those in other provinces. The relationship of the combined TFP and tractor technology is mixed as it is expected that tractor and livestock are substitutes, while tractor and crops are complements. The benefits of literacy and medical facilities are spatially well spread and motivate TFP growth across most of the provinces. However, judicial services tend to retard combined TFP in Punjab, while a converse is true for those having informal system of justice.

Well developed extension activities for crops in Punjab are is reflected in positive and strong impact on combined TFP than the same for livestock. On the other hand, uprising livestock industry is attracting a great deal of research efforts which is reflected in strongly positive impact on the base coefficient estimate. The trend in crop research variable is negative, which is consistent with results reported by Ellahi *et al.* (2010)

and in contrast with the inferences drawn by Rosegrant and Evenson (1993). This needs to be carefully interpreted as implications of research expenses for TFP growth are obtainable with a time lag (Ali, 2005 and Kiani *et al.,* 2008). The situation in other provinces contrasts with that in Punjab and accord with Rosegrant and Evenson's (1993) results. There seems a plausible explanation for this inference. Punjab has long benefited from research and extension for crops, while it is yet to be accomplished in the other provinces. Finally, coefficient estimates for animal health have a positive impact on combined TFP.

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Water Quality Evaluation of Hand-Dug Wells in Ibadan, Oyo State, Nigeria

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Abstract - In many countries around the world, including Nigeria, access to potable water has become a mirage. Exploitation of groundwater through the construction of hand-dug wells is a major source of drinking water for majority of the populace. The need to assess the quality of water from this source to ascertain the role of well construction methods has now become imperative because of the health impacts on individuals. Random surveys of three classifications of hand-dug wells were done between June and October 2010, in Ibadan, Nigeria. One hundred and one (101) hand-dug well were selected. A standard form was used for capturing data used for the classification of the wells into protected, semi protected and unprotected. Standard laboratory methods were employed for the analysis of electrical conductivity, pH, Temperature, Chlorides, Nitrate, E. coli and Total Coliform Count. Results show that Nitrate concentration, E. Coli and Total Coliform Count are more pronounced in wells that are installed close to domestic refuse waste, abattoir, Pit latrine, stagnant water and drainages. The pronounced concentrations decreased with increasing distance from the pollution sources irrespective of well classification. Protected wells gave better water quality relative to semi protected and unprotected wells. The paper recommends regular monitoring of groundwater quality, abolishment of unhealthy waste disposal practices and regulation of self supply well construction and design.

Keywords : *hand dug well, groundwater, protected well, semi-protected well, un-protected well.*

GJSFR-D Classification : *FOR Code: 090508*

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Strictly as per the compliance and regulations of :

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I. Introduction

Access to safe drinking water is a problem facing a large proportion of the inhabitant of the developing nations (UNICEF, 2005; Cosgrove and Rijsberman, 2000; Gomez and Nakat, 2002). In spite of the considerable investments of Nigerian government in water supply programme, over 52% of its population have no access to potable water (Oluwasanya, 2009). For instant in Ibadan, despite the effort of public water agency in providing potable water to the populace, the problem of acute water shortage is still dominant. Low access to safe water in Nigeria has been attributed to the enormous socio-economic development, growing industrial base, poor planning, insufficient funding and haphazard implementation, to mention a few (Oluwasanya, 2009). Consequently, the inhabitants have resulted into the use of hand-dug wells as an alternative source of water supply. Hand-dug wells also provide cheap and low-technology solution to the challenges of rural and urban water supply. Well construction too affords an opportunity for community participation during all phases of the water supply process (Seamus, 2000). Hand-dug wells could either be protected, un-protected or semi-protected. A protected well is one equipped with a dedicated pump (manual or motorised), concrete lining and platform (or apron), head wall, cover and drainage channel (Murcott, 2007; Oluwasanya et al., 2011). Un-protected well is without any of the features stated above and a semi-protected well may have one or more of the features found in a protected well (Oluwasanya et al., 2011). Most hand-dug wells are shallow, although wells as deep as 120 metres have been reported (Watt and Wood, 1977). The wells are often more vulnerable to contamination than deeper boreholes. Whilst some shallow dug wells have a mechanised pumping, the majority (particularly those in developing countries) have water abstraction through some form of hand pump, windlass or rope and bucket system (Collins, 2000). Shimizu et al. (1980) have shown that bacteria contaminate well water depending on location. Thus, it is suspected that water from wells in unhygienic areas could be contaminated according to their proximity to sources of pollution. Contaminants such as bacteria, viruses, heavy metals, nitrates and salts have polluted water supplies as a result of inadequate treatment and disposal of waste from humans and livestock, industrial discharges, and over-utilisation of limited water resources (Adeyemi *et al.*, 2007). Contamination of well water, which has led to health risks, is known in the study area. Therefore, it becomes imperative to investigate the effect that construction pattern of hand-dug well has on water quality.

a) Study Area

Ibadan was derived from two words 'Eba Odan' meaning near savannah (Ayoade, 1979). The city is located in southwsetern Nigeria between latitudes 7^0 00^1 and 7^0 30^1 and between longitudes 3^0 30^1 and 4^0 00^1 (Figure 1). It is the capital of Oyo State. The city is located at about 128 km northeast of Lagos and 530 km southeast of Abuja. Its elevation ranges from 150 m above sea level (asl) in the valley to 275 m asl on the major North-South ridge (Lloyd et al., 1987). Ibadan is located within the undifferentiated basement complex and the rock types consist of quartizes of meta-

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sedimentary series and migmatites complex consisting of branded gneiss and auger gneiss. The minor rock type is pegmatites. The gneiss in Ibadan is strongly folated into a general strike of NNW-SSW (Adeyemi et al., 2007). In 2006, Ibadan had a population of 2,550,593 (National bureau of Statistics, 2006). Ibadan is continually growing in human population and this has resulted in continuous increase in water consumption demand. This situation has led to persistent water shortage in the city and its environs.

II. Materials and Method

One hundred and one (101) hand-dug wells were randomly selected from four Local Governments in the core area of Ibadan. The core area includes Ibadan North Local Government, Ibadan North East Local Government, Ibadan South East Local Government, and Ibadan South West Local Government (figure 1). The selection criteria for the wells were based primarily on construction pattern and mode of operation of the wells (Table 1). Typical examples of the selected wells per classifications are shown in Figure 2. Other considerations include location in residential areas and accessibility.

Water samples at different locations collected for laboratory analysis were taken following standard procedure and immediately labelled on the field using appropriate well codes. A plastic bottle was used to collect water samples for physico-chemical analysis, while a sterilized plastic bottle kept in an insulated cold box was used to collect samples for microbial analysis. Standard laboratory methods were employed for the analysis of Electrical Conductivity, pH, Temperature, Chlorides, Nitrate, E. coli and Total Coliform Count (TTC). The information on age of well, static water level, depth of well, distance to toilet/burial site, number of users was also gathered in the study. The information was sourced either by measurement, interviews or personal observations.

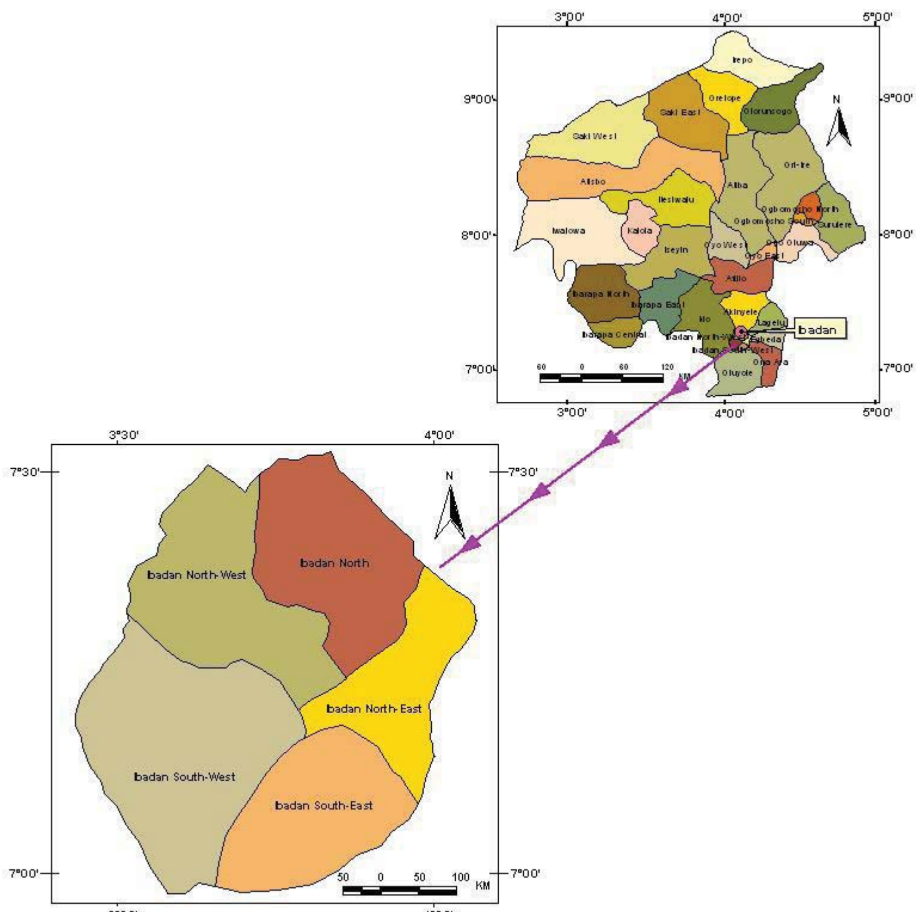

Figure 1 : Map of Ibadan land showing the study Areas

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Table 1 : Hand dug well classifications based on structure and mode of operation

Well Operation	Hand-Dug Well structures				
	LCAD	LAD	CAD	LC	NONE
Pump	P^{+}	S	S	P	U
Bucket/Rope	P^{-}	S	S	S	U

Note: L: Lining, C: Cover, A: Apron, D: Drainage, P: Protected Well, +: Best practice, -: Lower level than best practice, S: Semi-protected or missing one or more construction features, U: Unprotected or missing most of/no protective feature. Source: (Oluwasanya et al., 2011)

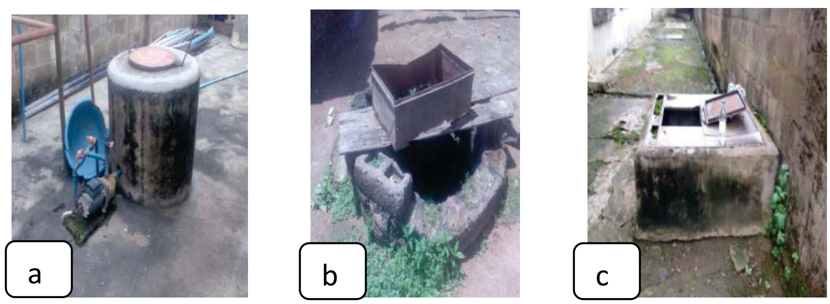

Figure 2 : Construction patterns of selected wells- a: protected well; b: unprotected well; c: semi-protected well

III. Results and Discussions

The number of selected wells that fits into each well classification is presented in Table 2. Forty one percent (42) of the hand-dug wells are protected, 37% (37) and 22% (22) of the wells are semi-protected respectively (Figure 3).

Table 2 : Number of wells within existing well classifications, type of operation, proximity to sanity facilities and number of users

Construction Pattern	Mode of Operation			Average Distance to Pollution Source		Average No of Users
	Pump	Pump/Bucket& Rope	Bucket & Rope	Toilet (m)	Burial Site (m)	
Protected Well	8	3	31	35.70	40.58	50
Semi-Protected Well	2	-	35	14.20	20.66	99
Unprotected Well	-	-	22	9.42	7.94	200
Total	10	3	88			

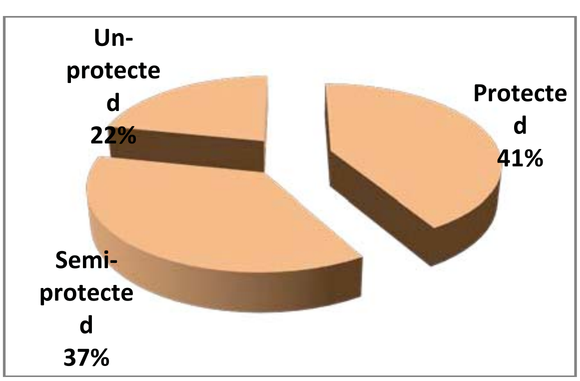

Figure 3 : Construction patterns of hand-dug wells

a) *Hand-dug Well classification and Water Quality*

The result of water analysis for different well classification is presented in Table 3. Table 3 shows that the highest average value of 869.98 us/cm was recorded for electrical conductivity in unprotected well relative to 688.65 us/cm and 808.46 us/cm that was recorded in protected and semi- protected respectively (Table 3 and Figure 4). The recorded high EC in unprotected wells may be due to direct ingress of water due to poor well construction. However, all of the recorded values are below the recommended value of 1000 us/cm (WHO, 2011; NDWQS, 2007).

Table 3 : Relationship between the average water quality status and hand dug well classifications

	EC (us/cm)	PH	TEMP (^{0}C)	CHLORIDES (mg/l)	NITRATES (mg/l)	E.COLI (100ml/cfu)	TTC (100ml/cfu)
Protected Well	688.65	6.77	27.10	54.25	45.91	23.5	348.19
Semi-Protected Well	808.46	6.81	26.89	74.78	61.37	58.37	424.86
Un-Protected Well	869.98	6.94	26.21	67.72	56.61	74.09	685.00
WHO Standard	1000.00	6.50-8.50	27.00	200.00	50.00	0.00	10.00

The average chloride values ranges from 54.25mg/l for protected well, 74.8mg/l for semi-protected well and 67.73mg/l for un-protected well (Table 3 and Figure 5). All this values are below the recommended WHO (2011) value of 200mg/l for drinking water.

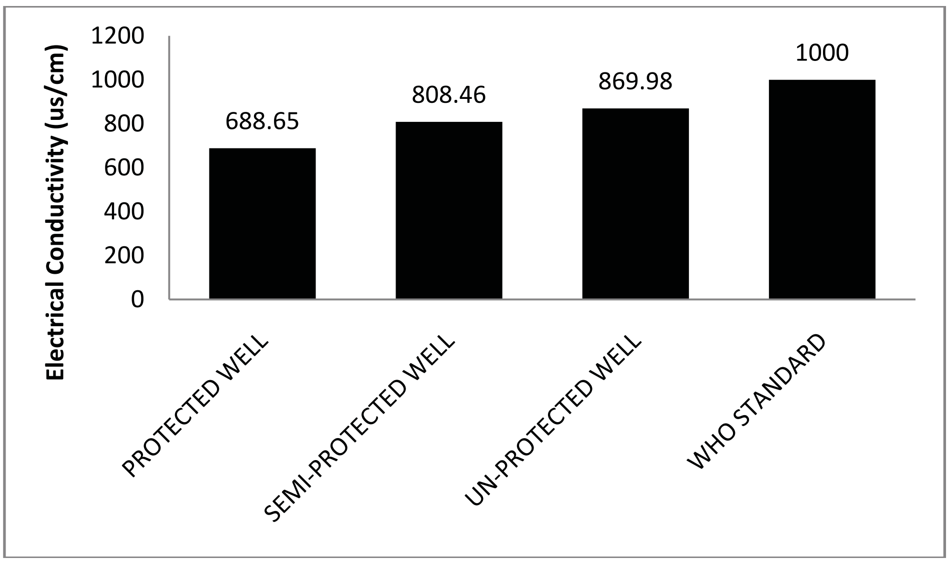

Figure 4 : Average level of electrical conductivity in hand-dug wells

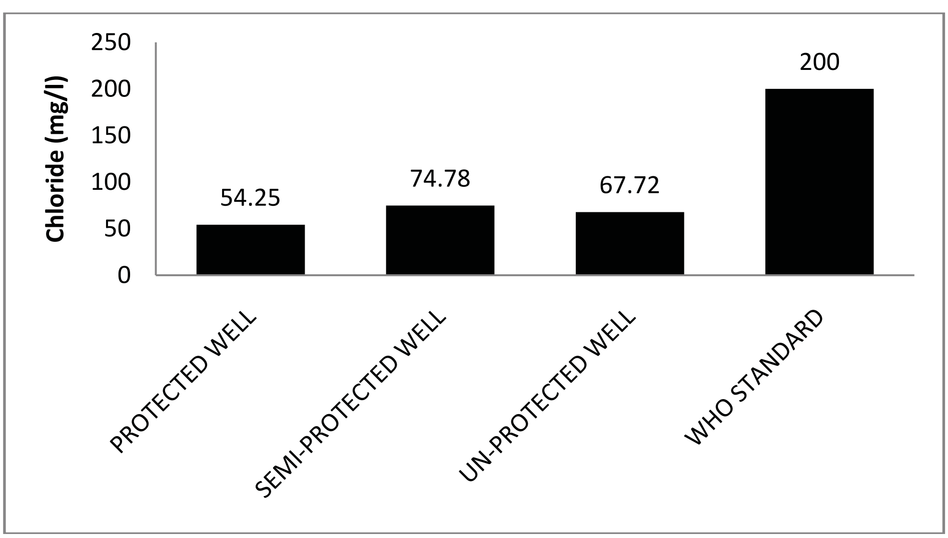

Figure 4 : Average values of Chlorides in hand-dug wells

Elevated nitrate were identified in the unprotected and semi-protected samples tested, with average values of 61.37 mg/l and 56.62 mg/l respectively compared to the protected well with an average value of 43.19 mg/l (Table 3 and Figure 6). Most of the semi-protected and the un-protected wells have nitrate concentrations higher than the WHO (2011) recommended value of 50 mg/l for drinking water.

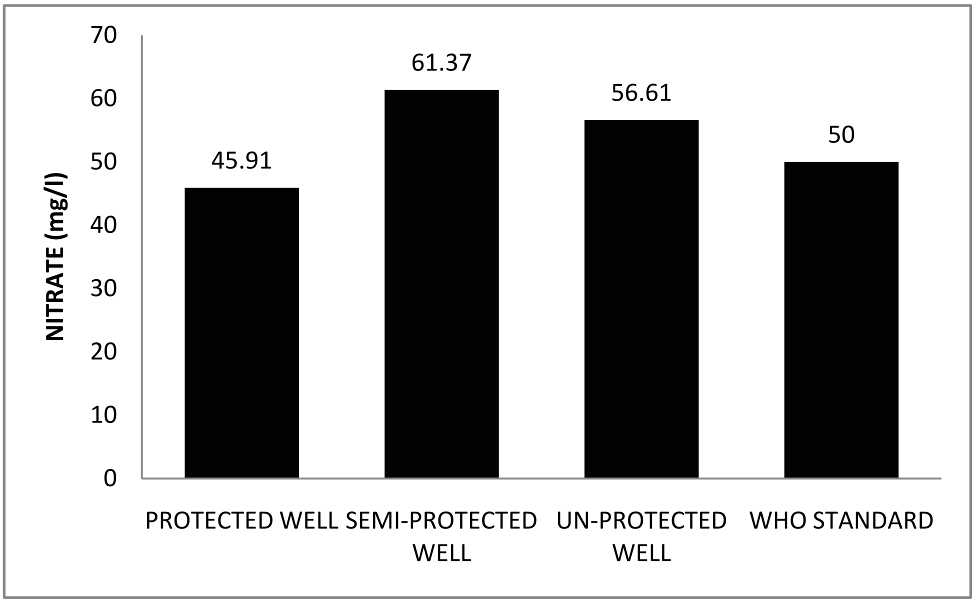

Figure 5 : Average values of Nitrate in hand-dug wells

Nitrate has known human health impacts, primarily in infants. Nitrate affects haemoglobin in the blood and reduces the babies' ability to transport oxygen; infants so affected are said to have 'blue baby syndrome'. There is also a 'suspected link between exposure to nitrate and cancer in human (WHO, 2004). The most common origins of nitrate in groundwater within the study area are agricultural activities and disposal of untreated human waste.

Furthermore, the results showed that all water samples contained E. coli that does not conform to the maximum contaminant level of 0cfu/100ml. The E. coli in protected well ranges between 0-90cfu/100 ml, while in semi-protected and unprotected well, it ranges from 0 - 120cfu/100ml and 0 - 270cfu/100ml respectively (Figure 7).

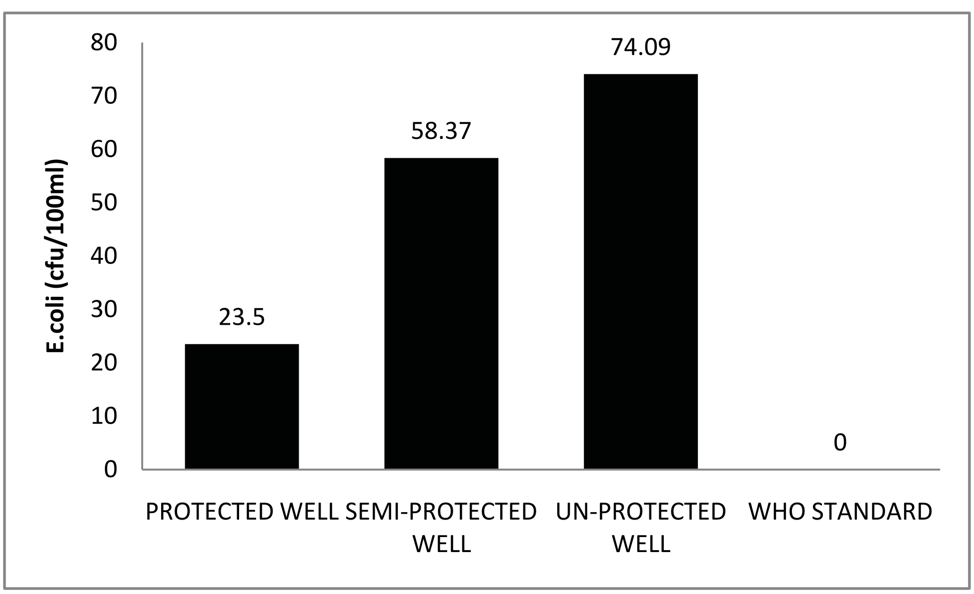

Figure 6 : Average values of E. coli in hand- dug wells

Effects of the presence of E. coli in water include: Urinary track infections, bacteraemia, meningitis, diarrhea, (one of the main cause of morbidity and mortality among children), acute renal failure and haemolytic anaemia (WHO 2006).

From the result of the analysis on TTC , it was observed that all the tested samples have detectable amount of TTC, with concentration ranging from 0-1260 cfu/100 ml for protected, 120-840cfu/100ml for semi-protected and 210-1420cfu/100ml for unprotected wells (Table 3 and Figure 8), as against the WHO (2011) acceptable limit of 10 cfu/100ml for potable water. This is an indication of faecal contamination.

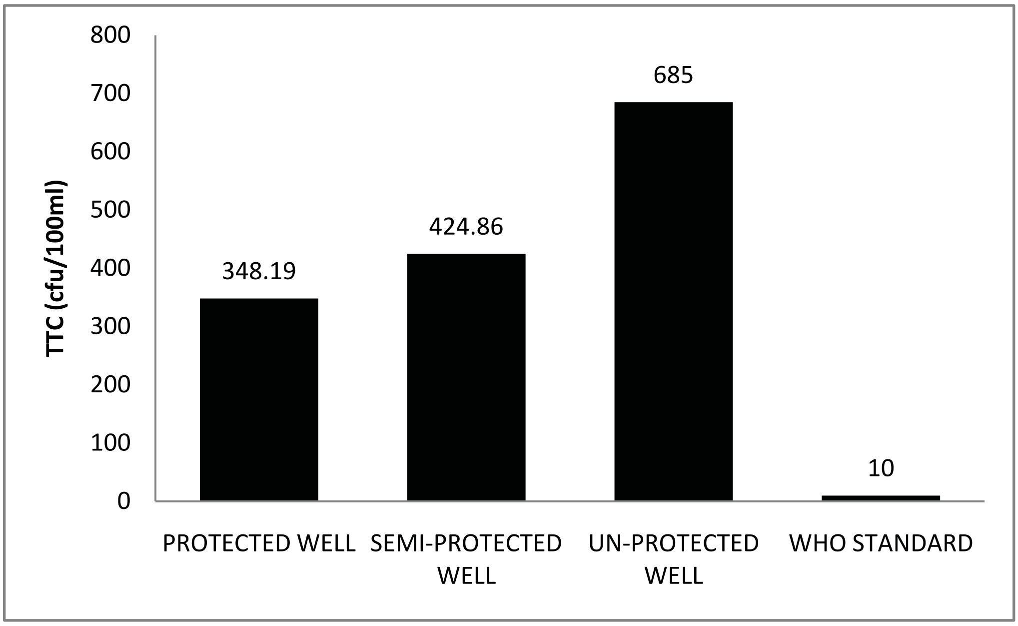

Figure 7 : Average values of Total Coliform Count in hand-dug wells

b) Hand-dug Well Classification and Mode of Abstraction

Observations during survey shows that possible contamination during abstraction because 3% of the hand-dug wells were operated with both pump and bucket & rope while 10% are operated through a motorized pump and 87% of the hand-dug wells were operated through bucket and rope gotten from different sources. This implies that high level of contamination during abstraction will be expected (Table 3 and Figure 8).

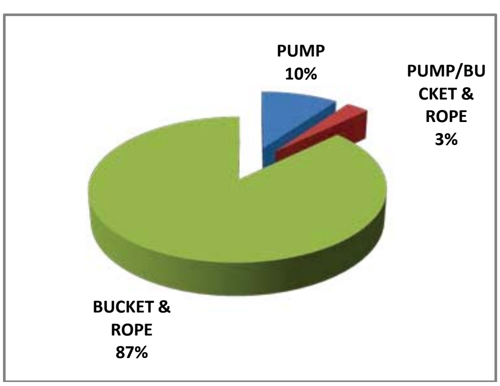

Figure 8 : Means of hand-dug wells Abstraction

Poor well design and construction can also contaminate groundwater by allowing polluted surface water to reach the groundwater without filtering through soil. Wells constructed in pits, or built without being sealed or without a cap, may allow infiltration of contaminated surface water to carry bacteria, nitrates, pesticides, fertilizer, or oil into the drinking water supply. Proper well design and construction reduce this risk by sealing the well from contaminants that might enter from the surface.

c) Hand-dug Well Classification Versus Well Location

Proper location of hand-dug well is important to water quality. Locating a well in a safe place takes careful planning and consideration of surface drainage and possible contamination sources. A well downhill of pollution source has a greater risk of contamination than a well uphill of pollution sources. Similarly, as expected and as shown in this study, the greater the distance a well is from a potential contamination source, the less likely the well will be contaminated directly by that source. The Mississippi State Department of Health requires that a new well be installed at least 15.24 m from a septic tank and at least 30.5 m from the septic system drain field. These are *minimum separation distances*, and a well must be installed farther away from all pollution sources if possible.

Therefore, as presented in the result above (Table 3) an unprotected well with distance 9.42 m from pollution source has a greater risk of contamination

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relative to the semi-protected and protected hand-dug wells with 14.20 m and 35.70 m respectively from pollution sources.

d) Well Age and Total Number of Users

The average age for Protected, Semi-protected and Un-protected hand-dug wells are 13 years, 32 years and 48 years respectively (Table 3). Age of well can be an important indicator of its ability to keep out contaminants. Hand-dug well of more than 70 years old is more likely to be shallower, located at the center of homestead, and surrounded by many potential contamination sources. Older well pumps are more likely to leak lubricating oils into the well. Older wells also are more likely to have thinner casing that may be corroded and allow in a contaminant. Even wells 30 to 40 years old may be subject to corrosion.

IV. Conclusion

The paper shows that the use of bucket and rope in the abstraction of water from hand-dug wells may contribute to increase in contamination of water in the wells irrespective of the well classification. Judging the importance of each of the well category in the study area, the use of protected wells design has been proven to be the best for proper hygiene and protection of wells. However, the combined effects of installing wells close to sanitary facilities, waste dumps, industrial effluent discharge area and burial ground, contributes significantly to high pollution of wells, resulting in the deterioration of the quality and its potential public health risk. Hence, there is therefore the need for a periodic water quality monitoring and incorporation of household water treatment practices with hand-dug well water. Upgrade of semi-protected and unprotected wells is recommended, and public enlightenment on water quality is necessary to forestall potential public health treats from such sources.

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

Research articles: These are handled with small investigation and applications

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

5.STRUCTURE AND FORMAT OF MANUSCRIPT

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

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

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

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

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

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

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

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

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

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

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

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

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

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

Acknowledgements: Please make these as concise as possible.

References

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

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

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6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

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(Free of charge) from the following website:

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TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

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

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

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6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

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15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

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

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

Informal Guidelines of Research Paper Writing

Key points to remember:

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

Final Points:

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

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

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

General style:

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

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

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

· Shun use of extra pictures - include only those figures essential to presenting results

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

Abstract:

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

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

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

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

Approach:

- Single section, and succinct
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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
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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.
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- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

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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.

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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:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- 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:

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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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