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BACTERIOLOGICAL EXAMINATION OF DRY SACHET MILK POWDER SOLD IN RETAIL OUTLETS IN AUCHI

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Abstract: *The bacteriological examination of five (5) commercially retailed dry sachet milk powder (Three crown, Cowbell, Loya, Dano, and Peak) were analysed using the pour plate method. The result showed that the bacteria isolated from the powdered milk samples were Streptococcus* spp*, Bacillus* spp*. Staphylococcus* spp*. Pseudomonas* spp*, Micrococcus* spp*. and Lactobacillus* spp*. Although the microbial count was low, the fact remains that their presence in the product would certainly compromise its shelf life and there by constituting health hazard especially to children and lactase intolerance people. In view of this result, there is need for the manufacturers to tighten their in –process quality control checks and for retailers and, consumers to store these sachet powdered milk properly in their to avoid spoilage. Food regulatory agencies such as National Agency for food and Drug Administration and Control (NAFDAC) are enjoined to carry out routine checks from time to time on these milk producing companies to ensure consumer safety standards are not compromised.*

Keyword: *Bacteriological, examination, dry powdered sachet, milk powder, retail outlets.*

INTRODUCTION

Milk is uniquely nutritious and a major source of protein and calcium. Dried Milk powder is a

powder-like food product obtained by means of drying previously condensed milk. Powdered milk has a far longer shelflife than liquid milk and does not need to be refrigerated due to its low moisture content. It is less expensive and easier to store than fresh milk, but has a disadvantage that it never tastes quite like the real thing. Milk powdered was first made in 1802 by a Russian doctor Osip Krichevsky (Pearce, 2000). It is found abundantly in many developing countries because of reduced transport and storage cost (as it does not require refrigeration) like other dry foods. It is considered non- perishable and is favoured by survivalist, hikers and other people in need of nonperishable easy to prepare food stuff (Anshumala and Niranjan, 2012).

Powdered milk is often used in baking, in recipes where adding liquid milk would render the product too thin to be used. It is a common sight in UN food aid supplies, fallout shelter, warehouses and wherever fresh milk is not a viable option. Powdered milk is also used in western blots as a blocking agent to prevent non-specific protein interactions. The body needs Vitamin D to absorb calcium. Good sources of vitamin are sunshine, Cod liver Oil, Multivitamins, liver and of course milk. Milk drawn from a healthy animal already contains some bacteria. Most of the changes which take place in the flavour and appearance of milk, after it is drawn from the ruminant udder are as a result of the activities of microbes (Oliver *et al*, 2009). The favourable microbes bring favourable changes in flavour and appearance and are carefully propagated while the pathogenic (Unfavourable) ones which may cause diseases are destroyed to make the milk and its products safe for human consumption (Pearce, 2000).

Milk and dairy products are generally very rich in nutrients which provide an ideal growth environment for many microorganisms. The microorganisms associated with milk spoilage include: Psychrotrophic bacteria, which are bacteria that are capable of growing at 7^0C or less. They are of primary concern to dairy industry since they can grow and cause spoilage in raw and processed dairy products commonly held under refrigeration. The commonly bacteria found in milk are the gram-negative rods belonging to the genus *Pseudomonas.* These bacteria produce some enzymes that are

neither inactivated by pasteurization nor by other local treatment. They continue to degrade milk products even when the bacterium is destroyed (Salman and Hamad, 2011). Serious taste and odour defects can appear due to an accumulation of products resulting either from cell metabolism or from the effect of complex enzyme systems on the milk constituents. Many undesirable changes in organoleptic quality of milk are possible when environmental conditions are conducive to microbial proliferation and enzyme activity (Varnam and Sutherland, 2001). Most frequently one speaks of milk that is sour, bitter, fruity, rancid, malty, with an off-flavour taste, and also of dirty milk, etc. These forms of spoilage are associated with the growth of yeasts, moulds and bacteria. In view of its ecological characteristics, bacteria contamination is the most frequent and the greatest, and its potential development should be feared most of all. This contamination is responsible for two main types of defects: souring and lipolysis. The defects due to acidification are the most frequently encountered since lactic flora is one of the main natural contaminants of milk, being predominantly mesophilic in character. Thermoduric bacteria are responsible for the spoilage of milk due to their ability to survive pasteurization and other local treatment while coliform bacteria when detected in pasteurized milk generally indicate recontamination after pasteurization. These coliforms include *Escherichia coli, Klebsiella* spp*, Enterobacter* spp, and C*itrobacter* spp. The Lactic Acid Bacteria (LAB) are a group of bacteria capable of fermenting lactose to lactic acid which may be responsible for the sour taste and odour associated with spoilt milk. These bacteria are normally present in the milk and are used as starter culture in products such as yoghurt. Lactic acid bacteria generally are not heat resistant and most of them are destroyed by low temperature pasteurization (Ogbanna *et al,* 2012). However, the survivors or recontaminating bacteria can be responsible for further souring if temperature conditions are favourable to their development. The predominant lactic flora in milk is mesophilic and the natural environmental conditions in warm and hot regions are often favourable to its proliferation. The use of cold treatment at different stages of production, processing and marketing makes it

possible in practice to decrease considerably the dangers of spoilage due to uncontrolled proliferation of these lactic acid bacteria.The aim of this study is to isolate bacteria from dry sachet milk powder sold on retail outlets in Auchi.

MATERIALS AND METHODS COLLECTION OF SAMPLES

Five (5) commercially available dry powdered sachet milk (Three crown, Cowbell, Loya, Dano, Peak) were purchased at different locations within Auchi metropolis. The sample were coded as Sample A, B, C, D and E respectively (Table 1). The samples were transported to the microbiology laboratory for analysis.

STERILIZATION OF MATERIALS

The work bench was first disinfected by swabbing with cotton wool soaked in 70% alcohol. The glass wares used were washed with detergent, rinsed properly in several changes of tap water and further rinsed with distilled water. The glass wares used included test tubes, pipettes, conical flasks, beakers and McCartney bottles. They were then air dried and wrapped with aluminium foil and sterilized in the hot air oven at 170^{o}C for 2-3 hours. Aseptic technique was applied in the working environment by ensuring that all work was done near the naked flame of Bunsen burner.

PREPARATION OF CULTURE MEDIA

Two different kinds of media were used for the isolation of different microorganisms from the samples and they are nutrient Agar (NA), and MacConkey Agar and they were prepared according to the manufacturers specifications. Other reagent used were employed in the various biochemical tests to characterize and identify the bacterial isolates.

ISOLATION OF BACTERIA AND TOTAL BACTERIAL COUNTS

10g of the powdered sachet milk were weighed using a weighing scale and was introduced into sterile containers, 90ml of sterile distilled water was used to dissolve it. Thereafter, ten (10) fold serial dilutions of the samples was carried out. 1ml of each Milk sample was drawn aseptically using a sterile pipette and transferred into a test tube containing

9ml of sterile distilled water. After shaking, 1ml of the first diluted sample (10^{-1}) was aseptically withdrawn and transferred into another 9ml of sterile distilled water contained in a test tube and shaken again, this represents 10^{-2}. This was done repeatedly until a dilution of 10^{-5} was obtained. Subsequently 1ml each from dilutions 10^{-1}, 10^{-3} and 10^{-5} was aseptically taken and plated on nutrient agar (NA) using the pour plate method. This was used for the total bacterial count. Each of the plates was incubated at 37^{o}C for 24 hours. Colonies that developed on the plate after incubation were observed and counted and records were made accordingly. Pure cultures were made by sub-culturing distinct colonies using the streak plate technique on nutrient agar until a clear distinct colony was obtained. The pure colony obtained was inoculated on a nutrient agar slant in a MacCartney bottle and incubated at 37^{o}C for 24 - 48 hours and this was stored in the refrigerator as stock culture.

ISOLATION OF ENTERIC BACTERIA

After the serial dilution of the milk, 1ml each from dilutions 10^{-1}, 10^{-3} and 10^{-5} was aseptically taken and plated on MacConkey agar using pour plate method. This was used for the enteric bacteria count. Each of the plates was incubated at 37^{o}C for 24 hours. Colonies that developed on the plate after incubation were observed and counted and records were made accordingly. Pure cultures were made by sub-culturing distinct colonies using the streak plate technique on nutrient agar until a clear distinct colony was obtained. The pure colony obtained was inoculated on a nutrient agar slant in a MacCartney bottle and incubated at 37^{o}C for 24 - 48 hours and this was stored in the refrigerator as stock culture.

CHARACTERIZATION AND IDENTIFICATION OF BACTERIAL ISOLATES

COLONIAL MORPHOLOGY

The bacterial colonies were first described and characterized by their morphological appearances (i.e. colony shape, edge or margin, pigmentation, elevation, colony surface, consistency and optical characteristics) on the plate. The isolates were subsequently identified using the Bergey's manual of Determinative Bacteriology (Buchanan and Gibbons, 1974)

RESULT: The bacteria count and the different bacteria isolated are shown in the tables below

Table 1: Sachet Powered Milk Samples Collected and Identities

CODE	NAFDAC. NO	NAMES	INGREDIENTS	PRODUCED BY
A	01-1033	Three crown milk	Skimmed milk, vegetable fat, lecithin, sucrose, vitamins A, D3,F, K.	Friesland campina
B	01-0822	Cowbell milk	Skimmed milk, butter milk, vegetable fat, sugar, soy lecithin, vitamins A, C, D, E, K folic acid.	Promasidor
C	01-6231	Loya milk	Full cream milk, calcium, soya lecithin, vitamins (A, C, D, E and K).	Promasidor
D	A1-3697	Dano milk	Skimmed milk, butter milk, vegetable fat, sucrose, soy lecithin, vitamins A, D3.	Arla food
E	01-6215	Peak milk	Whole milk powder, lecithin, vitamin, A, B1, B6, C and D3.	Friesland campina

TABLE 2: TOTAL BACTERIA COUNT

(CFU/ML).

PLATES	COUNTS (CFU/ML)
A	$4.0x10^2$
B	$3.7x10^2$
C	$7.2x10^3$
D	$3.6x10^3$
E	$4.8x10^3$

TABLE 3: BACTERIA ISOLATED FROM DIFFERENT SACHET POWDERED MILK BRAND

BACTERIA ISOLATED	SACHET POWDERED MILK BRANDS				
	A	**B**	**C**	**D**	**E**
Lactobacillus spp	+	+	+	+	+
Streptococcus spp	+	+	-	-	-
Bacillus spp	+	+	+	+	-
Staphylococcus aureus	+	+	-	+	-
Pseudomonas spp	+	-	-	-	-
Micrococcus spp	-	+	+	+	-

Key: + = Present
- =Negative

DISCUSSION, CONCLUSION AND RECOMMENDATION

Milk powder as a good source of many nutrients consumed by both adult and children must be of good microbiological quality. Milking done under aseptic condition must be practically free from bacterial flora. The presence of different microorganisms in freshly produced milk may be due to the care employed in milking, cleaning, and handling of utensils (Alan and Heather, 1990). The result obtained shows that the sampled milk powder harbors a wide range of microorganisms. Generally, the overall assessment of the milk samples indicated that the microbial loads were within the permissible limits stated by New Zealand FDA. The low incidence of microbial contamination found in this study indicates, consequently, a low contamination of the milk samples. The bacteria isolates encountered indicate possible contamination either during milking operation, transportation storage, processing or packaging. The contamination could as well be from the environment and/ or inadequate handling and unsanitary conditions

The microbial load in different milk powder samples is shown in Table 3. Growths were observed on nutrient agar, MacConkey agar. The probable organisms from the milk powder samples: *Streptococcus* spp, *Bacillus* spp. *Staphylococcus* spp. *Pseudomonas* spp, *Micrococcus* spp *and Lactobacillus* spp. The bacterial isolates; *Bacillus subtilis*, have been reported in the past to be found in feeds and because they are spore forming bacteria, the spores can survive the passage through the alimentary tract of dairy cow, and are excreted with feces (Solomon *et al,* 2013). Species of *Bacillus* are associated with the spoilage of heat-treated dairy product thereby reducing the shelf-life. The spores of *Bacillus* species are ubiquitous and can be isolated from plants, beddings materials, concentrated feeds, roughages and cattle feces (Mennane *et al.,* 2007).. Several studies have indicated that silage is also a significant source of contaminating milk with *Bacillus* spores, which is

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due to growth of spore-forming bacteria in poorly conserved silages. The presence of *Bacillus* spp and *S. aureus* calls for concern because some strains of these organisms are known to be toxigenic and have been implicated in food borne intoxication, their presence therefore calls for concern. *Bacilus* spp is common environmental contaminants while *S. aureus* is of human origin, their presence could therefore be from the food handlers, utensils and the environment. (Javaid *et al.,* 2009).

Staphylococcus spp recorded could be as a result of the hardy nature of the genera which enables them to withstand low water activity. The organism, being a normal flora of the human body may have been introduced into the milk by the handlers. *Bacillus* could have been introduced into the milk from the environment. *Streptococcus* sp was present in milk. This organism is a commensal in human body which could have been the sources of the organism in the milk. Some strains of the organism have beeimplicated in dental caries. Therefore public health agencies should imbibe and enforce continuous microbial monitoring and evaluation of retail outlets.

Conclusion

The presence of microorganisms in the milk powder samples can pose a public health hazard. The detection of microorganisms in the milk powder samples could be of public health significance and hence there is an urgent need for concerned regulatory bodies to impose necessary measures to safeguard health of consumers.

Recommendation

In view of this result, there is need for the manufacturers to tighten in –process quality control checks and for government food regulatory agencies such as National Agency for food and Drug Administration and Control (NAFDAC) to carry out routine checks from time to time on these milk producing companies to ensure consumer safety standards are not compromised.

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PHYSIOCHEMICAL AND BACTERIOLOGICAL QUALITY OF SURFACE WATER CONTAMINATED BY WASTES IN AUCHI

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Abstract: *Water samples from different surface water within Auchi, were collected for physiochemical and bacteriological analysis. The pH ranges between 6.0- 7.0. Also the temperatures were between 26.0^{o}C to 29.0^{o}C. Also the appearance of the water served in Auchi ranges from slightly clear with some brownish particles. The viable bacterial count for the water samples ranges from 3.5x10^{4} to 8.0x10^{4} cfu/ml. Bacteria in water sample were Escherichia coli, Bacillus sp.***,** *Salmonella sp.***,** *Staphylococcus aureus and Proteus sp. The result presented in this study revealed some disease causing bacteria present in the contaminated water. These disease causing organisms apart from causing disease to human and animals may also cause the loss of aquatic life, anaerobic and toxic water. However, good practices may go a long way to reduce pollution of surface water bodies. Therefore, proper method of managing domestic, agricultural, industrial and commercial wastes should be encouraged to avoid finding their ways into surface water. Good hygiene practice when using such water bodies, for example avoidance of release of human waste into water should be encouraged.*
KEY: *Physiochemical, Bacteriological, contaminants, surface water.*

INTRODUCTION

Surface water bodies such as river, stream, pond etc. serve as a source of domestic water to many, both in urban and rural areas. However, these water bodies are constantly being polluted or contaminated (Harrad and Harrison, 1996). One of the ways of contamination is by indiscriminate disposal of waste into these water bodies directly or indirectly. Indirectly in the sense that wastes collected and dumped indiscriminately along roadsides, market junction, gutter, drainage etc. are washed down by erosion into these water bodies (West *et al*, 1998). All forms of debris collected will form organic or inorganic contents for microbes in water Domestic pollution may involve seepage from septic tanks, pit latrine, cesspools and privies. Agricultural pollution is from irrigation water and run-off water after rains, carrying fertilizers, pesticides, herbicides and fecal matter. Environmental pollution is mainly from sea water intrusion into coastal aquifer.

The greatest risk from microbes in water is associated with consumption of drinking water that is contaminated with human and excrete. Also infectious disease caused by pathogenic bacteria, viruses and parasites (e.g., protozoa and helminths) are the most common and widespread health risk associated with drinking water. Other microorganisms sometimes found in surface waters which have caused human health problems include: *Burkholderia pseudomallei, Cryptosporidium parvum, Giardia lamblia, Salmonella, Clostridium, Streptococcus,* Parasitic worms *(helminths), Novovirus* and other viruses (Diaze, 2006).

Waste has been defined as unwanted or unusable material (Wall and Zeiss, 1995). Again it has been defined as any substance or materials which is discarded after primary use, or is worthless, defective and of no use. Generally, waste is considered to be something which poses a significantly different threat to human health or environment, partly because of the way in which it may be disposed or partly because the holder no longer has the same sense of obligation in relation to it. The health of the people depends solely on the quality of water available for consumption. The health aspects of environmental quality were among

the first to receive scientific consideration through the recognition of water borne disease (Vrigheid, 2000). Water pollution from microbial contaminants and pollutants has resulted in epidemics of waterborne diseases such as typhoid fever, cholera and dysentery. Waterborne disease are caused by pathogenic microorganisms which are directly transmitted when contaminated fresh water is consumed (Zmirou *et al*, 1994). Contaminated fresh water, used in the preparation of food, can be the source of foodborne disease through consumption of the same microorganisms.

Domestic sewage is also a major source of plant nutrients, mainly nitrates and phosphates. Excess nitrates and phosphates in water promote the growth of algae, sometimes causing unusually dense and rapid growths known as algal blooms (Sangodoyin, 1993). When the algae die, they add to the organic substances already present in the water; eventually, the water becomes more deficient in oxygen. Anaerobic organisms (organisms that do not require oxygen to live) then metabolize the organic wastes, releasing gases such as methane and hydrogen sulfide, which are harmful to the aerobic (oxygen-requiring) forms of life (Pheby *et al*, 1997). The process by which a lake changes from a clean, clear condition—with a relatively low concentration of dissolved nutrients and a balanced aquatic community—to a nutrient-rich, algae-filled state and thence to an oxygen-deficient, waste-filled condition is called eutrophication (Douglas, 1992). Eutrophication is a naturally occurring, slow, and inevitable process. However, when it is accelerated by human activity and water pollution (a phenomenon called cultural eutrophication), it can lead to the premature aging and death of a body of water (Attahi, 1999). Sources of toxic chemicals include improperly disposed wastewater from industrial plants and chemical process facilities (lead, mercury, chromium) as well as surface runoff containing pesticides used on agricultural areas and suburban lawns (chlordane, dieldrin, heptachlor).

MATERIALS AND METHODS

Materials

The materials used were Nutrient agar, MacConkey agar, peptone water, lactose broth, specimen bottle, cylinder, thermometer, pH meter, microscope, Petri dish, cover-slip, glass slide, beaker, wire loop,

incubator, autoclave, colonies counter, McCartney bottles, Durham tubes etc.

Collection of Samples

Surface water samples were collected from various location in Auchi. Samples were taken to the laboratory immediately for analysis. Water was collected from five different location namely: River ole (A), River owan (B), Pond water (C), Stream water (D) and Sabo road river (E).

TABLE 1: SAMPLES AND DESCRIPTION

SAMPLES	DESCRIPTIONS
A	River ole water
B	River Owan water
C	Pond water
D	Stream water
E	Sabo road river water

Physico-chemical analysis:

pH: pH of the samples was measured by using digital pH meter (Hanna Instruments, USA).

Temperature: The temperature of samples was measured by using thermometer.

Sterilization Of Equipment

Specimen bottles, test tubes, conical flask, beaker, round bottom flask and all glass ware were soaked in soapy water and later washed and rinsed with warm water and finally rinsed again with distilled water. Specimen and McCartney bottles were covered and nutrient agar bottles were wrapped with aluminium foil paper. Then plugged with cotton wool and then completely wrapped and then sterilized in the hot air oven at 160^{o}C for one hour.

Media Preparation

The media was commercially prepared according to manufacturer's instruction and specification. All commercially available media in powder form were reconstituted with distilled water according to manufacturer's guide media already mixed with water were poured into round bottom flasks, plugged with cotton wool, wrapped with foil and sealed with masking tape and autoclaved for 30

minutes at 121^{o}C, after which the media were then poured into Petri dished and allowed to solidify.

Microbial Analysis Three fold serial dilutions were prepared. 9ml of sterile distilled water was put into each of five 50ml test tubes prelabelled 10^{-l}, 10^{-2}, 10^{-3}. The serial dilution was carried out by withdrawing 1ml from the water sample with a sterile 1ml pipette and transferring to the first tube to give a 10^{-1} dilution and it was gently shaken together to ensure a proper mixing. From the first, 1ml was transferred into 10^{-1}, then from 10^{-1}, 1ml was transferred to 10^{-2}, then from 10^{-2} 1ml was transferred to 10^{-3}. This was done respectively to other samples. The plating used is the spread plate method and the dilution employed in this analysis is 10^{-1} to 10^{-3} of the different samples of water. In this spread plate method, the bacterial suspension in the serially diluted inoculum was introduced into the surface of a prepoured, solidified agar medium. Using a sterile glass spreader the inoculums was spread uniformly over the surface of the agar. Then the plates were incubated at room temperature ($28^{+}2^{o}$C) for hours, and. The colonies that were observed were counted at the end of the incubation period. The total colony that was observed on various plates was counted using light colony counter. The total numbers of colonies on the medium plates was taken as the total heterotrophic plate count.

Number of viable organism per 1ml of water = Colonies X dilution factor.

Presumptive Coliform Count

This is a quantitative test for all coliform bacilli and was performed using the mice and misra method. The McCartney bottles contained single strength MacConkey broth of 5ml each and 20 universal bottles containing double strength MacConkey broth. Twenty five bottles containing single strength were inoculated with 1ml of water sample, another 20 bottles were inoculated with 0.1ml of water sample, 1ml bottle containing double strength MacConkey broth was inoculated with 10ml water sample each. A Durham tube was placed (inverted) in each of the bottle to trap and collect gas produced and bottles were incubated at 37^{o}C. The observation of the tubes was done after 24 hours. colour and gas production were recorded as positive presumptive. The most probable number of coliform bacilli per

100ml of water sample was determined from Macrady 1918 probability table.

Confirmatory Test

This was carried out by sub culturing from positive presumptive tube to MacConkey agar. A sterile wire loop was used to streak the culture into the MacConkey agar plate and was incubated at 37^{o}C for 24 hours after which colonies were observed and recorded. From the MacConkey agar, distinct colonies that were suspected to be *E.coli* from colonial morphology were picked with sterile wire loop and plated on nutrient agar slant and kept in the refrigerator. These serve s stock culture used for gram staining.

COMPLETED TEST

The Eijkman test was used to ascertain whether the coliform bacilli detected in the presumptive test were *E.coli* cells. This test is employed because it depends on the ability of *E.coli* to produced gas when growing in lactose broth. This was done by transferring 10ml culture from the positive presumptive tubes into 10ml double strength of lactose broth in three test tubes 1ml and 0.1ml of culture from fermented tubes containing single strength and double of lactose broth respectively (each transfer was done after shaking gently). These tubes were then incubated at 44^{o}C in a water bath for 24 hours. At the end of incubation the tube showing positive reaction due to the production of acid and gas were considered as containing *E.coli*. Gram staining and biochemical test were carried out.

Results

Table 2: Total Viable Bacterial Count (CFU/Ml)

Water Sample	Bacterial count (CFU/ML)
A	7.0×10^4
B	8.0×10^4
C	4.0×10^4
D	3.5×10^4
E	3.8×10^4

TABLE 3: TOTAL COLIFORM COUNT (CFU/ML)

Water Sample	Coliform count (cfu/ml)
A	2.1×10^4
B	3.4×10^4
C	1.9×10^4
D	4.2×10^4
E	2.5×10^4

TABLE 4: OCCURRENCE OF BACTERIA IN WATER SAMPLE.

Location	*Bacillus*	*Escherichia coli*	*Salmonella sp.*	*Proteus sp.*	*Staphylococcus aureus*
A	+	+	_	+	-
B	+	+	_	_	+
C	_	+	+	_	+
D	+	_	+	+	-
E	_	+	+	+	+

TABLE 5: BIOCHEMICAL CHARACTERISTICS OF ISOLATES

Isolate	Cultural characteristics	Cell Morphology	Gram reaction	Citrate	Oxidase	indole	motility	Mannitol	Catalase	Lactose	Glucose	Maltose	MR	VP	ISOLATES
1	Rod shape and straight often arranged inchains with squamy and creamy colony.	Rod	+	+	+	-	+	-	+	AG	AG	AG	+	-	*Bacillus spp.*
2	Spherical cells occuring in chainssometimes elongated on the axis.	Cocci	+	+	-	-	+	-	AG	AG	AG	AG	-	-	*Staphylococcus spp.*
3	Rod arranged in pairs or short chains with rounded or pointed ends.	Rod	-	+	-	+	+	AG	-	AG	AG	AG	+	-	*Salmonella spp.*
4	Long rods occuringin short chains	Rod	-	+	-	+	+	AG	+	AG	AG	AG	+	+	*Proteus spp.*
5	Convex yellow spherical or ovoid cells occuring in chains elongated to the axis.	Cocci	-	+	-	+	+	AG	+	AG	AG	AG	+	+	*Escherichia coli*

TABLE 6: PHYSIOCHEMICAL PROPERTIES OF SAMPLES.

Water Sample	pH reading	Temperature (^{0}C)	Appearance
A	6.9	26.0	Clear
B	7.0	28.0	Clear
C	6.7	29.0	Clear
D	6.8	27.0	Clear
E	6.0	28.0	Clear

Discussion

Result obtained from the total plate count indicates a high bacteria count from river water sample. The high count of microorganism in water sample could be attributed to the several source of contamination of river water due to human activities as a result of waste disposal around the source of water. Organic matter from leaf debris, dust, faecal materials from animals or human also contribute to the high amount of microorganism in water samples.

Water samples from different surface water within Auchi, were collected for bacteriological analysis. The pH range between 6.0- 7.0. Also the temperatures were between 26.0^{o}C to 29.0^{o}C. Also the appearance of the water served in Auchi ranges from slightly clear with some brownish particles. The viable bacterial count fr the water samples ranges from $3.5x10^4$ to $8.0x10^4$ cfu/ml. Bacteria in water sample were *Escherichia coli, Bacillus sp.***,** *Salmonella sp.***,** *Staphylococcus aureus and Proteus sp*. The result presented in this study revealed some disease causing bacteria present in the contaminated water. These disease causing organisms apart from causing disease to human and animals may result in the loss of aquatic life, anaerobic and toxic water. However, good practices may go a long way to reduce pollution of surface water bodies.

The presence of *Escherichia coli* in the river wateris a proof of that human contamination of the sources through faecal material had occurred. *Escherichia coli* appears to be exclusively faecal in origin (Fourie and Morris, 2003). It occurs in immense number in human and animal intestine and cannot multiply in natural site outside the body but fairly rapidly dies and disappears outside the host environment (Barret and Lawor, 1995). These high counts and presence of the above bacteria could be due to the nutrient status of the water samples and

the prevailing environmental conditions as well as human activities in the river water.

Conclusion

Surface water bodies e.g. river, stream, pond serve as a source of domestic water to many, both in urban and rural areas. However, these water bodies are constantly being polluted or contaminated. One of the ways of contamination is by indiscriminate disposal of waste into these water bodies directly or indirectly. Indirectly in the sense that waste collected and dumped indiscriminately along roadsides market junction, gutter, drainage etc. is washed down by erosion into these water bodies. All forms of debris collected form organic or inorganic contents for microbes in water. The result presented in this study revealed some disease causing bacteria present in the contaminated water. These disease causing organisms apart from causing disease to human and animals may also cause loss of aquatic life, anaerobic and toxic water. However, good practices may go a long way to reduce pollution of surface water bodies. Going by the various standards for potable water and especially the WHO, 1971, international standard of drinking water, the river water failed to meet any of the existing standards.

Recommendation

Proper method of managing domestic, agricultural, industrial and commercial waste should be encouraged to avoid their finding their ways into surface water. Good hygiene practice when using such water bodies, for example avoidance of the release of human waste into water should be encouraged. Modern technologies should research on the recovery and recycling of water to useable and economic materials. One of the best controls over the final quality of water is chemical treatment involving chlorination. Boiling of water before use should be encourage and made a common practice. However, treatment of water should be based on recommendation by health authorities like W.H.O. Therefore all supplies derived from river water sources should receive coagulation, filtration and disinfection as a minimum treatment. As a short term measure, till the quality of water supplied improves, household level purification is recommended as a measure of personal protection.

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Determination of Gold Number of Isolated Native and Modified Maize Starches

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Abstract *In this research work starch were extracted from the following samples; maize (zea mays), the isolated starch was modified by acid hydrolysis. Physicochemical properties; gelatinization temperature, p H, bulk density, tapped density, Hausner index, Carr's index, swelling density, moisture and ash content of the isolated native and modified maize starch were determined and reported. The gold number (protective ability) of the native and modified maize starches were determined and compared, the gold number of the native maize starch was 21. The gold number results obtained for the acid modified maize starch was 13. The result suggest that the modified maize starch has a better colloidal protective ability compared to the native starch*

Keyword: *Gold Number, protective ability, colloids, starch Corresponding author email; henryoregbeme@gmail.com*

Introduction

Gold Number is a measure of the protective ability of colloids, the term 'Gold number' introduced by Richard Adolf Zsigmondy (1865-1929) in 1925 describes protective action of different colloids and is defined as the number of milligrams of a hydrophilic colloid that will just prevent the precipitation of 10 mL of a gold sol on the addition of 1 mL of 10 per cent sodium chloride solution.

The use of protective colloids to stabilize colloidal systems is widespread. In the preparation of ice cream, gelatin is added to act as a protecting agent to the colloidal particles of ice. If the ice particles coagulate, the smooth texture of ice cream is lost. *Argyrol*, used in eye drops is a sol of silver

protected by organic material. (Ogurtsov *et al.*, 2012)

Lyophobic (solvent hating) sols are readily precipitated by small amounts of electrolytes however these sols are often stabilized by the addition of lyophilic (solvent loving) sols. The property of lyophilic sols to prevent the precipitation of a lyophobic sol is called protection. The lyophilic sol used to protect a lyophobic sol from precipitation is referred to as a protective colloid.

Colloids and colloidal systems are essential to life. Most of the substances, we come across in our daily life are colloids. The meals we eat, the clothes we wear, the wooden furniture we use, the houses we live in, the newspapers we read are largely composed of colloids. Noteworthy examples of colloids are the blue colour of the sky, fog, mist and rain, food articles such as milk, butter, ice creams, fruit juices, etc., are all colloids in one form or the other. Colloids function in everybody cell, in the blood, and in all body fluids, especially the intercellular fluids. The styptic action of alum and ferric chloride solution is due to coagulation of blood forming a clot which stops further bleeding (Rodney 1990). All life processes take place in a colloidal system and that is true both of the normal fluids and secretions of the organism and of the bacterial toxins, as well as in large measure of the reactions which confer immunity. (Ogurtsov *et al.*, 2012)

The long-term colloidal stability of dispersion will be of great importance in a number of industries such as pharmaceutical, ceramic, paints and pigments. The term “stability” can have different connotations to different applications. When applied to colloids, a stable colloidal system is one in which the particles resist flocculation or aggregation and exhibits a long shelf-life. This will depend upon the balance of the repulsive and attractive forces that exist between particles as they approach one another. If all the particles have a mutual repulsion then the dispersion will remain stable. However, if the particles have little or no repulsive force then some instability mechanism will eventually take place e.g. flocculation, aggregation etc (Zumdahl 1997)

The protective ability i.e. gold number of potato starch is 25 (Porter, 1994) but little is known of the protective ability of other starch product especially modified starch that has better industrial properties than native starches

Since not so much is known of the protective ability of other starch product especially modified starch that has better industrial properties than native starches, thus the objective of this study is to determine the colloidal protective ability (Gold Number) of a number of extracted and modified starch maize samples

Materials and Method

Materials

The Maize; white *(Zea mays)*samples were bought from the local market in Auchi, Edo State and were identified in the Botany unit Department of Science Laboratory Technology, Auchi Polytechnic Auchi. All chemicals and reagents used in this study were of analytical grade.

Isolation of Starch from Maize

The starch were extracted by steeping in water for 48 hours followed by grinding and centrifugation of the resultant mash that resulted into settling of starch which was obtained after removing the supernatant, the residue was air dried at 40 °C in an air forced oven and then stored in polythene bag at room temperature.

Modification of the starch

Acid Hydrolysis

The method described by Lawal (2004) was adopted, the slurring of the starch was prepared by adding 0.15 M HCl (500 mL) to 100 g of each starch sample and the mixture was placed in water bath set at 50 °C for 1hr and stirred magnetically for 8 hours. The acid modified starch was filtered. The residue obtained was washed four times with distilled water; air dried at 30 ± 2 °C for 48 hours. The sample were labeled and kept for further analysis.

Proximate analysis

Determination of Moisture content

The moisture content was determined using the Official Methods of Analysis (AOAC, 1990). 5 g of the starch was weighed and transferred into previously dried and weighed glass dishes. The dishes with starch samples were placed in a thermostatically controlled oven and heated at 105 ^{o}C for 5 hours to a constant weight. The dishes were removed and cooled in a desiccator and re-weighed. The dishes were dried again for 30 minutes, cooled and weighed. This procedure was repeated until constant weight was reached. The moisture content was then determined by difference and expressed as a percentage.

$$\% \text{ Moisture} = \frac{W2 - W1}{W0} \times 100 \quad \text{.....(i)}$$

W_2 = weight of wet sample + dish
W_1 = weight of dry sample + dish
W_o = weight of sample

Determination of ash

The ash content was determined using the Official Methods of Analysis (AOAC, 1990). Two grams of starch was transferred into a porcelain crucible which had previously been ignited, cooled and weighed. The crucible and its contents were then placed in a muffle furnace preheated to 600 ^oC for 2 hours. The crucible was removed and cooled in a desiccator. The crucible and its contents were weighed. The total ash content was calculated and expressed as a percentage.

$$\% \text{ Ash} = \frac{W2 - W1}{Wo} \times 100 \quad \text{..... (ii)}$$

W_2 = weight of crucible + ash.
W_1 = weight of empty crucible.
W_o = weight of sample.

Determination of Percentage Crude Fat Content

Previously dried, fat free thimble was weighed as W_1. 5 g of sample was weighed into the thimble and weighed as W_2. The thimble and the sample was carefully wrapped and tied. Washed and dried 500 ml round bottom flask was weighed as W_3. The flask was half filled with 40/60 petroleum ether and the sample was dropped into the sample holder of the soxhlet extraction apparatus. The flask was then placed on a heating mantle and the heat source was adjusted to allow it to boil gently at 34 ^oC. It was allowed to siphon for 5 hours. The condenser was detached and the thimble removed. Petroleum ether was distilled from the flask. The distilling flask containing the oil was air dried at 100 ^oC for exactly 5 minutes to remove the solvent residues in oil. This was put inside a desiccator to cool and the weight was taken as W_4. The percentage fat contained was determined thus:

$$\% \text{ Crude fat} = \frac{\text{Weight of Flask + oil} - \text{Weight of empty flask}}{\text{Initial Weight of Sample}} \times 100 \quad \text{....iii}$$

$$\% \text{ Crude fat} = \frac{W4 - W3}{W2 - W1} \times 100 \quad \text{..... iv}$$

Determination of Percentage Crude Fibre

The starch and the protein part of food were dissolved by boiling with acid and then with a very strong base (NaOH). The residue, which comprises of cellulose and lignin was washed and dried and weighed. The residue was ashed and the weight subtracted from the weight of the residue.

3 g of defatted sample was weighed (W_1) into 250 ml beaker containing 200 ml of 0.125 M or 1.25 % tetraoxosulphate (iv) acid (Sulphuric acid). The mixture was heated in a steam bath at 70 – 90 ^oC for 2 hrs; it was then allowed to cool. The cooled mixture was filtered using a muslin cloth over a Buckner funnels. The residue was washed three times with hot distilled water to remove the acid and then put in a beaker containing 200 ml of potassium hydroxide. The mixture was heated as before over a steam bath for 2 hours. The solution was filtered and the residue washed three times with hot distilled water, then with petroleum ether and water. The final residue obtained was put in clean preweighed (W_2) crucible and dried at 120 ^oC to a constant weight. The crucible with the oven dried sample was put in a muffle furnace and ashed at 550 ^oC for 30 minutes. The crucible and its contents were removed from the furnace, cooled in a desiccator and reweighed (W_3). Percentage fibre was calculated as followed:

$$\% \text{ Crude fibre} = \frac{\text{weight of oven dried sample} - \text{weight of ash X 100}}{\text{Initial weight of sample}} \quad \ldots\ldots\ldots \quad \text{v}$$

$$\% \text{ Crude fibre} = \frac{W2 - W3}{W1} \times 100 \quad \ldots\ldots\ldots \quad \text{vi}$$

Determination of Percentage Crude Protein

The analysis of Crude protein was determined using Kjeldahl method. This process involved 3 different stages namely; digestion, distillation and titration.

A chemical mixture of 150 g of K_2SO_4 and 10 g of $CuSO_4$ was made. 1 g of sample and 10 g of chemical mixture was weighed into a 250 ml digesting tube**.** 12 ml of concentrated H_2SO_4 was carefully added to the mixture. The digesting tubes containing samples were kept in a rack and digested for 30 minutes at 420 ^0C in a fume cupboard. After digestion, the samples were allowed to cool to room temperature for about 1 hr. 80 ml of distilled water was then added to the digested samples. 25 ml of diluted digested sample as well as 25 ml of NaOH were measured into a distillation tube. Distillation

was carried out using 5 ml of Boric Acid and methyl red indicator. This process was stopped when the conical flask containing boric acid-indicator solution reached 100 ml mark. The distillate was titrated using HCl until end point was reached. At this stage, the purple colour obtained during distillation changed to dark yellow.

Carbohydrate Content Determination

The carbohydrate content of the sample was obtained by difference, that is, as the difference between the total summations of percentage moisture, fat, fibre, protein and ash.

% Carbohydrate= 100 – (% moisture + % fat + % protein + % fibre + % ash) …. ix

Physicochemical Analysis

Determination of pH

The pH was measured using a pH meter (Hanna HI 9813 model) with glass electrode. Initial standardization was done with buffer solutions and direct reading of 5 g of the starches weighed and mixed with 50 mL of distilled water to obtain slurry were made by dipping the pH electrode into the sample, leaving for about 1 min to have a stable reading. This was carried out using the method described by APHA 1992

Determination of Gelatinization temperature

This was evaluated using the method of Attama *et al* (2003). The starch (1 g) was put in a 20 mL beaker and 10 mL of distilled water was added. The dispersion was heated on a hot plate at 100 ^{o}C. The gelatinization temperature was then read with a thermometer suspended in the starch slurry.

Swelling power

The method described by Daramola *et al* (2006) was used to determine the swelling power with slight modifications. The starch sample (2 g) was weighed into a pre-weighed test tube and 10 mL of distilled water was added. The mixture was heated in a water bath at a temperature of 65 ^{o}C for 30 min with continuous shaking. In the end, the test tube was centrifuged at 1500 rpm for 20 min in order to facilitate the removal of the supernatant which was carefully decanted and weight of the starch paste taken. The swelling power was calculated according to equation (x)

$$\text{Swelling power} = \frac{\textit{Weight of starch paste}}{\textit{weight of dry starch sample}} \times 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots (x)$$

Determination of Bulk and Tapped Density

For the bulk and tapped densities, the samples (20 g) was carefully put in a dry 100 mL graduated measuring cylinder and the volume (V_0) occupied

by the sample without tapping was recorded. The sample contained in the measuring cylinder was tapped mechanically (500 taps) at the bottom of the cylinder, the new volume (V_{500}) was also recorded. The densities were determined as the ratio of the weight and the volume of the sample in each case (Bean et al., 1957). The densities were determined in triplicate. The bulk (B_d) and the tapped densities (T_d) were calculated as using equation (xi) and (xii) respectively

$$B_d = \frac{w}{V0} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(xi)}$$

$$T_d = \frac{w}{V500} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(xii)}$$

Where; w is the weight of the sample used

Hausner ratio: (i.e. the ratio of tapped density to bulk density) was calculated for all the starches according to equation (xiii)

$$\text{Hausner ratio} = \frac{\text{Tapped density}}{\text{Bulk density}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(xiii)}$$

Compressibility Index (Carr's index %)

Percentage compressibility (Carr, 1995) was determined using the equation (xiv);

$$\text{Carr's index \%} = \frac{\text{Tapped density} - \text{bulk density}}{\text{Tapped density}} \times 100 \quad \ldots\ldots\ldots\ldots \text{(xiv)}$$

Preparation of colloidal solution (sol) of starch

The starch (5 g) was placed in a morter, 2 mL of distilled water added and ground to a thin paste, 100 mL of distilled water was added and heated to boiling, the pastes was poured slowly with stirring into the boiling water in the beaker and was filtered, the filtrate obtained is the starch sol

Preparation of Gold colloidal sol

1 cm^3 of 1 % Gold Chloride ($AuCl_4.3H_2O$) was added to 100 cm^3 of distilled water. The solution was heated to boiling while stirring continuously using a magnetic bead; 2.5 cm^3 of 1% sodium citrate ($Na_3C_6H_5O_7.2H_2O$ FW 294.10) was added. The solution was kept boiling until ruby red gold sol was formed

Gold Number Determination

This was done according to the standard method of gold number determination, the starch was added in milligram to 10 mL of standard gold sol, 1 mL of 10 % aqueous sodium chloride was added to it when no

precipitation or coagulation occurs, the amount of starch in milligram was taken as the gold number (Goldberg,1998)

Result and Discussion

Table 1 functional properties of isolated native and modified maize starch

	Native	Modified
Parameter	Maize	Maize
Gelatinization temp ^{o}C	65.7	65
pH	7.1	6.2
Bulk density (g/cm^3)	0.38	0.57
Tapped density (g/cm^3)	0.47	0.74
Hausner index	1.27	1.30
Carr's index (%)	25.30	22.30
Swelling power (%)	13.40	12.5
Moisture content (%)	11.40	11.20
Ash content (%)	1.25	1.20
Gold Number	21	13

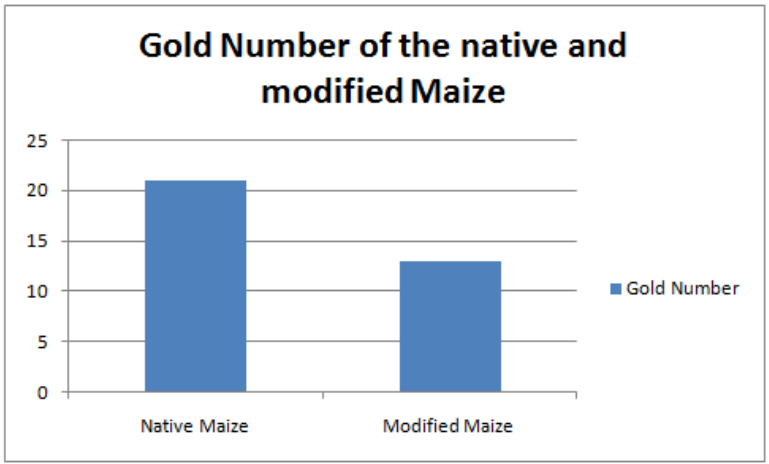

Figure 1 Gold number of native and modified maize starches

DISCUSSION

The native maize starch was acid hydrolyzed to modify the starch, the acid hydrolysis involved suspending the starch in an aqueous solution of Hydrochloric acid in the presence of strong acid and heat, the glycosidic bond between the monosaccharide in the starch polymer are cleaved (Yiu *et al.*, 2008). This has been shown to change the physicochemical properties of starch without destroying its granular structure yielding starch with increased solubility and gel strength but decreased viscosity, the extent of hydrolysis depends on the starch consistency, acidity of the medium of hydrolysis, temperature and duration of hydrolysis (Odeku *et al.*, 2009)

Gelatinization is the process that takes place when starch is heated in the presence of water, resulting in the irreversible disruption of molecular order within

a starch granule. The gelatinization temperature of the native maize starch was 65.7 ^{o} C while the acid modified starch gelatinization temperature was 65 ^{o}C. The lower gelatinization temperature of the acid hydrolyzed starches may be due to the weakening of the hydrogen bond during hydrolysis. High temperature of gelatinization can be an indication of the higher stability of the starch crystallites in the starch molecules, which means that more heating is required to swell the granules (Adejumo *et al.*, 2011). However the native and modified starches gelatinization temperature fell within the range of the gelatinization temperature commonly observed for starches; 60 ^{o}C to 80 ^{o}C (Bello-Perez, et al., 1998).

The pH is the decimal logarithm of the reciprocal of hydrogen ctivity, its use for the measure of acidity or alkalinity of a solution; it is an important property in starch industrial application, being used to generally indicate the acidic or alkaline property of the starch. The pH value of the native maize starch was 7.1. BeMiller JN, Whistler RL (1996) reported similar result. The pH value of the acid modified maize starch was 6.2. However the pH values obtained for the native and modified starches fell within the pH range of 3 – 9 commonly obtained for native and chemical modified starch (Whistler, 1984). Starches having a measurable pH of at least 4.6 to 7.5) are considered neutral BeMiller J.N, Whistler R.L (1996).

Bulk density is the weight of a unit volume of loose material such as powder in a given volume. The tapped bulk density is maximum packing density of a powder; it depends on the particle size distribution, true density, particle shape and cohesiveness. Bulk and tapped density are properties of powder or granules, these parameters are important to industrialist in packaging and transportation of powdered materials. Starch or materials with higher bulk density has greater quantity of the material that can be packaged within a specified packaging space (Fagbemi 1999). The result obtained for the bulk density of the native maize starch was 0.69 g/cm^3 the acid modified maize starch have a higher bulk density of 0.57 g/cm^3

The native maize starch had value for tapped density of 0.47 g/cm^3 and 0.74 g/cm^3 for the acid modified starch

The Carr's index and Hausner ratio are measures of the products ability to settle, predict the flow and compressibility of powders and densification that

would occur (Carr, 1965). As the value of these indices increases, the flow of the powder decrease (Staniforth, 1996) and better cohensiveness is obtained. Flowability and compressibility are important parameters in pharmaceutical industry for drug excipients and tabletting. The results obtained for the native maize starch was 1.27 for Hausner ratio and 25.30 % for Carr's index which shows excellent flowability, while the acid modified maize had a value of 1.30 for Hausner ratio and 22.30 % for Carr's index, the result indicates a passable flowability.

Swelling power: when starch is heated in excess water, the crystalline structure is disrupted due to the breakage of hydrogen bonds, and water molecules become linked by hydrogen bonding to the exposed hydroxyl group of amylose and amylopectin. This causes an increase in granule swelling and solubility.

The results of the swelling power observed shows that the swelling power of the acid modified starch were lower than that of the native starch; this may be due to the fact that acid molecules preferably attack the amorphous region of the starch granule and disrupt it, which in turn results in relatively higher crystallinity of starch granule and thus restricts its swelling power. The results obtained for the modified maize starch was 12.50 %, while the native maize starch gave a value 13.40 %

The moisture content is the amount of water in a material or substance. It influences the shelf life, taste, texture, weight, and appearance of a substance. It is an important factor in starch utilizations (Moorthy, 2002). The moisture content of the native maize starch was 11.40 % while the acid modified starch was 11.20 %, However both values were within recommended range (10 to 20 %) for starches (Soni *et al.*, 1993).

Ash content is a reflection of the mineral content, it is the portion of a substance or an organic material that remains after it is burned at very high temperature. It is the measure of the total amount of minerals present within an organic substance, whereas the mineral content is a measure of the amount of specific inorganic component present such as calcium, sodium and potassium (Jane, 1999). Determination of ash and mineral content is important for nutritional labeling, quality, microbiological stability (high mineral content can hinder the growth of microorganisms) etc (Falade and Ayetigbo 2015). The values of the ash content obtained for the native maize and modified maize

starch were 1.25 % and 1.20 % respectively. A slight reduction of the ash content of the acid modified starch was observed, this may be due to hydrolysis of some mineral component.

The Gold Number result of the native maize and the acid modified starches were 21 and 13 respectively. The result indicates that acid modified starches were lower in Gold Number and have more protective power when compared to native starch. Wurzburg 1986 reported that acid hydrolysis modified starches have increased hydrophilicity and low viscosity. Omojola *et al.*, 2010 reported that in acid hydrolysis attack both the amorphous and crystalline regions of the starch granule to obtain water soluble molecules. Fagbemi (1999) reported that acid hydrolyzed starches are more soluble than native starches. Aiyeleye *et al.*, 1983 reported increase in hydrophilicity of acid hydrolysed starch which may be due to shortening of the chain lengths of the starch, corresponding to the weakening of the hydrogen bonds and the increase of hydroxyl groups. These reasons could be attributed to the increase protective ability of the acid modified starch compared to the native starch

CONCLUSION

The Gold Number of starches from native maize and modified starch samples has been determined. The results showed that acid modified samples have a better effective protective ability than the native starches based on the lower values of Gold Number obtained

The study has showed that starch modification through acid hydrolysis improves the hydrocolloids protective ability

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COMPARATIVE ANALYSIS OF THE BACTERIAL LOAD OF BOTTLED ZOBO DRINK AND SELECTED BOTTLED BEVERAGES SOLD IN AUCHI POLYTECHNIC CAMPUS.

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Abstract: *Samples of zobo drink and three selected bottled beverageswere collected from different sellers at different points in Auchi polytechnic campus and stored in sterile containers and taken to the laboratory for analysis. The samples were labeled A, B, C (Zobo drinks) and D, E, F (Commercially sold bottled beverage) for easy identification. The samples were serially diluted and the 2^{nd} and 4^{th} dilutions from each sample were inoculated on nutrient agar and MacConkey agar. Total plate count was determined by pour plate method and colonies were counted using the colony counter and measured in cfu/ml. The results revealed that the bacterial load of the zobo drinks were high with viable bacterial count ranging from 2.0×10^2 cfu/ml to 1.2×10^5 cfu/ml and a total mean count of 2.1×10^4 compared to the selected industrially processed commercially sold bottled beverage with bacterial count less than of 1.0×10^3 cfu/ml. Further analysis were carried out to identify the bacteria implicated, the different bacteria isolated were Staphylococcus aureus, Escherichia coli and Streptobacillus spp. All the sampled zobo drinks were contaminated with varying levels of bacterial that can be said to be unacceptable and unsatisfactory. The bacterial content of this drink is high compared to commercially produced soft drinks and the tested zobo drink was contaminated with bacteria which may be potentially pathogenic to humans and are of public health concern. Therefore, there is need to maintain adequate hygienic conditions during processing and packaging of the beverage to eliminate these bacterial contaminants and to improve on the quality of the final product.*

Key words*: zobo, beverage, Hibiscus sabdariffa, comparative, bacterial load, non alcoholic drink.*

Introduction

Zobo drink, a non-alcoholic local beverage, is produced from the dried petals of *Hibiscus sabdariffa.* It is locally called Zoborodo in Hausa, Isapa in Yoruba, and Sorrel in English and is a delicacy in many parts of Nigeria (Chude *et al.*,

2017). It is a red liquid drink and tastes like fruit punch, served as a fair source of vitamin A, riboflavin, niacin, calcium, and iron (Raimi 2013).

Zobo drink is extracted from purple red petals of the plant *Hibiscus sabdariffa.* The economic situation in Nigeria has made the Zobo drink gain wide acceptance in different occasions. It is used as refreshment entertainment in parties or as appetizers before the main dish is served and it is also sold in markets to various consumers (Raim 2013). Zobo drink has a shelf life normally 24 to 48 hours after which it begins to deteriorate. It is best preserved by refrigeration which contains the microorganism reaction of the drink. Due to the ubiquitous nature of microorganism, the level of contamination of can be reduced if produced under standard hygienic conditions to prevent the proliferation of pathogenic microorganism that can cause infection to consumers (Aliyu *et al.,* 2000).

The zobo plant also known as Roselle Plant (*Hibiscus sabdariffa*) is an annual, erect, bushy, herbaceous plant. It has smooth or nearly smooth, cylindrical and tropically red stems, with a green or red coloured stalk and a red or pale yellow calyx that is edible (Amin *et al.,* 2008). The *Hibiscus sabdariffa* is a species of hibiscus, native to the old world tropics, used for the production of bast fiber and as an infusion (herbal tea). The plant is an annual or perennial herb or woody-based sub-shrub, growing up to 2-2.5 m (7-8 ft) tall. The leaves are deeply 3- 5 lobed, 8-15 cm long arranged alternatively on the stems. The flowers are 8-10 cm in diameter, white to pale yellow with a dark red spot at the base of each petal and have a stout fleshy calyx at the base 1-2 cm wide, enlarging to 3-3.5 cm, fleshy and bright red as the fruit matures. It takes about 6months to mature plant while native to India and Malaysia is now found in many tropical and subtropical countries of Africa, Asia and the Americas. It is a dicotyledonous plant belonging to the subclass Archichlamydea, order Malvale and family Malvaceae (Chude *et al.,* 2017). *Hibiscus sabdariffa* grows to about 3.5 meters in height as such can be classified as a microphanerophyte. It thrives well in loamy well drained soil with annual rainfall of about 1500- 2000mm[3] and can tolerate floods, heavy winds and stagnant waters (Umeh *et al.,*2015).

The quality of zobo drink depends on mainly on the physiochemical constituents of the raw materials, water used in their production and the hygiene condition of the processors (Izah *et al.,*

2015). Water is the major resource used for production of this drink from its raw material. Poor quality with regard to both microbial (total heterotrophic bacteria, total fungi, total coliform and fecal coliform), physiochemical (colour, pH, turbidity, total suspended solids, total hardness, total salinity, electrical conductivity) and heavy metals (lead, cadmium, chromium, iron, zinc, copper, nickel, arsenic) could also impact the overall quality of the beverage, the environment in which the drink is processed could also influence the quality of the drink especially microbiologically (Izah *et al.*,2016).

Typically, bacteria invade zobo drink from several perspectives ranging from exposure, handling, and type of flavouring used, preservatives, water, storage and most importantly the nature of the zobo leaves. Handling is the major route through which the drink gets contaminated by bacteria. The hygiene of the processors is one of the main means of contamination. The possible contaminants of ready to eat food such as zobo are the nature of the preparatory environment, the use of contaminated water, contaminated utensils and distribution. The presence of *Staphylococcus* spp in zobo is due to the handling condition, this is because humans are the primary reservoir of this bacterium which is found in the nasal region, hand and skin (Izah *et al.*, 2016).

The microorganism that have been widely isolated from zobo drink sold in public places in Nigeria belong to the bacteria genera *Staphylococcus*, *Escherichia*, *Proteus*, *Pseudomonas*, *Salmonella*, *Shigella*, *Enterobacter*, *Klebsiella*, *Serratia*, *Bacillus*, *Streptococcus*, *Lactobacillus*, *Clostridium*, *Aeromonas* and *Micrococcus*. The fungi genera *Aspergillus*, *Saccharomyces*, *Penicillum*, *Candida*, *Rhizopus*, *Mucor* and *Fusarium*. To a large extent *Staphylococcus*, *Escherichia*, *Proteus*, *Bacillus*, *Aspergillus* and *Candida* are predominant microbial isolates in zobo drink (Izah *et al.*, 2016).

The factors that influence the proliferation of bacteria in zobo drink constitute a list of intrinsic (nutrients, pH and buffering capacity, Water activity, and Antimicrobial), extrinsic (Relative humidity, Temperature/ time and Gaseous atmosphere) and processing (Packing and storage conditions, Washing) factors. Intrinsic factors are those that are characteristic of the food itself; extrinsic factors are those that refer to the environment surrounding the food (Anetekhai, 2004).

Zobo drink is a nutritional drink widely consumed by people in Nigeria; however, the consumption of this local beverage could be a potential source of transfer of food borne diseases including Staphylococcus, Salmonellosis, Brucellosis, Tuberculosis, Shigellosis, Listeriosis, *Escherichia coli* infections etc. (Umaru *et al.,* 2014). Therefore this study is aimed at accessing the bacterial load of Zobo drink in relation to some selected bottled beverages sold in Auchi Polytechnic campus in view to contributing to ongoing series of research aimed at improving the production and retail quality of the non-alcoholic drink.

Materials and Methods

Sample Collection

Samples of zobo (35cl) and three selected commercial beverages were collected from different sellers at different points in Auchi polytechnic campus (School of engineering, School of ICT and Eboreime market) and stored in sterile containers and taken to the laboratory for analysis. The samples were labeled for easy identification. The samples were stored in the refrigerator for two hours before use.

Culture Media

Nutrient agar and MacConkey agar are employed in the culturing, isolation and characterization of specific organism or classes of organisms encountered in the study. They were prepared according to manufacturer's specifications.

Bacteriological Analysis

Pour plate method was used with each sample serially diluted using sterile distilled water as diluents. The 2nd (10^{-2}) and 4th (10^{-4}) dilutions of each sample were inoculated. The plates were inverted and incubated at 37^{o}C for 24 hours. The total bacterial count was determined by counting the colonies developed in each plate using a colony counter (Stuart Colony Counter). The total bacterial counts are expressed in cfu/ml. Pure cultures of the different distinct colonies were made by using sterile wire loop to take a portion of each distinct colonies and streaking the portion on the surface of a sterile fresh nutrient agar plate. The plates were incubated at 37^{o}C for 48 hours to obtain pure cultures of bacteria which were characterized and identified according to the methods as described by Ezeigbo, *et al*., 2015.

Result

Table 1.0: Number of Viable Bacterial Count on Nutrient Agar

Sample	Dilution factor	Number of Colonies on plate	Total number of Colony forming units per ml (cfu/ml)
	10^2	11	1.1 X 10^3
A	10^4	NG	NG
	10^2	2	2.0X10^2
B	10^4	NG	NG
	10^2	35	3.5X10^3
C	10^4	12	1.2X10^5
	10^2	NG	NG
D	10^4	NG	NG
	10^2	NG	NG
E	10^4	NG	NG
	10^2	1	1.0X10^2

F	10^4	NG	NG

Key:-**A**: Zobo drink from school of engineering. **B**: zobo drink from ICT. **C**: zobo drink from Eboremie. **D**: Cocacola. **E**: Nutri-milk. **F**: Bigi orange. **NG**: no growth.

Table 2.0: Number of Viable Bacterial Count on MacConkey Agar

sample	Dilution factor	Number of Colonies on plate	Total number of Colony forming units per ml (cfu/ml)
	10^2	20	$2.0x10^3$
A	10^4	NG	NG
	10^2	10	$1.0X10^3$
B	10^4	NG	NG
	10^2	NG	NG
C	10^4	NG	NG
	10^2	NG	NG
D	10^4	NG	NG
	10^2	NG	NG

E	10^4	NG	NG
	10^2	NG	NG
F	10^4	NG	NG

Key:-**A**: Zobo drink from school of engineering. **B**: zobo drink from ICT. **C**: zobo drink from Eboremie. **D**: Cocacola. **E**: Nutri-milk. **F**: Bigi orange. **NG**: no growth.

Fig 1:Chart Showing Comparision of the Bacteria load of zobo drink and selected botttled beverages

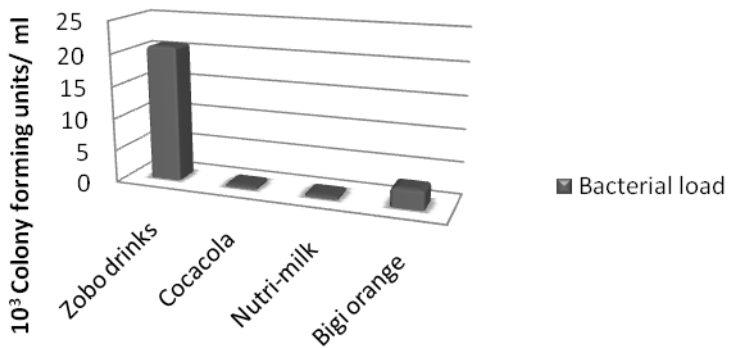

Table 3.0: Cultural and Morphological Characteristics of the Isolates

Sample	A		B	C		F
	Isolate 1	Isolate 2	Isolate 3	Isolate 4	Isolate 5	Isolate 6
Cultural characteristics	Whitish to creamy circular elevated on nutrient agar	White circular on nutrient agar, pinkish circular on MacConkey	Whitish circular colonies on Nutrient agar	Transparent to milky irregular flat on Nutrient agar	Creamy circular elevated on Nutrient agar	Creamy irregular flat on nutrient agar
Morphologicalcharacteristics	Cocci in clusters	Slender rods	Cocci in clusters	Short rods in chains	Cocci in clusters	Cocci in clusters

Key:-**A**: zobo from School of engineering. **B**: zobo from ICT. **C**: zobo from Eboremie. F: Bigi orange.

Table 4.0: Biochemical characteristics of isolates

Sample	A		B	C		F
	Isolate 1	Isolate 2	Isolate 3	Isolate 4	Isolate 5	Isolate 6
Gram reaction	+	-	+	-	+	+
Coagulase	+	ND	+	ND	+	-
Catalase	+	+	+	-	+	+
Indole	-	+	-	-	-	-
Oxidase	-	-	-	-	-	-
VogesProkauer	-	-	-	-	-	-
Glucose	+	+	+	+	+	+
Maltose	+	+	+	+	+	+
Lactose	-	+	-	-	-	-
Probable bacteria	*Staphylococcus aureus*	*Escherichia coli*	*Staphylococcus aureus*	*Streptobacillus* spp	*Staphylococcus aureus*	*Staphylococcus* spp

Key:-A: zobo from School of engineering. **B**: zobo from ICT. **C**: zobo from Eboremie. **F**: Bigi orange.
ND: Not determined**+:**positive -:negative

Discussions

Table 1.0 shows the number of viable bacterial count on nutrient agar of the different sample. The number of viable bacterial count on MacConkey agar are shown in Table 2.0.Table 3.0 shows the cultural characteristics and morphological characteristics of the isolates and table 4.0 shows the biochemical characteristics of the different isolates. Fig 1 shows the comparison of the bacterial load of zobo drink and selected bottled beverages.

Zobo drink is a non alcoholic beverage drink prepared and consumed in large quantities in Auchi campus, Auchi polytechnic, Auchi and its

environ. The drink is well accepted by all in the area, thus been produced and consumed as supplementary and complementary to commercial bottled soft drinks in schools and during occasions and hence this study to compare the bacterial load of the zobo drink and some selected bottled beverages sold within Auchi campus, Auchi polytechnic, Auchi.

The results revealed that the bacterial load of the zobo drinks was high with viable bacterial count ranging from $2.0x10^2$ cfu/ml to $1.2x10^5$ cfu/ml and a total mean count of $2.1x10^4$ compared to the selected industrially processed commercially sold bottled beverage with bacterial count less than 10^3 cfu/ml (Table 3 and fig 1). Zobo drink is highly contaminated with bacteria which implies extreme potential health hazards. The findings of this study are similar to earlier reports of (Raimi 2013; Ezeigbo *et al.,* 2015; Ayandele 2015 and Seiyaboh *et al.,* 2013) whose findings revealed high bacterial load in zobo drink. The high incidence of bacterial contamination encountered in this study are mainly due to unsanitary and largely unhygienic nature of the drink's preparation and packaging areas, as contaminants in food and drinks are good indicators of the state of environment in which they prepared or served (Omemu and Aderoju, 2008).

Further analysis was carried out to identify the bacteria implicated. The bacteria isolated mainly from the zobo drink were predominantly *Staphylococcus aureus* and scantily *Escherichia coli* and *Streptobacillus* spp.

The presence of *Staphylococcus aureus* could be due to poor handling; this is because humans are the primary reservoir of *Staphylococcus aureus* and is found in the nasal region, hand and skin (Chukwu *et al.,*2010). *Staphylococcus aureus* is a Gram positive, facultative anaerobe , non- spore forming round shaped (in clusters) bacterium, which produces toxins that cause staphylococcal gastroenteritis (Anetekhai, 2004). The symptoms of staphylococcal gastroenteritis may include vomiting, abdominal cramps, headache, weakness and fatigue (Akhigbemidu *et al.,* 2015).

The presence of *Escherichia coli* indicates the contamination by feacal material of the zobo drink which may be from the water used in the preparation of the drink, inappropriate washing of hands after using the toilet during preparation or the water used in washing the container in which the drink is packed and sold. *Escherichia coli* is a Gram

negative, facultative anaerobic, rod shaped, non spore forming bacterium which is a normal flora of the gut of animals (Umaru *et al.,* 2014). *Escherichia coli* cause varying degrees of intestinal disorders which include diarrhea which is sometimes bloody, urinary tract infection, abdominal cramps and dysentery (Odu and Imaku, 2013).

Streptobacillus spp is associated with poor sanitation and environmental hygiene. *Streptobacillus* spp is an aerobic, Gram negative, facultative anaerobic, rod shaped (in chains) bacterium. (Elliott, 2007). Symptoms associated with ingested food or drink contaminated with *Streptobacillus* spp include fever, rash, headache, chills, vomiting, muscle pain, weight loss and bacteremia.(Elliott, 2007).

Generally, the intensity of the disease manifestations produced may depend on the quantity of contaminated food ingested and the susceptibility of the individual to the toxin.

Conclusion

Conclusively, zobo is a widely patronized drink sold in the public places in Nigeria and has become a house hold name in almost every Nigerian home. Despite its high patronage, bacterial contamination from production, packaging to retailing raises concern. The bacterial content of this drink as shown in this study is high compared to the commercially produced soft drinks. The contaminants are pathogenic to humans and are of public health concern. Therefore, there is need to maintain adequate hygienic conditions during processing and packaging of the beverage to eliminate these bacterial contaminants and to improve on the quality of the final product.

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…EXAMINATION OF THE SUSTAINABLE FUTURE FOR BIOETHANOL, BIODIVERSITY AND THE ENVIRONMENT

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Abstract: *Biofuel production has been made more significant due to the global rise in the price of fossil fuels used for automobile transportation and the negative impact on the environment with increase in Greenhouse gas (GHG) emission. Thus, there is a global shift to the utilisation of renewable energy such as biofuels instead of fossil fuels. Liquid fuels formed from biomass, waste materials, plants, vegetable oil and forest products are known as biofuels. To mitigate the negative environmental impact of fossil fuels, the production and use of biofuels was encouraged by many countries where policies and targets were set to encourage their utilisation. Currently, the two main biofuels energy fuel is bioethanol, used to blend gasoline mixtures and biodiesel (an ester) usually produced from animal fats or vegetable oils. The increased cultivation of 1st generation feedstock (feedstock mainly from biological crops) has led to the replacement of natural ecosystems with cropland, threat to biodiversity and forest, competition for water resources and increased food price. Therefore, globally, sustainable environmental, agricultural, and renewable energy policies are necessary. To achieve a sustainable future for the cultivation and utilisation of biofuels, research and experiments are currently going on to explore the sustainability of 2nd and 3rd generation biofuel feedstock from grasses, trees, waste vegetation and algae. The purpose of this paper is to review literature extensively to examine the sustainability of bioethanol production and utilisation on the environment and biodiversity. It was discovered from the literature search that the major world producers of bioethanol are the USA, Brazil and the member states of the European Union (EU). Also, that different policies and targets are adopted by different countries for bioethanol as a renewable energy. Furthermore, this is dependent on the feedstock used by that country for bioethanol production. Currently, the production and utilisation of bioethanol is largely driven by governmental subsidies and targets. Therefore,*

vigorous research is necessary for sustainable bioethanol production to replace fossil fuels and avert catastrophic climate change and prevent the loss of biodiversity.

Keyword: Bioethanol; Feedstock; Biodiversity; Climate Change

Introduction

The amount of Greenhouse Gases (GHG) emission in the atmosphere is increasing due to the use of expensive fossil fuels in automobile transportation (Liu, Lin, and Sagisaka, 2012). Also, Timilsina and Shrestha (2011) stated that the oil crises of the 1970's provoked attention in biofuels as a substitute to fossil fuels. Therefore, biofuel is accepted as a possible option for reducing GHG. This has received international attention in terms of its technical development.

This has also prompted many countries to develop policies and targets on renewable energy expansion.

According to Demirbas (2009) the term biofuel is liquid, gas or solid fuels mainly produced from biomass. Renewable energy might be essential to guarantee energy sustainability and security. Energy crops are crops grown primarily to provide a feedstock for biofuels production (De Vries, Van de Ven, Van Ittersum,. and Giller, 2010) (See table 1 for a list of energy crops known as 1st Generation feedstock). Furthermore, they stated that these energy crops might also be used as food crops. Currently, the two main biofuels energy fuel is bioethanol, used to blend gasoline mixtures and biodiesel (an ester) usually produced from animal fats or vegetable oils.

Table 1: Showing the major feedstock used for biofuel production

1st Generation feedstock	
Bioethanol	**Biodiesel**
Sugar cane	Rapeseed oil
Corn	Palm oil
Wheat	Jatropha
Sugar beet	Soya beans
	Sunflower

Source: (Biemans *et al.* 2008, as cited in Campbell and Doswald, 2009).

Ajanovic (2011); Timilsina and Shrestha (2011) in their studies discovered that globally, the United States is the largest producer of bio-ethanol fuel in the world. This amounts to about 47% of the world's bio-ethanol production. Internationally, Brazil is the second largest producer of bioethanol and the major exporter of bio-ethanol. Furthermore, United States of America uses corn and Europe largely uses starch barley, wheat, sugar beet, wheat and rapeseed, while Brazil utilises sugar cane for bio-ethanol production. In Brazil, bioethanol production is very high and completely based on sugarcane. Borjesson (2009) discovered that ethanol produced from sugarcane from Brazil leads to a decrease of GHG by an average of 85%, while bioethanol from corn in the USA leads to a decrease of only 20% on average. In addition, bioethanol from an EU member state Sweden is produced from wheat and decreases GHG emissions by about 80% compared to fossil fuels. Therefore, some countries have policy mandates in

the blending of bioethanol with fossil fuels in different proportions.

According to Liang, Xu, and Zhang, (2012) the increased production of the first generation bioethanol has led to direct and indirect environmental concerns such as, increase greenhouse gas (GHG) emissions, threat to biodiversity and forest, intensive land use, the alteration of natural ecosystems to cropland ,increased food price and competition for water resources. Therefore, other types of feedstock were explored for bioethanol production. These are known as 2nd and 3rd generation feedstock from cellulosic materials such as grass, trees and using waste vegetative biomass as feedstock (See Table 2). This has received a high attention from the academia, industry, the general public and the government.

Table 2: Showing the future feedstock used for biofuel production

2nd Generation feedstock	3rd Generation feedstock
Grass	Algae
Poplars	
Willows	
Forestry waste product	
Agricultural waste product	

Source: (Biemans *et al.* 2008, as cited in Campbell and Doswald, 2009).

Sustainable, environmental, agricultural, and biodiversity friendly policies and activities are

necessary for most countries involved in the cultivation and production of biofuels. The mass use of bioethanol for renewable energy generation may lead to energy security, mitigation of greenhouse gases, and prospects for new employment opportunities. Some academic researchers have studied and reviewed some issues on biofuels. These studies have focused on issues. Ajanovic (2011); researched on the impact of the recent increase in biofuels production on feedstock prices; Liu, *et al*. (2012) on the effects of bioethanol use, such as CO_2 emission to the environment. According to Campbell and Doswald (2009), fewer studies have been focused on the impacts of biofuels on biodiversity; few studies are also available on the sustainability of bioethanol, biodiversity and the environment. The purpose of this paper is to review literature extensively to examine the sustainability of bioethanol production and utilisation on the environment and biodiversity.

POLICIES ON BIOFUELS, THE ENVIRONMENT AND BIODIVERSITY

The government of each country is in charge of the development of a biofuel targets and policy. These policies are dependent on the feedstock used for biofuel production, the extent of blending and use of these fuels and the countries national agricultural policies and the procedure for the biofuel production. These policies should include guidelines for sustainable performance of biofuel production, policies on product-oriented certification of biofuels. Furthermore, these policies should take into account all relevant environmental effects (soil, water, air, biodiversity, landscape and climate). De Meester *et al*. (2011) discovered that countries that have integrated biofuel policies and targets into their renewable energy policies are: the USA, Brazil, the EU, Canada, China Argentina, Colombia, Japan and New Zealand. In the UK, biofuel now accounts for 2.5% of the fuel blend. The EU, for example, has fixed a 10% target for biofuel use within the transport sector by 2020. Furthermore**,** as at 2010, the targets set by the European Union (EU) in 2001 to stop biodiversity loss was not met. In addition, they stated that three key points to the urgency of an effective biodiversity conservation policy are: 1) the alarming global decline in biodiversity; 2) the associated diminishing return in ecosystem services that are key to human well-being; 3) the dangerous mix of climate change and biodiversity loss. They suggested that a good policy on biofuels should be an interaction of the policy on biodiversity,

ecosystem and climate change. They further suggested that education and awareness, collaboration, research, and sustainability should be stresses in any biofuel policy.

According to Tscharntke, *et al.* (2012) the EU biofuel directive 2008 target is that 10% of all transport renewable fuel should originate from biofuel by 2050. Currently, global production of biofuels is low, but increasing gradually.Also, they stated that in Brazil, the sugarcane industry has been encouraged and protected by lobbyists and politician for centuries. Subsequently, the industry has exhibited disregard for social laws and the in the country. A vivid example is the non-compliance of the law regulating banning sugarcane burning practices and civil suits regarding the wretched living conditions of sugarcane cutters have been overlooked by the judicial system.

BIOETHANOL FEEDSTOCK

According to Dale, Kline, Wiens and Fargione, (2010), to achieve social economic and environmental sustainability in the cultivation and utilisation of biofuels for the future, second and third generation feedstock were explored. This type of feedstock will not alter natural ecosystems, introduce invasive species, have a low ecological footprint, should not pose a threat to biodiversity and the carbon dioxide emission along the lifecycle analysis of this feedstock should be low and not affect the environment negatively. Furthermore, that the type of feedstock that should be favoured should not have negative effect on the land, biodiversity or the environment. De Vries et al. (2010) provided data from literature they reviewed on the best feedstock for the production methods for biofuel. The objective of their study was to improve understanding of the pros and cons of certain types of feedstock for the production of biofuels, they believe that this may assist better choices in the selection, production and utilisation of biofuels now and in the future (See table 3, 4 and 5).

Table 3: Comparison (advantages) of 1st, 2nd and 3rd generation biofuels and fossil fuels

1st generation bioethanol	2nd and 3rd generation bioethanol	Fossil fuels
-This reduces GHG, thus is	-Does not compete with food.	Currently mainly used

environmentally friendly. -provides employment, social and economic security	- It is environmentally friendly -Cost of bioethanol might be reduced.	globally in automobiles for transportation.

(Source: Adapted from Naik., Goud, Rout and Dalai, 2010).

Table 4: Comparison (disadvantages) of 1st generation fuels, 2nd generation fuels and fossil fuels

Ist generation bioethanol	2nd generation bioethanol	Fossil fuels
-Feedstock for the production needs a large expanse of land. -Has to be blended with conventional fuel. -Increased production may cause biodiversity loss and extinction	-Planting of second generation bioethanol feedstock on degraded land might affect the quality of the bioethanol fuel produced. -Some may act as invasive species. -Needs advanced conversion technologies into biofuels	-Causes environmental pollution -Causes ecological and economic problems -Causes decline and depletion of petroleum reserves - Natural resources (crude oil) decreasing and may be exhausted eventually.

(Source: Adapted from Naik., Goud, Rout and Dalai, 2010).

Table 5 Comparison of some parameters in feedstock producing bioethanol to determine their sustainability.

Biofuel crop	Fertilizer use	Water use	Energy input	Pesticide use	GHG emission (kg CO2/MJ)	Fuel yield (l/ha)	Energy conservation efficiency
Sugar cane	high	high	Med.	Med.	4-12	5300-6500	8-10.2
Corn	high	high	high	high	81-85	1135-1900	1.1-1.25
Native prairie	low	low	low	low	-88	Est. 94o	Est. 5.44
Switch grass	low	Med. - low	low	low	-24- 11	2750-5000	1.8-4.4
Poplars and willows(2nd Generation fuel)	Low-med.	Low-med.	low	low	-24 -11	5500 - 9000	10

(**Source**: Groom *et al*. 2008)

De Vries (2010) also conducted analysis and compared the ecological sustainability of the production of biofuels from several major feedstocks. They discovered that bioethanol from sugarcane from Brazil is highly sustainable compared to corn feedstock used in the USA. In the cultivation of sugar cane from Brazil for bioethanol, the pesticide application is moderate and not high (See Table 5). The energy input is moderate, the ethanol produced is high and the greenhouse gas emission is reduced compared to corn feedstock and fossil fuels. Dale *et al.* (2010) suggested that internationally, the long-term sustainability of bioenergy feedstock depends on the land-use practices. That next to sustainable land-use change the costs and benefits of biofuel production is largely dependent on the type of feedstock and method of processing the feedstock into biofuels. Feedstock that have low GHS emission example poplar and Willows as seen in table 5, may

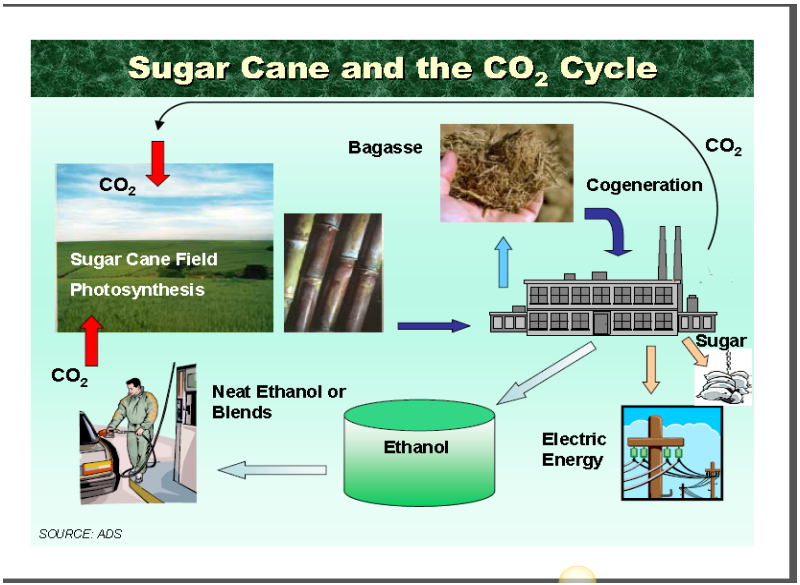
contribute to achieve a GHG balance in nature. A major reason for the shift to the use of 2nd generation feedstock for bioethanol production is a negative GHG balance as shown by switch grass, poplars and willow as seen in the data in table 5. Based on the low GHG emission, low water, fertilizer and pesticide use by the 2nd generation feedstock, if sustainable guidelines are pursued, thus bioethanol will be a useful renewable energy to mitigate climate change.

BIOFUELS AND CLIMATE CHANGE MITIGATION

According to Campbell and Doswald (2009) biofuels have the potential to contribute to climate change mitigation. However, there is the need to guide against the negative impacts on biodiversity. A number of "climate stabilization wedges," for substituting fossil fuels with biomass fuels, that could serve together to reduce emissions enough to prevent the more harmful effects of climate warming, were suggested (Pacala and Socolow, 2004, in De Meester *et al*. 2011).They stated that biofuels on their own are unlikely to reduce emissions adequately. Thus the use of many strategies to meet the challenges of global climate change is needed. Some biofuels example, from bioethanol achieves real emissions reductions (UN-Energy 2007, in Campbell and Doswald, 2009, p.10). Ecological footprint, lifecycle analysis (LCA) of biofuel crop and greenhouse gas emission (GHG) should be considered (Groom, Gray and Townsend, 2008).

The environmental impact of corn-based ethanol (a pesticide and fertilizer intensive crop) is thought to be the highest of any agricultural crops in the US (Groom *et al.*, 2008).For example, when sugarcane is used to produce ethanol, 80-100% greenhouse gas savings could be achieved by using ethanol (Howarth *et al.* 2009, as cited in Campbell and Doswald, 2009). According to Escobar, Lora, Venturini, Yanez, and Castillo (2009), an important tool to determine the environmental impact of the biofuels is the life cycle analysis (LCA).This determines the the evaluation of the production, consumption and impacts in all the stages of the life cycle of the product .

Figure 1: Showing the sugarcane and the carbon dioxide cycle



(Source: Jank *et al.*, 2007)

According to Goldemberg (2008) by using sugarcane for bioethanol production, initially, the sun's energy can be converted through photosynthesis into glucose and starch. Energy for further processing of sugar cane into ethanol is got from a waste product of sugarcane extraction known as bagasse (See figure 1) and not from fossil fuels as is the case of using corn in the USA. Also, emissions from land use changes resulting in massive deforestation and burning of the sugar cane during harvesting could be a source of GHG emissions. The carbon dioxide from this emission and from other emissions, example the use of automobile vehicles may be utilised by plants for photosynthesis.

Table 6: Some environmental pros and cons of bioethanol production using 1st generation feedstock.

Pros	Cons
-Bioethanol is biodegradable -Bioethanol has a better energy balance to the atmosphere than other fuels -The emission of soot, NOx, CO, is very low and there is no SO_2, and no sulphur content.	-Production of bioethanol may be more expensive than other renewable energy fuels. -The cultivation of energy plants encourages monocultures. -Production of bioethanol may require the use of some fossil fuels energy. -The use of fertilisers and pesticides may pollute wetlands, the ground and ground water. - may endanger biodiversity

Source: Puppan (2002)

The environmental cons are more than the pros. However, the future trend is to emphasise on the sustainable production of bioethanol from 2nd generation feedstock.

EFFECTS OF BIOFUELS ON BIODIVERSITY

Biodiversity is defined by Andrés, Calvet, Van den Bergh, Ring, and Verburg, (2012), as the variability of life forms, microorganisms, fungi, plants and animals. Wallace (2012) stated that biodiversity continues to decline globally in response to strong adverse processes, largely anthropogenic in nature. Drivers of biodiversity loss may include: deforestation, land use, fragmentation, water use causing desiccation, pollution with climate change, existing policies in agriculture and fisheries. Other drivers that may lead to biodiversity loss can be subsidies from government for biofuel production. This might promote the conversion of tropical forest

to tilled fields or affect other ecosystems .All these may reduce the habitat that supports a unique biodiversity. Spierenborg (2012) suggested that the impacts of biofuels on biodiversity depend on the agricultural practice employed, the recent land use change, the fragmentation of habitat, biofuel feedstock, and the previous land use. In addition, proposed 2nd generation feedstock energy crops pose significant risk of becoming invasive and causing unintended effects on species. In addition, the major impact of biofuel crops on biodiversity is through the indirect or direct conversion of natural ecosystem such as wetlands, forests, grasslands into monoculture farms or croplands (Lui and Zehao ,2014).

Dale *et al*. (2010) in their research *stated that sustainable production of bioethanol is crucial to avoiding negative impacts on the environment, biodiversity, water, climate, and soil. They proposed three key guidelines that should be tackled in any biodiversity risk-mitigation strategy: mitigation of negative impact related to indirect land-use change; conservation of areas of important biodiversity value; and promotion of agricultural practices with minimal negative impacts on biodiversity.* Such efforts entail preserving the health and well-being of our planet for future generations. Brazil for example is a deforestation hotspot and also, a biodiversity hotspot. Therefore enforcement of sustainable policies and practices are urgently needed in Brazil to prevent biodiversity loss and to protect the environment. In the USA, set aside land now used for corn cultivation has higher bird nesting rate. This protected land is supposed to be preserved to protect biodiversity but it is now used to cultivate corn for bioethanol production (Koh and Ghazoul, 2008; Manning, Taylor and Hanley, 2015).

According to Hellmann and Verburg (2010) in their study present an assessment of the potential impact of the EUs biofuel directive on European land use and biodiversity. The results of this study show that the expected indirect effects of the directive on biodiversity are largely greater than its direct effects. This suggests that indirect effects need to be taken clearly into account in designing sustainable pathways for implementing biofuel policies and evaluating the environmental effects of biofuel crop cultivation. Andres *et al*. (2012) also had a similarresult**.** They explore the relationship between biodiversity, ecosystem services and conservation policy. They proposed a framework for studying their interdependence. They further argued that a

necessary condition for making a transition to a truly sustainable economy is biodiversity conservation and its analysis taking into account undesirable and preventable indirect effects of all kinds in a biodiversity policy. They identified five types of such sustainable reforms and propose the terms: environmental, biodiversity (2 types), services and ecological reforms be conducted for the sustainability of bioethanol production.

SUSTAINABLE BIODIVERSITY AND ENVIRONMENTAL - FRIENDLY PRACTICES FOR BIOFUELS

Brundtland's definition of sustainability is that **"**sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs'' (Brundtland *et al.*1987 as cited in Andres *et al.*, 2012). The sustainability proposals adapted from Groom *et al* (2008) can be summarized by three general principles: promote sustainable and low-impact feedstock with a small ecological footprint, maintain native and essential food crop habitats, and require net carbon neutral biofuels. Practical efforts to create biofuels sustainability criteria in renewable energy development started to have significant trends in 2008. According to De Meester *et al.* (2011) policy recommendations to promote sustainably grown feedstock and biodiversity-friendly biofuels are:

- Encourage polycuzlture to decrease soil depletion and make biofuel cropping systems that can be utilised by a more diversity of wild species.
- The need that the sustainable biofuel feedstock is produced and assessed, and to promote only biofuels that can be produced sustainably.
- Estimate the entire life cycle of biofuel production, use, and waste disposal to estimate the ecological footprint of any biofuel.
- Ban clearing of natural areas to preserve and protect these areas.
- Support restoration or salvage of degraded areas for biofuel cultivation, when suitable.
- Choose species with high conversion efficiencies to small land area needed for the production of biofuels. This will largely include lignocellulose feedstocks for next-generation biofuel production.
- Agricultural-environmental schemes were developed and implemented so that farmers receive financial support for implementing environment-friendly agricultural practices.

- Encourage the use of energy crops that may be grown with low pesticide, fertilizer, and energy inputs in most locations.
- Ensure that feedstock used in biofuel production does not adversely affect ecosystem processes and sensitive habitats and investigate production procedures that may enhance ecosystem processes over time.
- Encourage use of native and perennial species.
- Employ conservation tillage or other appropriate techniques to conserve soils.
- Calculate the greenhouse gas emissions over the biofuel production and use life cycle, and encourage only those biofuels which are based on the type of feedstock and refining approaches that are net carbon neutral or that sequester carbon.
- Prohibit use of species that can become invasive.
- Sustainable management practices such as no-till cultivation and the use of cover crops can all improve environmental performance.

In addition, the proposed criteria for sustainability for bioenergy includes the requirements for reduction of greenhouse gas emissions when compared to fossil alternatives, criteria for sustainable land use and criteria for social sustainability. Furthermore, their study examines the significance of standards for sustainable bioethanol production. Sustainability of bioethanol production is crucial if bioenergy is likely to contribute effectively to climate change mitigation. To prevent the impact of bioethanol production on food production, sustainability criteria proposed by Hennenberg *et al*. (2010) is the production of bioethanol on "degradable land". Many studies and academic research encourage the use of degradable land and waste vegetative product in the production of bioethanol for mitigating climate change and protecting biodiversity. However, the issue is the lack of consensus on what defines a degradable land. Furthermore, other researchers stated that if degradable land is referred to as a low carbon land, then this could have a negative effect on biodiversity. Regardless of land availability concerns, biofuel production on degraded land is economically inferior to production on higher quality agricultural land.

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

Discussions

There is the need to preserve biodiversity, protect the environment and develop sustainable policies and practices that will make the production of bioethanol sustainable for future generations. Sustainability in biofuel production might be achieved through environmental, social and economic protection. Many academic papers are focused on the economic sustainability of the production and utilisation of bioethanol and neglecting the effect of the production of biodiversity on biodiversity and the environment.The impacts on biodiversity will depend upon the biofuel feedstock with low ecological footprint and LCA, the effects of the biofuels on the environment, Land use, and agricultural practices employed, the increased the development of future biofuels offers some potential for reducing biodiversity impacts.

Many countries develop targets and policies to enable the sustainable use of bioethanol as a substitute to fossil fuels. These policies and target are not complied with by the citizens of these countries. Brazil is reported to produce the best ethanol from sugarcane and is the world largest exporter of biofuels. However, in Brazil it was reported by Martinelli and Filoso (2008) that the people involved in the renewable energy industry have disregard for environmental and social policies of the country. The ban on the prevention of deforestation to plant sugarcane and burning of sugarcane during harvesting is not adhered to by the renewable energy industry. Deforestation practice and the harvesting practice emit carbon dioxide into the atmosphere. Increased quantity of GHG, may lead to climate change and global warming. The production of bioethanol is supposed to mitigate adverse effect of climate change and not some of the procedures of production contributing to climate change, if this is allowed to continue, then the production of biofuels will not be sustainable. Also the social sustainability is not achieved in the renewable industry in Brazil because the workers are treated poorly and not well paid,

Conclusion

It was discovered from this study that major world producers of bioethanol are the USA, Brazil and the member states of the European Union (EU). This study also shows that different policies and targets are adopted by different countries for bioethanol as a renewable energy. Furthermore, this is dependent on the feedstock used by that country for bioethanol production. Currently, the production and utilization

of bioethanol is largely driven by governmental subsidies and targets.

The feedstock for bioethanol production has advantages and disadvantages. It was discovered that the USA is major producer of bioethanol from corn feedstock. Brazil is the world major exporter of bioethanol from sugar feedstock. However, it was discovered that corn based feedstock is not environmentally friendly and sustainable.

Sustainable futures for bioethanol production and utilization, the environment and biodiversity will involve the following: preserving natural habitats and the use of carbon friendly neutral biofuels, the use of 2nd and 3rd generation feedstock. However these types of feedstock have not yet been produced on a commercial scale. Sustainable feedstock should have a small ecological footprint, a life cycle analysis with low carbon dioxide emission, a sustainable food crop habitat with native species and should sequester carbon. Some authors are of the view that currently, despite the disadvantages of fossil fuels, the sustainable use of bioethanol alone may not achieve the carbon dioxide emission reductions necessary to avert disastrous climate change. Therefore, vigorous research is necessary for sustainable bioethanol production to replace fossil fuels and avert catastrophic climate change and prevent the loss of biodiversity.

Recommendation

- Life cycle assessment (LCA) of product that is, throughout its life cycle, from "cradle to grave" should be conducted on bioethanol feedstock. This assists to decide the choice of feedstock to be utilized for bioethanol production that has low carbon dioxide emission throughout its life cycle.
- The ecological footprint of the feedstock has to be sustainable.
- Further research is necessary on the effect of 2nd and 3rd generation biofuels feedstock on the environment and biodiversity

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DESIGN AND CONSTRUCTION OF METALLIC PROBE SOIL CONDUCTIVITY MEASURING DEVICE

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Abstract: *The amount of water passing through the soil is used to determine the electrical conductivity of metals. The metallic probe soil conductivity device is designed to measure the movement of water that passes through the soil from the top soil surface. As the metals come in contact with the water passing the soil, the resistance of the conductor decreases and the conductivity of the metallic conductor increases. The device consists of four major units. The first unit consists of a metallic probe made from aluminum or brass. The lower end of the probe will be inserted into the soil to about 3.00 cm. The upper ends will be connected to the base and emitter of the transistor. The second unit is made up of a common emitter amplifier. This amplifies the base voltage between the potential divider as the transistor is forward bias. The collector-emitter voltage is connected to the analog to digital converter. The third unit comprises of an analog to digital converter (ADC). This converts the analog input of the probe to digital data. Lastly, the display unit comprises of a liquid crystal display. The digital output signal from the ADC is connected to the LCD for visual display. This device can be used by researcher and farmer to determine the movement of water through the soil and the conductivity of metallic materials. It is cheap and easy to maintain.*

Keywords: *Metallic probe, electrical conductivity, amplification and soil conductivity*

INTRODUCTION

The soil is the solid part of the earth in which many physical activities such as farming, mining and

construction take place. Soil conduction is the process by which a fluid and other materials passing through or into another substance travelling through pores and interstices (Haghnazari, *et al.*, 2015). There is need to know the soil water conductivity. Soil water conductivity has been determined manually by farmers and researchers and this had lead to in accurate data and error prone readings. The manual method involves digging a hole down the soil sample and pouring water and gradually from the top and watching the movement of water across the soil profile. This has been a tedious practice of measuring the soil conductivity by farmer and researcher. The intake (conduction) cannot be ascertained by common vision. The practice had led to waste of human energy and time. This method of observing the soil water conduction is prone to errors. However, there is need to design and construct a measuring device using metallic conductors (aluminum and brass) to indicate the presence of water in the soil when the top surface is naturally or artificially flood. Also, the device will determine which of these metallic materials have high conductivity when electrical charges flow through. This device will use the electrical conductivity of water to measure the soil conductivity. The device will be use to determine the porosity of soil and irrigation practice to be employ by farmers This will reduce human effort and time wastage when done manually. The relationship between conductivity and resistivity of a metallic material is given in the characteristics equation below.

$$\sigma = \frac{1}{R} \text{----------1}$$

Where **σ** = conductivity of the rod

R = resistance of metallic material

Some scientists and researchers have designed instrument for the measurement of soil conductivity using different materials;

Rhoades, et al (1999), designed soil salinity device that was used in large area without employing ground (contact) electrode. The device used the electromagnetic principle by providing a depth of exploration of 1.5 m and 0.75 m in vertical and horizontal dipole mode. The electromagnetic induction material does not come in contact with the soil surface.

A low cost conductivity cell water device was designed using aluminum rod for the measurement of fresh water soil conductivity. It was found that

the device had a low conductivity when used to measure different soil sample (Torrents, 2004)

A frequency capacitance device was designed for water conductivity measurement. It was discussed that the electrical conductivity was low since the fresh water does not contain any solution. The amount of dissolved impurities in water determines the electrical conductivity (Jikun, 2009).

The electrode geometry impedance spectroscopy was designed for the measurement of soil conductivity. It was found that the electrode type and its area have an adverse effect on the electrical conductivity of water in the soil (Ahmed and Ken, 2011).

Factors influencing soil conductivity

The soil conduction rate is determined by the interaction of a number of physical and chemical soil characteristics. These soil properties vary from one location to another and change over time due to cultural practices (e.g compaction and tillage), water management and biological processes (e.g macro and micro-organisms).

Soil Texture

The hydraulic conductivity of the soil is strongly influenced by the soil texture, i.e .the relative proportions of sand, silt and clay. Clay particles are particularly important as their small size makes them able to fill the voids between larger particles while their charge orientation gives them a crucial role in binding the soil matrix into larger structures. For a media with a single particle size the hydraulic conductivity is approximately proportional to the square of the particle diameter (Iwata *et al*. 1995) .However, in a natural soil the particle sizes range from the microscopic clay colloids (<0.0002 mm) to the much larger sand grains (0.05 - 2 mm) up to large boulders (Haghnazari, 2015).

Soil Structure and Compaction

The majority of factors influencing the infiltration rate have a direct effect on the soil structure namely the soil porosity. Porosity refers to the ratio between the volumes of solid and fluid components of a soil sample. However, for conduction the average pore size, distribution of pore sizes and connectivity of pores are of greater importance. The soil pores must be large enough and offer sufficient continuity in order for infiltration to occur. Soil pores are classified by size into macropores (> 0.075 mm), mesopores and micropores (< 0.03 mm). Soil pores may be created or altered through biological activity, shrinkage from temperature or moisture effects, formation of ice lenses, cultivation and

collapse or plugging of larger pores (Lal and Shukla, 2004).

Soil Erosion

Soil erosion is the process by which material is dislodged, transported and deposited elsewhere in the landscape via the effects of wind or water. Disregarding wind, the severity of erosion is determined by the soil particle size, field slope and water flow velocity. In furrow irrigation, maximum flow velocity is realised close to the inlet and gradually declines over the furrow length. Hence, the sediment load generally increases throughout the first quarter of the field length and steadily declines over the second half of the field (Trout, 1996).

Methods of soil conductivity measurement

i. **Contact Sensor**

The contact sensor uses metals as an electrode to make contact with the soil. The approach use two or more metallic rods mounted on a toolbar, one pair provide electrical current into the soil (transmitting electrode) and the other rod (receiving electrode) measure the voltage drop across the conductors. The soil conductivity is measured and stored in a data logger with location information using the global positioning system (GPS). This method is common for the precision of farming application because of its large area mapping and it is least susceptible to outside electrical interference.

ii. **Non-contact Sensor**

The non-contact method uses the electromagnetic induction (EMI) principle to carry out measurement in the soil. The electromagnetic induction material has a transmitter and a receiver coil attached to opposite ends of the unit. The transmitting coil sends an electrical field into thr soil and the ability to carry the electrical field is related to the soil properties. The strength of the secondary electromagnetic field is proportional to the soil electrical conductivity. The device measures the resulting electromagnetic field that the current induces. The sensor must be mounted on a non-metallic bar to prevent interference.

Materials/components

1. Copper electrode
2. Resistor $R_1 = 1K\Omega$
3. Resistor $R_2 = 12K\Omega$
4. Resistor $R_1 = 4.7K\Omega$
5. TIP 31A Transistor
6. Digital Multimeter
7. Vero-board
8. Voltage Regulator

Design

The design and construction of metallic probe soil conductivity circuit is shown in figure 1. The device was used to measure the voltage drop across the aluminum and brass electrodes as water was conducted through the soil particles. The device consists of aluminum and brass rods, common-emitter amplifier, analog to digital converter (ADC) and display system. The aluminum and brass electrodes serve as a voltage divider to the base of the transistor and it was inserted into the soil. The amplified output from collector was connected to the ADC. The analog to digital converter converts the analog input to digital output voltage signal. The output signal was connected to a liquid crystal display (LCD). The LCD displays the digital data for clear vision. The digital multimeter block diagram is shown in figure 2.

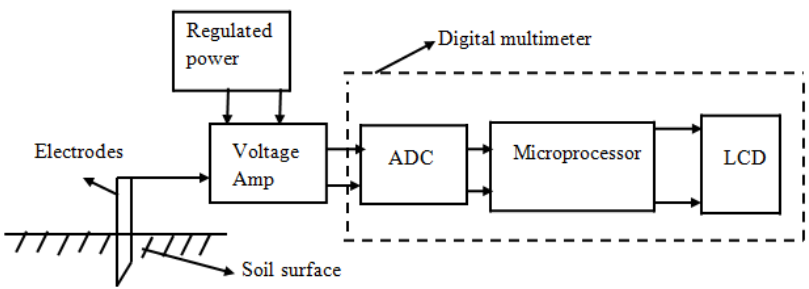

Figure 1: System block diagram

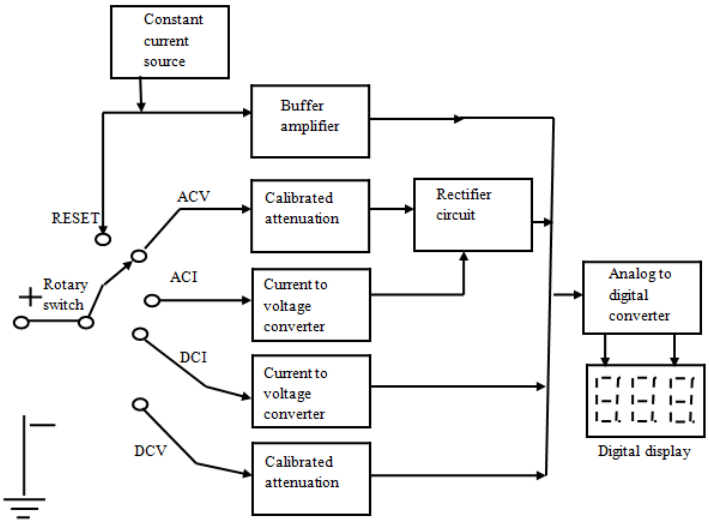

Figure 2: Digital multimeter circuit

CIRCUIT ANALYSIS

Voltage amplifier

The input voltage is amplified at the collector of the transistor . The voltage gain (A_v) gives;

$$A_V = \frac{V_{out}}{V_{in}} \approx \frac{R_C}{R_E + r_e} \quad ------ 2$$

Buffer amplifier

The buffer is a unity gain amplifier using a negative feedback configuration with a high input impedance and low output impedance and it is used to avoid loading of signal source. Op-amp (LM741) is used for the unity gain amplifier.

Calibrated attenuator

The digital multimeter (DMM) adjustment is programmed to reduce instability in the offset gain and linearity of transfer function of signal processing. The sectional block is subject to the source of various in performance. The transfer function of DMM is given as;

$$y = mx + b \quad (3)$$

Where
y = output
x = input
m = gain
b = offset fro zero

Current to voltage

The current to voltage converter produces a voltage that is proportional to the given current. An Op-amp (LM741) isapplied for the application.

$$\frac{V_{out}}{V_{in}} = -\frac{R_f}{R_l}$$

$$I_{in} = -\frac{V_{in}}{R_l} \quad (4)$$

Where
I_{in}= input current
V_{in} = input Voltage
R_l = load resistance

Rectification

The rectifier circuit converts the a.c voltage into a pulsating d.c voltage for power supply. The output d.c voltage for a full-wave across the load is given as;

$$V_{d.c} = \frac{2V_{max}}{\pi} \quad (5)$$

Where
V_{max} = 0.639

Analog to digital converter

This device converts the analog input signal to digital signal output. The DMM use the IC_L 7106 integrated circuit to convert analog input to binary output.

RESULT AND DISCUSSION

The designed metallic probe device was used to measure the soil conductivity using Aluminum and Brass at the field as shown in figure 2(a-b). When the soil is flooded with water and the common emitter is forward bias, the saturation current at the collector will be maximum hence the transistor will conduct. As the soil is moist, the resistance of the electrode will be reduced and an increase in the

conductance of the electrode. From figure 2a, the electrode was made of aluminum and the LCD device displayed a voltage reading of about 6.37 V. But from figure 2b, the electrode was made of brass with a voltage reading value of 1.55 V. From the results displayed, it shows that aluminum conducts electrical charges than brass as water conducts through the soil. The resistances of the metallic electrodes decrease with an increase in the conductivity of the electrode. This device can be used to determine good conductors of electric charges


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DIGITAL MULTIMETER
DT9205A

Conclusion

The instrument has a high precision measurement reading on soil conductivity using metallic probes. This showed that the device can be used to determine the conductivity of material through it and the conductivity of most metallic substance in the soil. It can be helpful to researcher to determine the electrical conductivity of metal when inserted into the soil. However the use of the device will reduce human effort and data errors from manual measurement. The device is cost effective and easy to operate.

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REVIEW: THE SIGNIFICANCE OF NANOZYMES IN HEALTH CARE DELIVERY

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ABSTRACT: *Nanomaterial-based enzyme mimetics (nanozymes) have attracted enormous interest. They exhibit unique advantages such as excellent robustness, stability, and low cost production with easy scale-up which are critically needed as an alternative to natural enzymes. These nanozymes exhibit natural enzyme-like activity and have been applied to various kinds of detection and treatment methods for biomolecules such as DNA, proteins cells and small molecules including glucose. To highlight progress in the field of nanozymes, this review discusses recent nanozyme-based research results and their application in the area of therapeutics, water treatment/pollutant removal, imaging and sensing and immunoassays. Current challenges and future prospects of nanozymes for widespread use in biotechnology are also discussed.*

Keywords: *nanozymes, enzyme, immunoassay, biotechnology.*

Introduction

Nanozyme is a blend of two (2) root words; Nano and Enzyme. Nano is .
a unit prefix meaning “One billionth” (1, 000 000 000; 10^9) while enzymes are biological catalyst that accept chemical reactions. Nanozyme is a Nanomaterial with enzyme-like characteristics. It is an inorganic nanoparticle (bare or surface modified) that mimic the catalytic properties of various enzymes. The nanoparticle $Fe_30_4$is a good example which is well known for mimicking the peroxidase enzymes. Compared to natural enzymes Nanozymesare advantageous in several aspects such as low cost, ease of mass production, robustness to harsh environments, high stability long terms storage and size /composition dependent activity

(Wei *et al.,* 2013). Nanozyme is significant in healthcare delivery, its uses have been extensively investigated for diverse applications in bio-nanotechnology, ranging from detection of cells (especially cancer cells) and bacteria, therapeutics, immunoassays, pollutant removal and water treatment. Nanozyme's enzyme-like activities comes from the nanomaterial itself, rather than conjugating additional enzymes onto the nanomaterials, as inert ferromagnetic nanoparticles have intrinsic peroxidase activity (Gao *et al.,* 2007). So far, there are more than 50 kinds of nanomaterials that have been found to possess intrinsic activity similar to enzymes such as peroxidases, oxidases, glucose oxidases, habperoxidases, superoxide dismutases and sulfite oxidases (Gao and Yan, 2013; Ragg*et al.,* 2015). These findings lead to the discovery that nanomaterials are not chemically inert and that they are also bioactive.

Nanozymes lacks active sites, where only a specific substrate molecule binds and undergoes a chemical reaction as seen in natural enzymes. Researchers have developed various strategies to endow nanozymes with specificity to target molecules,the most representative strategies can be divided between oxidase-coupled method and surface-modification method. For the oxidase-coupled method, the peroxidase-like activity gains specificity by being coupled with oxidase which generates H_2O_2 as a product of thecatalytic reaction which occurs only in the presence of the target molecules, peroxidase-like nanozymes in turn catalyzes the oxidation of colorimetric substrates with the resulting H_2O_2. Whilethe surface-modification method involves conjugating an antibody on the surface of the nanozyme to provide specificity towards antigen molecules mostly in the colorimetric immunoassay system, this conjugation on the target makes it target-specific probe, generating a colorimetrate and H_2O_2 ligand conjugated nanozymes uses same mechanisms to specifically bind to target receptors and produce a colorimetric signal when the targeted molecules bind on the nanozymes are generally believed to be produced by atoms present on the surface as well as in the nanozyme's inside core. Thus, the atoms composition of nanozymes is the most important factor in determiningtheir catalytic activity, although, other factors such as size, morphology, surface coating and modification, pH and temperature can also have an impact (Wei and Wang, 2008).

ENZYMES VERSUS NANOZYMES

Enzymes are macromolecular biological catalysts that are proteinous in nature. Enzymes accelerate chemical reactions. Enzymes acts upon substrates (as the molecule acted upon) converting them into different molecules known as product. In rendering a good health care, early detection of diseases helps improve therapeutic decision-making, which decreases the severity of illness and length of hospital stay. Accordingly, a number of biosensing techniques have been developed for rapid, reliable, and sensitive detection of biomolecules that can be used as indicators of disease. Among various biosensing methods for diagonising human diseases, natural enzymes such as horseradish peroxidase have been frequently used for bioassay as they can catalyze various colorimetric reactions in the presence of specially designed substrates and they display good sensitivity and selectivity towards the target molecules. In spite of their novel catalytic efficiency, natural enzymes have critical limitations for industrial application such as low stability in harsh conditions (temperature & pH), relatively high costs for preparation, purification and storage.

For the past few decades, researches have made an intense effort to develop artificial enzymes for a wide range of applications. Nanozyme; Nanomaterials with enzymes-like characteristics have been a great discovery as Fe_3O_4 magnetic nanoparticles (Mnps) for instance has been found to exhibit intrinsic peroxidase activity (Wei *et al*., 2013). This remarkable discovery opens up the way for a new class of enzymemimetrics. To date, various nanostructed materials have been reported to possess intrinsic enzymatic activity which includes; plantinum nanoparticles (Pt nps), cerium oxide nenoparticles (CeO_2nps), Gold nanoparticles (Au nps), Copper oxide nonoparticles (CuONps), $BiFeO_3$ nanoparticles, $CoFe_2O_4$ nanoparticles FeS andFeSe nanoparticles, grapheme oxide, single-wall carbon nanotubes and hemin-graphene hybrid nanosheets (Wei *et al.,* 2013). These materials are named ‘Nanozymes’ due to their enzyme-like catalytic activity. In contrast to natural enzymes, nanozymesare inherently robust, stable in harshconditions (pH and temperature) and easy to mass-produce with simple scale-up. These advantages make them promising candidates for analytical and environmental applications (Daun*et al.,* 2015).

CLASSIFICATION OF NANOZYMES BASE ON THE TYPE OF COMPOSITION

Based on the type of composition of the nanozyme, it can be distributed into three categories.

- Metal-Based Nanozymes
- Metal Oxide-Based Nanozymes
- Carbon-Based Nanozymes.

Metal-Based Nanozyme`

These are Nanozyme containing metal or have a metallic element as their main component. Metal-based nanozymes such as AuNPs and Pt NPs have been discovered to possess the catalytic activities of oxidase, catalase and superoxide dismutase. In addition to this, nanocomposites which combine a metal based nanozyme with other nanozyme have been also intensively develop, including Fe_3O_4 – graphene oxide (Go), Fe_3O_4 –Pt, AU – Pt and Go-Fe_3O_4- ptnanocomposites. Surprisingly, it was reported that metal-based nanozymes often exhibit synergistic effects which significantly enhance catalytic performance when coupled with other nanozymes as a composite (Wei *et al.*, 2013).

Metal Oxide-Based Nanozyme

These are Nanozymes of metals as their main constituent. Metal oxide nanoparticles have been widely used in the field of biomedical applications such as biosensor, targeted drug delivery, tissue repair, immunoassay and contrast agents in magnetic resonance imaging (MRI) and cell separation (Gupta and Gupta, 2005). Since metal oxide nanoparticles are commonly considered chemically and biologically inert, additional surface engineering and subsequent conjugations with functional substances are required to endow metal oxidenanoparticles with functionality. A variety of metal oxidebased nanozymes have been discovered to possess enzyme-like catalytic activities (which includes peroxidase, catalase, and superoxide dismutase).Metal-Based Nanozymes includes; CeO_2NPS (cerium oxide Nanoparticles), cobalt oxide nanoparticles (Co_3O_4, NPS), Manganese dioxide nanoparticles (MnO_2 NPs), Vanadium Pentoxide Nanoparticles (V_2O_5) and copper oxide nanoparticles (CuO NPs).

Carbon-Based Nanozymes

Carbon is the basic element of constituent in these Nanozymes. Carbon based nanozymes includes; Fullerence, carbon nanotube, graphene oxide and carbon dot. These Carbon-Based nanozymes are also attracting great interest owing to their unique enzyme mimicking activities (Wei *et al.*, 2013). They have been found to possess peroxide and SOD

(Superoxide Dismustase) mimicking abilities and are widely utilized as signaling agents for signal amplification and detection of analytes in the field of biosensors and immunoassays.

SIGNIFICANCE OF NANOZYME IN HEALTH CARE DELIVERY

- **DETECTION OF CELLS AND BACTERIA**

Nanozymes have been used for detection of cells (usually cancer cells) and bacteria. Due to their (Nanozymes) highly effective catalysis and versatile function, nanozymes strip could detect Ebola virus with 100 time's higher sensitivity than standard strips using the super-paramagnetism and amplifying the signal simultaneously (Daun*et al.*, 2015). Similarly, a magnet of erritinnanozymes shows great potential for rapid cancer diagnosis by combining tumor specific recognition (ferritin) and coloration (peroxidase) into a one-step reaction (Fan *et al.*, 2012).Asati et al., 2009 employed antibody conjugated ceria nanoparticles for detection of Folate receptor over-expressed lung carcinoma cell. Recently, several studies also showed that Folate receptor over-expressed cancer cells could be detect with various folate-modified Using AgI nanoparticles as the nanozyme, folate receptor over-expressed MDA-MB-231 (one of the most commonly used breast cancer cells in medical research laboratories) cells were detected under light irradiation.

MDA-MB-231 is a highly aggressive, invasive and poorly differentiated triple-negative breast cancer (TNBC) cell line as it lacks estrogen receptor (ER) and progesterone receptor (PR) expansion as well as Human epidermal growth factor receptor 2 (HER2) amplification (Liu *et al.*, 2015).

The colorimetric detection of *Shewannellaoneidensis*, a facultative anaerobic bacterium, on the basis of immunomagnetic capture of the bacteria and bacterial intrinsic peroxidase mimicking activities for signaling (Wen *et al.*, 2013). This discovery made a high impact and distinctive detection (selectivity) of *S. oneidensis*, it is also used for identifying spiked *S. Oneidesis* in water.

- **THERAPEUTICS**

Therapeutics in medicine is the branch that deals specially with the treatment of diseases and the art and science of healing. In pharmacology, therapeutics accordingly refers to the use of drugs and method of their administration in treatment of disease.Nanozymes have proven to be of great

important by mainly eliminating reactive oxygen species (ROS) and /or Reactive Nitrogen (RNS), nanozymes have been exploited for potential therapeutics (Vervekar*et al.,* 2014). Nanozyme's ROS scavenging capabilities can be traced from the superoxide (SOD) mimicking activities which convert superoxide into H_2O_2 as shown in the reaction below.

$$2O_2^{-2} + 2H^+ \rightarrow H_2O_2 + O_2$$

The reaction is catalyzed by SOD (superoxide)

Nanozymes application /significance in therapeutics can be viewed from the following perspective

Anti-Inflammatory

The ability of Nanozymes to nullify ROS effect has made it of very useful application in inflammatory. Nanozymes serves as Anti-Inflammatory responses which may lead to endothelial dysfunction and tissues injury (Mittal *et al.,* 2014). Nanozymes exhibits its anti-inflammatory effect by scavenging ROS with SOD or its mimics helping protect tissue and cell from ROS-induced inflammation. Nanozymes like ceria nanoparticles as studied by (Hirst*et al.,* 2014) exhibits anti-inflammatory properties. In a recent report, Son and co-workers integrated ceria nanopaticles onto a bioresorbable electronic stent as an inflammatory agent, the latter which is a therapeutic device for endovascular disease. They experimented their research using human umbilical vein endothelial cells as a model, the experiment demonstrated that the nanozymes was able to improve the cell viability under oxidative stress, also the canine common carotid artery was experimented on as the device (integrated ceria nanoparticles on a bioresorbable electronic stent) was implanted on it, it exhibited excellent anti-inflammatory effects.

Anti-Ageing

One of the effect of ROS (Reaction Oxygen Species) is ageing. Redox reactions are known to participate in ageing process. Detoxyfying the ROS help a great deal to combat ageing. The scavenging effect on ROS by Nanozymes helps detoxify the ROS and thus prevent ageing – related diseases. Quick et al., 2008 showed that the $C_{60}[C(COOH)_2]_3$- based SOD mimic exhibited interesting anti-ageing effects and improved wild–type mice's cognition ability, detailed studies revealed that the nanozymes decreases the age-associated mitochondrial superoxide production and thus improved the mitochondrial biological function,

which in turn rescued aged-related cognitive impairment due to its localization within the mitochondria.

Anti-Oxidation

Nanozymespossess excellent anti-oxidation effect as investigated (Vernekar *et al.*, 2014). The protective effect of PVP-Stabilized Iridium Nanoparticles against (H_2O_2) Hydrogen Peroxide-induced oxidative damage to A549 lung cancer cells (Su *et al.*, 2008), showed that the iridiumNanoparticles (Irnps) significantly reduces intracellular ROS levels and thus enhanced cell viability in a dose-dependent manner.

Nanoceria has also been demonstrated to possess interesting ant-oxidation properties, on the MNP-based peroxidase mimic (Yang *et al.*, 2015). CeO_2/Υ-Fe_2O_3nanoparticles exhibits the phosphatase mimicking behavior (Janos *et al.*, 2015); Organophosphorus pesticide-pathion methyl as well as the chemical warfare agents soman and VX at ambient temperature were decomposed resulting of the absorption and phophatase mimetic properties of CeO_2/Υ-Fe_2O_3.The Nanozyme still retained its magnetic properties, it could be recycled and used in various decontamination strategies (Janos *et al.*, 2015).

basis of the self-regenerating antioxidant mechanism, nanoceriaprotected cardial progenitor cells from H_2O_2 –induced cytotoxicity for one week (Pagliari*et al.*, 2012).

- **WATER TREATMENT POLLUTANT REMOVAL**

Water that is containing impurities or pollutant can betreated using nanozyme. Nanozyme that has phosphatase mimetic property, peroxidase mimics have helped greatly in removal of pollutant/impurities from water such as the removal of phenolic pollutants from aqueous solution (water) using the Fe_3O_4

- **IMAGING AND SENSING**

Imaging and sensing are concerned with developing molecules, materials, analytes and probe biological and physical process. Examples of materials used for imaging and sensingincludes; Oxygen sensing biomaterials, magnetic and plasmonic nanoparticles, carbon nanotube electrodes.Nanozymes are used for detecting a wide variety of important target cells whichincludes;

- ❖ Hydrogen peroxide sensing (H_2O_2 Sensing)
- ❖ Glucose and oxidase substrate sensing

Imaging

Imaging tumor tissue stained with magnet of erritin nanoparticles as a peroxidase mimic, the magnet of erritin were coated with recombinant human heavy-chain ferritin, this was due to the presence of over-expressed transferring receptor 1. Lots of patients were examined and the nanozyme-based imaging technique successfully distinguished cancer samples from normal ones with sensitivity of 98% and a specify of 95% (Fan *et al.*, 2015).

Glucose and Oxidase substrate sensing

For a corresponding oxidase substrate to be determined, an oxidase is to be combined with a peroxidase mimic. As reported by Wei et al., (2008),combining Glucose oxidase with Fe_3O_4 MNPs as the peroxidase mimic, a sensitive and selective colorimetric approach to glucose detection was achieved. A recent report on a distinctive method for glucose detection was given bQu et al., (2014);They replaced both glucose oxidase and peroxidase with nanomaterial mimics. Glucose oxidase was replaced with AuNPS (Gold Nanoparticle) and V_2O_5 (Vanadium (v) oxide) nanowires as the peroxidase mimic. The nanozymes were combined /assembled together via polymerized dopamine for cascade reactions; it displayed higher detection at a much lower cost.Other oxidases such as uricase (for detecting uric acid), their corresponding substrates as targets of interest can be detected; choline D-alanine uric acid have been determined. $NAYF_4$: YbEr nanoparticles as a peroxidase mimic was combined with uricase, uric acid was determined (Tang *et al.*, 2013).

Peroxidase-like nanozymes coupled with glucose oxidase (Gox) have been frequently employed in the construction of glucose biosensor. Wei and Wang, 2013 developed a colorimetric glucose detection platform by combining the catalytic oxidation of glucose with Gox and the MNPs. Glucose concentrations as low as 30μm were detected with a linear range from 50μm.

Hydrogen Peroxide

Hydrogen Peroxidase (H_2O_2) which is of diverse application in environmental protection, food industry,Biology and medicine, its detection is of great interest. H_2O_2 detection is usually achieved by using nanomaterials peroxidase mimicking activities in which H_2O_2- mediated oxidation of a substrate is catalyzed by a peroxidase mimic.

$$\rightarrow \quad AH_2 \quad + \quad ROOH \quad \overset{\text{peroxidase}}{} \quad A$$
$$+ \quad ROH \quad + \quad H_2O$$

By monitoring the production substrate of the oxidized substrate (A) in the reaction above, H_2O_2 can be determined. A colorimetric method for H_2O_2 detection was developed by using Fe_3O_4 magnetic nanoparticles as the peroxidase mimic and ABTS [2,2'-Azino-bis (3-ethylbenzothiazo line-6-sulphonic acid] as the substrate for signaling. In which the presence of H_2O_2 is accompanied by green coloured $ABTS^+$which could be quantified by absorption spectra or even visualized by the naked eyes, this method was adopted by Wei and Wang; 2008 which pave way for many other research. Apart from colorimetric detection with peroxidase substrates such as ABTS, H_2O_2 has been determined via fluorescent, electrochemical and surface enhance Raman scattering methods (Vang*et al.,* 2015). The colorimetric signal readout strategy has said is based on a redox reaction. A redox reaction which could be a reaction between HRP and colorimetric substractes such as 2, 2'- azino-bis (3-ethylbenzothiazoline -6-sulphonic acid (ABTs) and 3,3', 5,5'- tetramethybenzidine (TMB). This strategyhas been actively developed due to its high sensitivity, selectivity and simplicity for detection H_2O_2.

IMMUNOASSAYS

Immunoassays have been used in hospitals, laboratory medicine and research to improve the health and well-being of humans and animals. Information gained by clinical immunoassay testing has shortened the length by hospital stays and decreased the severity of illness by identifying and assessing the progression of disease, thereby leading to improved therapeutic choices. In life science research, immunoassays are used in the study of biological systems for tracking different proteins, hormones and anti-bodies. In industry, immunoassays to detect contaminants in food and water and in quality control to monitor specific molecules used during product processing. The most commonly used enzymes in immunoassay however, is HRP (Horseradish peroxidase) and alkaline phosphatase (Fan *et al.,* 2012) which lose their enzymatic activities gradually over long-storage, in order to overcome this limit various studies on replacing natural enzymes have been reported and consequently in place of HRP has been developed.

- **Antigen- Down Type Immunoassay**

Using chitosan-modified magnetic Nanoparticles (Cs-MNP), (Yang*et al.,* 2015), reported a replacement for Horseradish peroxidase in the traditional immunoassay. They provided protocols

for antigen-down and sandwich immunoassays with Cs-MNPs and detected mouse IgG and carcinoembryonic antigen (CEA) respectively. Chitosan modified on the surface of MNPs prevented aggregation of MNPs, so that MNPs were easily dispersed in aqueous solutions. Meanwhile, amino groups in the chitosan provided a convenient site for covalence linkage of HRP-conjugated antibodies to Cs-MNP-conjugated antibodies in the immunoassay. Capture-detected immunoassay was also developed to detect CEA by employing the magnetic properties of CS-MNPs which facilitate, capturing separating and enriching antigens as well as redispersing the MNP aggregation in solution.

An antigen-Down immunoassays uses a mechanism such that analyte is coated onto a 96-cell microtiter plate (rather than an antibody) and used to bind antibodies found in the sample. When the sample is added (such as human serum), the antigen on the plate is bound by antibodies (IgE) for example; From the sample which are then retained in the wall,a species-specific antibody (anti-human IgE for example) labeled with HRP is added next to the antigen on the plate. The higher the signal, the more antibodies there are in the sample. Antigen-assays can be configured as rapid tests are often used to diagnose allergy conditions routinely a patient's blood is tested against different allergens to see if the person has antibodies to that allergen.

CONCLUSION

Nanozymes from this review have emerged as a potent alternative to natural enzymes. As discussed, although the research is still in the initial stage, yet uses have developed substantially in many different detection and treatment methods for biomolecules. And it can be said that nanozymes will someday in the nearest future replaces natural enzymes in all their fields of applications.

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ADEQUATE RURAL INFORMATION STRATEGY FOR ENHANCING NATIONAL SOCIO-ECONOMIC DEVELOPMENT

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Abstract: *Every nation needs development which ought to be sustained. There is no meaningful development without information which is the bedrock of national socio-economic development. Information is crucial for national socio-economic development at all levels of society, there is need for effective dissemination of information at various levels of society and most especially to the people at the grassroots level. This is because over 65% of the people in Nigeria live in the rural areas, yet the low participation of rural dwellers in national socio-economic development in Nigeria is a serious concern. There is need to find how rural participation in national socio-economic development could be enhanced in order to achieve national socio-economic development, the situation of rural participation in national socio-economic development and possible factors that hinder rural participation in national socio-economic development. The paper suggests ways of enhancing rural participation in national socio-economic development such as information channels which serve either oral or visual benefits or combination of both including traditional media; the mass media primarily television and radio; seminars, workshop, conferences should be organized regularly; there is need to expand rural access to education especially socio economic development; library should be established in rural areas so as to meet information needs of the rural people.*

Keywords: *Rural, Information, Science, Technology and Development.*

Introduction

Information is valued in all fields of human endeavour particularly at all level of decision making. The busy professionals like top business executives and policy makers, researchers in industries, research institutes and universities, show increasing demand for valid information. They have great need for assistance in securing and using relevant information in their everyday work. In fact, the growth and well-being of any economy depends on the amount of information and idea accessible to all the sectors of that economy (Achebe, 2008). Therefore, information plays a very important role in the national socio-economic development process of the society. Effort must be made to give rural dwellers access to knowledge and information that constitute the majority of the country.

Any nation that neglects the development and empowerment of the rural communities should not expect meaningful socio-economic development (Alegbeleye & Aina, 1985). According to Ogbonyomi (2007) information is one of the most vital assets any organization must possess and information is important in human daily activities. Development can only be effective if rural dwellers have access to the relevant, diverse information for their activities. Rural development is a basis for economic development and information is an important ingredient in national socio-economic development (Okiy, 2003). People in rural areas whether literate or not should have access to any kind of information which will help them to become capable and productive in their socio-economic and political obligations to become better informed citizens.

Nigeria has the potentials to develop all sectors of human endeavour including national socio-economic development more especially if information services are fully enhanced in the rural communities throughout the country. The rural areas in Nigeria are the majority in terms of population, and yet the neglect and sufferings they are encountering presently form the bases for impediment to the effective information policy implementation. Effective information service in the rural community will enhance national socio-economic development (Diso, 2005).

The need to look up to the national socio-economic development cannot work without information from journals, books, and computer-internet. As Scientist and Technologists cannot acquire and apply scientific and technological know-how without

information from books, journals and internet. Information is a potent variable in the conduct of socio economic development.

National socio-economic development of a country cannot be achieved without the socio-economic of the rural areas. Information is vital in our daily life. It is a medium of socio-economic development and communication (Harande, 2009 & Haruna, 2011). This is because over 65% of the people in Nigeria live in the rural areas and they need positive and relevant information in their daily activities especially in the area of national socio-economic development for national development. The primary role of information of rural areas is to facilitate economic growth, poverty alleviation and to improve rural participation for national socio-economic development.

Information is very important in our everyday life. It is known throughout history, as an important agent in human development. It has different stages of its life and it changes forms. Information starts its life with the working and thinking process of people carrying out research, making measurement of thinking about problems (Achebe, 2008). Information is a very powerful tool of liberation. Informed rural people can analyze situations, define strategies, draw up programmes of action and opt for a better ideal on any socio-economic and indeed political matters. In Nigeria context, accessibility to information by urban and rural communities is stated in its development plans. But with emphasis to the support of government propaganda and many programmes that are not fully relevant to the development of rural communities. The information received by rural dwellers is either not reliable or distorted in the process of transmission (Issaet al., 2011). The unhealthy situation constitutes a major impediment, which keep the rural communities in Nigeria far away from national socio-economic development for national development.

Nigeria has policies and plans which induces rural information degeneration instead of advancing. Good health is an indispensable prerequisite for the socio-economic development of any country (Bii, & Otike, 2003). Information is therefore essential in rural areas for national socio-economic development. Information is power, and this power can only be acquired through record and disseminated information. How and where rural people and the society at large acquire their information is another area of concern. There is then a need for the rural participation in national socio-

economic development to be encouraged as means to attaining national socio-economic development.

Adequate rural information strategy for National Socio-Economic Development

The role of adequate rural information plays in any society is enormous. It is the bedrock of any national socio-economic development. According to Dangana (2015), national socio-economic development is therefore, the primary engine of economic growth and provides the key to unlocking the country's potentials. Where this engine for development and economic growth fails, it always results in serious atmosphere, economic and developmental challenges. These challenges among others include unemployment, poverty and underdevelopment. National socio-economic development goes a long way to equip rural dwellers to live effectively in our modern age of technology (FRN, 2007).

It is no longer news that Nigeria is in a recession; getting out of it is the major task confronting the government which has been exploring optimisms to get the economy back on track. To experts, Nigeria is to look inward for its economic revivals pills. National development aims at raising the standard of living through increasing income, better education more jobs, among others. A country's potential for economic growth is greatly influenced by its endowment in terms of physical and human resources. There is no way you can create jobs without creating industries, industries without innovation and innovation cannot come without research (Adeleye, 2016). Nigeria's socio-economic problems cannot be solved without national socio-economic development. Based on the scientific knowledge acquisition, man is able to improve his way and quality of life through national socio-economic development/discovery in order to add value to the large society at large. Without national socio-economic development, life would be disastrous and detrimental. Government should try to make national socio-economic development global and accessible for everyone particularly the rural people.

Rural Information and National Socio-Economic Development

In general terms, the rural areas engage in primary activities that form the foundation for any socio-economic development. The rural areas of Nigeria are

inhabited by the bulk of the nation's population which serves as the base for the production of food

and fibre. Yet, despite the importance attached to the rural areas, they are not attractive to live in. There are absence of infrastructure which improves the quality of life. There is absence of portable water, electricity and good feeder roads (Issa, Omopupa& Salman, 2011).

The rural population in Nigeria is over 65% and the people dwell in rural communities that contains over 80% of the natural economic resources which have great potentials to economic development but lacked government attention. This leads to negative consequences such as rural-urban drift, resulting in unemployment, child labour, insecurity, poverty, proliferation of shanty living areas, spread of diseases, etc (Harande, 2009). People in rural areas both literate and illiterate have no access to any kind of information which will help them to become capable and productive in their socio-economic obligations, to become better informed citizens generally (Issaetal. 2011). The rural people living in Nigeria suffer from deprivation including access to information resources. They most often fail to access various information resources and services even when such information is available.

Rural people need relevant and current information. Access to information is important for proper functioning of services in all societies. Freedom and access to information is essential for socio-economic development practice, representing a first step in any participatory process, now regarded as the standard for socio-economic approach. Despite the fact that this has become an evolving principle in the democratization process of modern societies, free and fair flow of information remain an exception rather than a rule in many countries especially the developing ones like Nigeria. Information is a means of enhancing national socio-economic development. A national socio-economic development cannot be possible when the rural populace is not provided with educational information. We are in the age of information, communication and technology (ICT). Information has a critical role to play in harnessing a country's human capital. It seeks to expand the frontiers of knowledge, it has not only boosts the capacity of the individual, and it actively seeks solutions to the problems and challenges that afflict mankind drives national socio-economic development and promotes socio-economic growth and development (Lawal, 2017).

The success of rural development programmes depends on effective use of information in daily

activities. The condition of rural dwellers in Nigeria and other developing countries is pathetic; with glaring evidence of abject poverty andgeneral backwardness. Given the near-total neglect of the Nigerian rural areas by successive government regarding infrastructural provision which could have made their life worthy, rural people had little or no alternative than to drift to urban areas as an escape. Even though government have come and gone with various policies and plans to improve their living conditions, including rural information services provision, not even the least remarkable results have been recorded (Issaet al.2011).

Poverty and illiteracy constitute the major barriers to rural development. This is contrary to the right of every citizen to enjoy the wealth, resources and services rendered by the government without any discrimination or neglect. The awareness can be created through information of government socio-economic development goals, accomplishments, constraints, etc to the rural people. When the rural people at the grass root are well informed of government development oriented programmes and projects such as construction of bridges, construction of new roads and maintenance of existing ones, building of functional hospital maternity homes, schools, etc these will help to remove apathy and then create interests in the rural people to want to participate in the national socio-economic development, knowing fully well that they have a stake in the national socio-economic development (Igbafe, &Igbafe, 2009).

A nation's socio-economic development is dependent on the extent that the people are informed. Generally, information is vital for the development knowledge, which brings out national socio-economic development (Agwu, 2011). It offers information a second chance to people who are deprived, willing to learn and discover missed opportunities so that they can forge ahead to enjoy the need developments (Oguntuase & Falaiye, 2004).

Information can only play an important role in many aspects of rural socio-economic development and also help to better govern various aspects of development. Information can strengthen the role of each governance pillar in rural development and poverty reduction; facilitating speeding transparent, accountable, efficient and effective interaction between the public, citizens, business and other agencies. The importance of information in strengthening rural livelihoods, providing national

socio-economic development information and lowering transaction cost of poor farmers and traders. Rural people are unaware of their rights, entitlements and the availability of various government schemes and extension services, information can also improve their general well-being.

Rural Participation in National socio-economic development

The less participation of rural people in national socio-economic development lies in the fact that rural dwellers are not encouraged to participates in national socio-economic development. According to Disco (2005) information hunger is prevalent and biting hard on our rural communities, which has resulted in poor living conditions, illiteracy and poverty. Rural areas in Nigeria are generally characterized by poor living conditions absolute poverty and absent of almost all amenities of life.

The rural populace have limited access to social and economic infrastructure such as health, portable water, sanitation and consequently, limited chance of advancing their quality of life (Issa et al., 2011). The information gap between the urban and rural areas can be bridged by effective information provision/services. In order to ensure access to information, there is need to provide for an information infrastructure which includes appropriate and effective communication channels, delivery system and access points needed for the acquisition processing of information (Harande, 2009). Poor economic conditions do not allow rural dwellers to have the means of procuring the necessary facilities that can bring about considerable improvement in their quality of life. There is also the need to make the rural dwellers at the grass root levels to be aware of their noble role in the society they belong at all times (Osunrinde, 2000). Nevertheless, in Nigeria today, poverty and illiteracy barriers prevent rural dwellers access to information (Oguntuase&Falaiye, 2004). For government to achieve meaningful and purposeful results, information becomes a necessary ingredient to be used in carrying along the rural people with its activities in all socio-economic development. It is clear that Nigeria's national socio-economic development and socio-economic growth will remain inextricably linked to the strengthening and development of its rural populace. To find solution to the problem of unequal access to information by government; lack of access to information by rural areas would have disastrous consequences to

national socio-economic development for national socio-economic development (Lawal, 2017).

Information Needs of the Rural Dwellers

The information needs of the rural populace are very numerous and exacting. The information needs reflect on their daily struggle for their means of livelihood and to survive the expanding challenges of our rather dynamic environment. The survival of enterprise whether public or private sector is condition by awareness of the necessity for change and adaptation in the conversion of information into product and service (Harande, 2009).

The areas of information needs of the Nigerian rural dwellers include the following:

- Agriculture
- Education
- Housing
- Transportation
- Religion, recreation and culture
- Welfare and family matters
- Legal matters
- Crime and safety
- Politics and government
- Land
- Government policies
- Housing
- Employment
- The neighborhood.

Enhancing Rural Participation in National Socio-Economic Development

The low participation of rural people in national socio-economic development is alarming, yet, national socio-economic development and rural people play vital roles in achieving sustainable socio-economic development, be it economic, social and environmental. There is then the need to discuss how to enhance rural participation in national socio-economic development for national socio-economic development. This task is enormous, so everyone; government, mass media, individual and other stakeholders must get involved to achieve the following:

- Information channels may serve either oral or visual benefits or a combination of both, including traditional media types. The mass media primarily, television and radio perform the noble function of entertaining, educating and informing people of on-going activities.
- Providing information to rural people who generally illiterate and relatively remote from formal sources of information technology can overcome these

barriers by delivering information right and need based to the rural people via new information technologies i.e. phone, internet, etc (Morris, 2005; Ommani, 2005).

The success of any development initiative requires a modification or hang of attitudes and behaviours of the rural people. Information support can be of help in achieving this change. Since grass root national socio-economic development participation is geared towards development at the grass root, information on national and socio-economic development through the various mass media such as radio, television and newspapers will to a large extent enhance rural scientific participation and socio-economic development in Nigeria (Igbafe&Igbafe, 2009).

- Information should be disseminated to the rural dwellers through agencies of communication such as Ministry of Information, Library Board, etc. which they are familiar with.
- Seminars, workshops and conferences should be organized regularly for rural people on science technology research for socio-economic development emphasizing on the importance of scientific education and help them erase the impression that scientific education is difficult.

Recommendations

- There is need to expand rural access to education (particularly national socio-economic development)
- Reward for excellent performance by rural people in national socio-economic development should be encouraged by school administrators.
- Collecting national socio-economic development information once publications are identified, it may be tasking to collect them, information becomes more accessible and possible more valuable when shared.
- Library should be established in rural areas so as to meet the information needs of rural dwellers participating in national socio-economic development.
- Information on special scholarship should be given and provided to rural dwellers to study science related courses in any tertiary institution with or by the federal, state or local government. This will enhance rural participation in national socio-economic development.
- Library Board and Ministry of Information should carry out community survey to identify the scale and adversity of information needs of rural people.

- Efforts should be made to translate and put in radio and other media needed for direct dissemination of information to the rural people especially scientific information.
- Government should establish viewing centre in every community considering the important role this would play in educating, informing, mobilizing and re-orienting the rural people especially in national socio-economic development.
- Counseling programmes should be organized on the importance of rural participating in national socio-economic development on the radio, television, jingles and the print media. In fact, there should be campaign at any level about national socio-economic development.
- The professional skills of science teacher especially rural teachers should be regularly enhanced.

Conclusion

From the foregoing, it is clear that rural dwellers need information in nearly all human endeavours while development can be possible, effective and relevant when their information needs have been met.

Many studies (Issaet al. 2011; Harande, 2009; Disco, 2005, etc) have shown that the rural areas are as information-hungry as any group of human beings anywhere else. This condition present is a huge challenge which must be overcome if the vest potentials of rural dwellers must be harnessed with a view of enabling them contribute their significant quota to national socio-economic development efforts.

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MARKETING STRATFOR RURAL BASED HOSPITALITY PRODUCTS

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Abstract: *The strategy a hospitality establishment employs in marketing its products should be determined by the environment and characteristic of the target market; hence the study is aimed at assessing strategy for marketing of hospitality products in rural area. Therefore, highlighting different strategies needed for developing and marketing this products and services. The sample populations consist of 6 selected hotels in Etsako west local government area of Edo state, using a systematic random sampling technique to randomly select 2 hotels each from 3 major commercial communities. Questionnaires were administered to staff in various level of management. Simple percentage and chi-square method of analysis was used to analyze the data collected. The result shows that 45.1% of respondents agreed that marketing strategies is very important to the Hospitality industry while* 94.1*% respondents agreed that lack of proper marketing strategies may result in poor product marketing. Conclusively, hospitality industry should be involved in planning and developing marketing strategies in line with the organization goals to enhance profitability and marketing strategy should be adapted and adopted to suit the rural market as well as improved upon to accommodate other kinds of customers.*

Keywords: *Hospitality industry, hotel Products, Strategies, Marketing, Rural.*

Introduction

The tools for strategic marketing and product management are used in many successful businesses while other businesses rarely attempt to use them even though they succeed for a while. (Amodu,Omotoye and Olusegun,2014)

Some hospitality businesses located in rural areas have suffered greatly because their strategies were not adaptive to the dynamic business environment. Marketing is known to be the art and science of finding, retaining and growing profitable customers, hence, Strategies for developing and marketing of hospitality products are becoming increasingly necessary in today's business. However, serious attention has not been given to developing and marketing of hospitality products through the use of marketing strategies. This is so, when products are not developed and marketed, potential consumer will not be found, because they are the main determinant of the product or service acceptance. Most times, customers are not aware of some exclusive and beneficial hospitality products and services, attributed to lack of patronage. Marketing is a social and managerial process by which individuals and groups obtain what they need and want through creating and exchanging products and values with others (Kotler, Bowen and Makens, 2010). The hospitality industry is a market; therefore, a market is a set of actual and potential buyers of a product who might transact with a seller. Today, the idea of marketing has changed as a result of modern technological development and other factors, given rise to improved mode of communication and transportation. This has contributed tremendously to the marketing of hospitality products and services on the internet, advertisement on the media (visual and audio) and orders are also sometimes taken from customers over the telephone while the goods requested are mailed to the buyers when and where required. In other words, marketing is a process by which company creates customers' interest in goods, products and services. Marketing generate the strategy that underlines sales techniques, business communication and business developments, it is an integrated process through which company builds strong customers relationship and creates value for their customer and themselves.

According to Kotler et al (2010), marketing is a human activity directed at satisfying needs and wants through exchange process. Exchange process

involve work, that is sellers have to search for buyers, identify their needs, design attractive products, promote them, deliver them and set prices. Such activities as product development, research communications and service are core marketing activities. Braimah (2011) sees marketing as the social process by which individuals and groups obtain what they need and want through creating and exchanging products and value with others. Effective marketing echoes throughout all aspects of an organization, from the front office to the housekeeping departments of hotel and the kitchen to the restaurant of a fine dining cuisine, as well as delivers on the brand's promises. Marketing as the heart and soul of every successful business creates a competitive advantage by helping companies make better decisions, create and drive better strategies and have better exchange. Many hospitality businesses make the mistake of thinking that marketing is just one aspect of sales, but marketing is everything that consumer encounters when it comes to business from advertising to what they hear, to the customer service they receive, and the follow-up care that is provided. The key is finding the right method or strategy for marketing and defining the right message to use to educate and influence the consumers as well as creating an acceptable choice. Developing a marketing strategy for hospitality products and services is very important elements as they serve as a base for profits maximization and help the industry to succeed, create an edge especially in competitive markets, achieve the highest revenue per unit of overall cost of obtaining that revenue and help the industry maintain a comparative advantage in order to perpetuate profit maximization. The problem faced by most marketing managers in any establishment is how to get enough customers to buy the company's current output.

Statement of the Problem

Most people who are interested in the hospitality businesses especially hotels in the rural areas of Etsako West, Edo state usually go out of business within few years of venturing into the business or change the concept to a brothel, to encourage patronage from a particular gender, hence defeating the purpose of set up. Majority of these cases are as a result of poor sales due to inadequate strategies for developing and marketing of products, Hotel industry encounter the following problems:

1. Lack of patronage from potential customers.

2. Difficulties in developing and marketing of products.
3. Reduction in revenue
4. Competition from stronger brand.

This study will attempt to find probable solution in form of strategies for developing and marketing of hospitality product (hotels) and services that are rural based.

Objectives of the Study

The main objective of the study is to assess the different strategies needed for developing and marketing of hospitality products in rural area.

The specific objectives are to:

1. Ascertain management characteristics and distribution of respondents.
2. Examine the strategies used and its efficiency in the study area.
3. To reveal the need for useful strategies in developing and marketing of hospitality products.
4. To reveal the importance of marketing strategies to the hospitality industry.

Research Hypothesis

H_0: There is no significant relationship between developing marketing strategies and the marketing of hospitality products.

H_1: There is a significant relationship between developing marketing strategies and the marketing of hospitality products.

Significance of the Study

To give the hospitality industry in the rural area a guide in developing and marketing its products, using appropriate marketing strategies.

The Industry

Hospitality industry is a major service sector in the world economy. It encompasses an extensive variety of service industries that include food service, tourism and hotels. Hospitality industry can be divided into two parts: entertainment areas like clubs and bars and accommodation. Accommodation takes the form of public houses, resorts, inn, campgrounds, hotels, service apartment and motels. The club and bar category include restaurants, fast-food and nightclub. It also includes tourism support commercial activities like airline cabin staff and travel agents. (Aaker.2008)

In every aspect of hospitality industry, the customers want good products, without good product they will not engage in any form of business with the industry and even if they do in some cases, there is no possibility of return patronage.

Marketing Of Hospitality Products In Rural Environment.

Hospitality industry located in Auchi, Etsako west local government area, Edo state create and offer products which are much more than just physical goods or services in rural environment. Like any other kind in the industry, customers decide which event to experience, which tourist destination to visit, which hotel to stay in and which restaurant to patronize. To customer, these are the products. (Green, Tull and Albaum 1993)

Therefore, the aim of marketing in the hospitality industry is to enhance sales and identify customer's need in relation to how the products fit and sell itself to them .Marketing has assumed an increasingly prominent role in all sectors of the hospitality industry. It promotes product awareness to the market at large, helps the industry to stay one step ahead of competitors, increase sales percentage and production, educates people on the latest hospitality market trends, develop and maintain company reputation, boost sales and profits, help the industry grow and compete as well as sharpen customer's knowledge on the reliability and trustworthiness of the industry. However, the marketing environment must be conducive for good product placement.

Importance of Marketing Strategies

Marketing strategies when properly adapted prevents mismanagement of brand because one aspect of marketing plan affects all the others, coordinating activities is critical to eliminating interference and maximizing profits. The environmental adaptability of any strategy is very important. Adaptation only becomes effective when pragmatically examine and determine their industry characteristics. (Onyeonoro and Obinwanne, 2012)

A marketing strategy looks at all areas of selling activities and help each one support the next, making sure all departments are aware of what each is doing. The importance of marketing strategies includes:

1. Streamline Products Development:
2. Help Determine Optimal Price
3. Establish Effective Distribution:
4. Assist with Marketing Communications
5. Organizational Impact

Marketing Environment

Imianvan and Braimah (2011) view marketing environment as factors and forces that affect a firm ability to build and maintain successful relationships

with customers. Kotler and Armstrong (2006) further emphasized that, hospitality marketing environment is made up of all the things that affect the way it operates. Some of the factors of marketing environment can be controlled by the industry while, others cannot be controlled. The industry need to understand their marketing environment so that they can make the most of positive factors and manage the impact of negative factors.

The Marketing Environment includes the macro – media such as; Health, population change, carbon neutral, green technology, smart phones, recession Marketing in areas with the greatest customer potential.

Marketing Research

Kotler et al (2010) opined that it is a process that identifies and defines marketing opportunities and problems, monitors and evaluate marketing actions in relation to the performance as well as communicate the findings and implications to management. Marketing researchers engage in a wide range of activities such as measuring market potentials, market-share analysis, and determination of market characteristics, sales analysis, studies of business, short-range forecasting and competitive and inflation. While micro environment consist of the media, banks, employers, costumers, distribution, suppliers, trade union and the internal environment includes; machines, employees, materials, capital assets, company policies and procedures. However, political, economic, social, technology, environment and legal factors can militate against the macro environment. (Kotler and Armstrong, 2006). When dealing with the marketing environment, it is important for a company to become proactive. By doing so, they can create the kind of environment that they will prosper in and can become more efficient by product studies, long-range and testing of existing products. This data in turn is collected and analyzed to make relevant marketing decisions, be it is in relation to setting up a business, developing a product, creating a brand or coming up with an advertising campaign (Parul, 2010).

Importance of Marketing Research

- To make marketing decisions
- Survive competition
- Help decide target markets
- Maximize profits
- Increase sales

Basic Steps of Marketing Research Process

1. Problem identification and definition:
2. Designing a Proper Approach:
3. Developing The Actual Research
4. Data Collection and Survey
5. Report Generation and Presentation:

Marketing Information System

Amodu et al (2014) opined that to ensure that hotels provide high quality services and products, managers need the right information for right decision making. Therefore marketing Information System begins and ends with marketing managers, first, it interacts with managers to access their information needs. Next, it develops needed information from internal company records, marketing intelligence activities and the marketing research process. Information analysts process information to make it more useful. Finally, the MIS distribution to managers in the right form and at the right time helps in marketing planning, implementation and control [Kotler et al, 2010].marketing information can be generated through internal data and marketing intelligence .it is also significant in organizing collected data and help to avoid challenges during analysis and future planning. Marketing strategy affects the way a business is run, so it should be planned and developed in consultation with organization objectives and skills of the marketing personnel. It is a wide-searching and comprehensive strategic planning tool that:

1. Describes a business and its products
2. Explains the positive and role of a product in the market.

3. Profiles customers and competition.
4. Identifies the marketing tactics that can be used.
5. Allows building of marketing plan and measure its effectiveness.

Marketing Mix Strategy: Marketing mix strategy is a term used to identify the crucial ingredients in a business such as the type of product, its price, place of distribution and promotion strategies used which will translate to long-term profits. (Olowo 2012)

Marketing Mix Strategies includes z:

- Product strategy
- Pricing strategy
- Place or distribution strategy
- Promotion or marketing communication strategy (Bamgboye 2003 in Olowo, 2012).
- People in the business [e.g. sales people, staff]
- Process representing the buying experience.
- Physical environment where the product is presented

Market Segmentation: Market segmentation is a marketing strategy that involves dividing the total market into subsets of consumers who have common needs and priorities and the designing and implementing strategies to target them [Wikipedia.com].

Criteria for segmenting: An ideal marketing segment must meet some or all of these following criteria. it must be;

a. Measurable
b. large enough to earn profit
c. stable enough not vanish after a while
d. Potential or target customers are identified and reachable
e. Respond consistently to a given market stimulus.
f. Reached by market intervention in a cost effective manner.
g. Useful in deciding on the marketing mix
h. Give support data for market positioning or sales approach for future.

Evaluating Market Segments

According to Kotler et al (2010), "A company must examine major structural factors that affects long-run segment attractiveness, consider it own objectives and resources in relations to a market segment and analyze the segment size and growth and choose the segment that best provides the best opportunities.

Strategies for Reaching Target Market

1. **Undifferentiated Marketing strategy:** This ignores market segmentation differences and goes after the whole market with one market offer.
2. **Differentiated Marketing Strategy:** The industry targets several markets and designs separate offers for each.
3. **Concentrated Marketing Strategy:** This is particularly effective for companies with limited resources. Instead of going for a small share of a large market, the company pursues a large share of one or two small markets.
4. **Bifurcated Marketing:** A market that is divided into two major markets. For example, in developing countries often a group of high-end hotels exists for international visitors and as a location for social occasions for high income locals. A group of low-end hotel exist for local and adventures tourists [Kotler et al, 2010].
5. **Direct Marketing:** for marketers, one way to reach out to target markets is through direct marketing. This is done by buying customer database based on defined segmentation profiles.

This database usually comes with customer contacts [e.g. email, mobile and home number].

Marketing Positioning

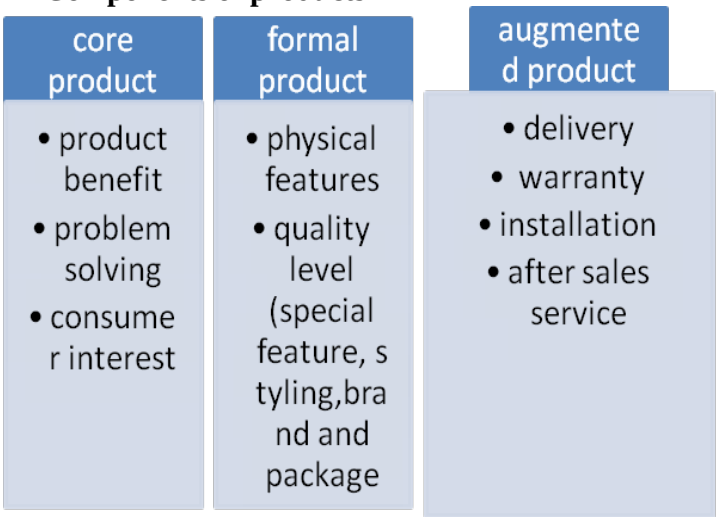
Once a company had chosen its target market segments, it must decide what positions to occupy in those segments [Kotler et al 2012]. Positioning is the process of developing competitive positioning for the product and an appropriate marketing mix. A product position is the way the product is defined by customers on important attributes – the place the product occupies in customer's minds relative to competing products (Kotler et al 2010).

Product Marketing Strategies

In marketing terms, a product is anything that can be offered to a market to satisfy a want or need. In other words, a product is the item[s] or service[s] that you are offering your customers.

A product can be a physical object or a service and may refer to a single item or unit, a group of similar products or a group of goods or services

Components of products



A product is first seen by the customers, however, the way they view its important attributes
relates to its usefulness and competitiveness with others products in its class, in terms of quality, characteristics, designs, branding, packaging and labeling.

Importance of service in product strategy

Many businesses underestimate the importance of quality customer service, but customers today are becoming more educated, more discerning, more demanding and more aware of their rights, so disregarding the customer service element in product strategy could be a costly error. It is worth noting the following points.

1. An unsatisfied customer will tell about 15 other people of the negative experience while a satisfied customer will tell not more than 6 people. Therefore, a hospitality operation cannot afford to have too many unsatisfied customers.

2. It is only loyal customers that take the time to complain, others simply take their business elsewhere. Hence, it is important to attend to all complaints.

How to develop service strategy

Retaining customers is of vital importance to business because losing customers will result in dwindling profits. Mullins (2007) agrees that the objectives of businesses should be finding the right service for customers and establishing long-term lasting customer relationships for organizational survival. Implementing a customer service strategy focuses on improving the entire customer experience, help create a brand image that may stand out from competitors. Customers need to gain access to company representatives and decision makers when dissatisfaction arises. [Olowo, 2012].

1. Define the goals of your customer service strategy.
2. Create a training program for all employees on the “front end” those who deal with customers directly and complete sales transactions.
3. Teach managers, supervisors and department heads to deal effectively with both employees and customers and explain the benefits of maintaining positive relationships with employees who deal directly with customers.
4. Set up a call centre to receive in bound customers calls or contact with an independent call centre to perform the work.

5. Develop a customer support strategy on the internet so customers can be serviced through the technology they use.
6. Motivate employees to get them excited about providing exemplary levels of customers' services.

Methodology

Brief history of study area

Etsako west local government area is located in Edo north senatorial district of Edo state. Its headquarters is Auchi, it has an area of 946km^2 and a population of about 197,609 .They speak Afemai language.

The study was conducted in Etsako west local government area of Edo state which has a high concentration of hotels, a systematic random sampling technique was used in selecting sample hotels for the study. The sampled communities were selected based on the level of commercial activities and location (Auchi, Jattu and Aviele)**,** while hotels were arranged according to their standard in terms of facilities in community located and every 'n' term ('n' is equal to 1st and 3rd element in successive counting on the list.). Hence , 6 hotels were chosen as samples for the study (2 hotels each from each commercial community)

Table 1. Sampling procedure

Towns	**Hotels**	**Number of respondents**
Auchi	**Uyi grand hotel and suites**	20
	Meremu hotel	
	Presto hotels	20
	Poly guest house	

Jattu	**Magita hotel**	20
	Victory hotel	
	Polaris hotel	20
	Guliver hotel	
Aviele	**Baladi**	20
	Peace hotel	
	Hotel de James	20
	Precious house hotel	
Total		**120**

The population of the study comprises of the top management,middle management and the low management of selected hotels in Auchi some casual staff in the hotel was also included in the
120 persons as the population of study.The sampling procedure used in this study is the stratified sampling technique. Questionnaires was used to generate primary data and administered to respondents in the selected hotel. In the course of this study, simple percentage and chi- square was used in analyzing the collected data

TABLE1: Distribution of respondents

Respondents	Qty Distributed	Qty Returned	Qty not returned	% returned	% not returned	% total
Top mgt	20	16	4	13.3%	3.3%	16.6
Middle mgt	30	26	4	21.7%	3.3%	25
Low mgt	64	54	10	45%	8.4%	53.4
Casuals	6	6	---	5%	---	5

Source: Field survey, 2018

Table 1 shows that questionnaires distributed were; top management staff,(20) middle management staff (30) , low management staff (64)and (6) to casual staff.

16 copies of questionnaires issued to the top management staff were properly filled and returned, while 18(15%) copies were not returned from the 120 administered. This could be described as a good response from the respondents.

TABLE 2: Marketing strategies used in the hospitality industry

Responses	Top mgt staff	Middle mgt staff	Low mgt staff	Casual staff	Frequency	Percentage
A	-	2	2	-	4	3.9%
S/A	6	6	10	-	22	21.6%
Undecided	2	2	2	-	6	5.9%
D/S	8	16	40	6	70	68.6%
D	-	-	-	-	-	-
TOTAL	16	26	54	6	102	100

Source: Field survey, 2018

Table 2 above shows that 4 respondents (3.9%) agreed that hospitality industries have the strategies for marketing the products and services, 22 respondents (21.6%) strongly agreed, 6 respondents were undecided (5.9%) 70 respondents disagreed (68.6%). The index in the table shows that hospitality industry marketing strategies is not different from others. Therefore, same strategy could be adopted for the hotel industry.

TABLE 3: Importance of Developing Marketing Strategies.

Responses	Top mgt staff	Middle mgt staff	Low mgt staff	Casual staff	Frequency	Percentage%
A	6	12	24	4	46	45.1%
S/A	8	10	26	2	46	45.1%
Undecided	-	2	2	-	4	3.9%
Disagreed	2	2	-	-	2	2%
S/A	-	-	2	-	4	3.9%
TOTAL	**16**	**26**	**54**	**6**	**102**	**100**

Source: Field survey, 2018

Table 3 above shows that 46 respondents (45.1%) agreed that it is important to develop marketing strategies within the industry, 46 respondents (45.1%) strongly agreed, 4 respondents (3.9%) were undecided, 2 respondents (2%) disagreed while 4 respondents (3.9%) strongly disagreed. The index in the above analysis shows that developing marketing strategies help to keep marketing in focus and improve sales.

TABLE 4: improper marketing strategies and poor product marketing

Responses	Top mgt staff	Middle mgt staff	Low mgt staff	Casual staff	Frequency	Percentage%
YES	16	24	5	6	96	94.1%
NO	-	-	2	-	2	2%
Neutral	-	2	2	-	4	3.9%
TOTAL	**16**	**26**	**9**	**6**	**102**	**100**

Source: Field survey, 2018

Table 4 shows that 96 respondents (94.1%) said that improper marketing strategies lead to poor product marketing, 2 respondents (2%) disagreed while 4 respondents (3.9%) remained neutral. From the

information above, it can be deduce that lack of proper marketing strategies result in poor product marketing.

TABLE 5: marketing strategies and overall goal achievement

Responses	Top mgt staff	Middle mgt staff	Low mgt staff	Casual staff	Frequency	Percentage
YES	16	18	48	4	86	84.3%
NO	-	6	4	2	12	11.8%
NEUTRAL	-	2	2	-	4	3.9%
TOTAL	**16**	**26**	**54**	**6**	**102**	**100**

Source: Field survey, 2018

Table 5 above shows that 86 respondents (84.3%) agreed that marketing.

Strategies plays a role in defining marketing direction and goals, 12 respondents (11.8%) disagreed, while 4 respondents (3.9%) remain neutral. Analyzing the two questions shown in table 4 and 5 above, it is evident that marketing strategies plays a vital role in defining overall goals and direction of rural hospitality operations.

0.05 = 5% degree of freedom

Tabulated value = (r-1) (c-1) under 0.05

= (5-1) (4-1) under 0.05

= (4) (3) under 0.05

= 12 under 0.05 = 21.026

Tabulated value = 21.026

Comparing calculated value and tabulated value;

80.26 > 21.026

From the decision rule above, because the calculated value exceeds the tabulated value, the null hypothesis is rejected and the alternative hypothesis is accepted which states that "there is significant relationship between developing strategies and the marketing of hospitality products.

Discussions of Findings

Marketing strategies is very important to the hospitality industry. This was confirmed with about 45.1% of the respondents supported the opinion. The study also shows that developing marketing strategies helps to keep marketing focused and improve sales as confirmed by 68.6% respondents.

The study also shows that lack of proper marketing strategies may result in poor product marketing in the hospitality industry as agreed by 94.1% respondents.

The research study also shows that marketing strategy is a vital tool in establishing effective marketing in the hospitality industry as revealed by 84.3% respondents in the study. The study also proved that marketing strategies helps to define the overall direction and goals for marketing in the hospitality industry

The findings show that it is imperative that every establishment or hospitality industry consider marketing strategy as a very important tool. This is informed by the fact that it is only through proper marketing strategies that an establishment may achieve its goals as well as cause an increase in the sales of its products and services, thereby enhancing profitability.

Conclusion

The following are the conclusion drawn from the findings:

- Marketing strategies have a strong effect on the marketing of hospitality products and services
- Developing marketing strategies helps to keep marketing focused and improve sales especially in the rural area.
- A hospitality industry does not have the different strategies needed for marketing their products and services.
- Lack of proper marketing strategies results in poor product marketing
- Marketing strategies helps to define the overall direction and goals for marketing.

Recommendations

Based on the findings, it is therefore, recommended that the;

- Hospitality industry should be involved in planning and developing marketing strategies in line with the organization goals to enhance profitability.
- Hotels in the rural setting should understand their marketing environment so they can make most of the positive factors and manage the impact of the negative factors.
- Operatives of the industry should sort marketing information required for effective strategy for marketing their products and services.

- Marketing strategy should be adapted and adopted to suit the rural market as well as improved upon to accommodate other kinds of customers.

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THE IMPACT OF STAFF MOTIVATION ON CATERING PERSONNEL PRODUCTIVITY (A CASE STUDY OF MR. BIGGS, SAPELE ROAD, BENIN CITY)

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Abstract: The study examines the impact of staff motivation on catering personnel. Subject for this study were forty staffs of Mr Biggs sapele road in Benin city Nigeria. The Stratified random sampling techniques were used in the selection. Questionnaire was used to collect data for the study. The data collected from the survey were analyzed using both descriptive and statistical tools such as percentage and one way analysis of variance (ANOVA). Each of the four hypothesis postulate were tested at alpha level of 0.05 significance and the result showed that Employees perception of monthly Emolument significantly influences worker satisfaction, the opportunity for training and development significantly enhances workers productivity, the P value is greater than the alpha level, so the null hypothesis which states that "There are no motivational technique put in place in the establishment retained and the P value is less than the alpha level, so the null hypothesis which states that "Individual bonus does not significantly improve the performance of employees" is rejected. Therefore individual bonus significantly improves the performances of employees. It is therefore recommended that catering establishment should always review wages, salaries and motivate catering personnel to reflect the economic realities of the moment. This will help to motivate them thereby enhance productivity.

Keyword: Motivation, Incenatives, Catering Personnel Productivity.

Introduction

There is a general consensus that behavioural traits can be is motivated and that people have reasons for doing things they do or behaving in a particular way. In other words, all human behavior is designed to achieve certain objectives. Such goals directed towards behavior revolve around the desire for satisfaction. This behavior is manifested in all human gathering such as home, school, churches and work organizations.(Donglass Maegregor 1960).

It is important to note that productivity and performance of a worker on his job does not rest entirely on his ability but includes his willingness to work. Performance therefore depends on both ability and willingness to work and willingness in turn depends on motivation. (Oloko 1977).

However, the main objective of catering industry is essentially to maximize profit and minimum cost. If it is to achieve this main objective it must be able utilize efficiently and effectively, the human resources within it, it should be able to know those things that will make the worker or staff maximize his or productivity (Donglass Maegregor 1960).

Management in catering sector generally cannot operate in a vacuum but involves people who are the focus on which any catering sector revolves (Herzberg 1981).

Before the advent of the colonialist, trade was in existence between the small communities both far and near and the existence was throughout the country. This do not involves cash payment, it was based on traditional African hospitality and generosity. But towards the end of the 18th century, these trading communities had established relationships that went beyond trading activities with the extent that building structures were established other than their domicile. However, the advent of the European paid labor was introduced. This could be linked to motivation which organizations engaged in today (Oloko 1977).

It is therefore not surprising that in recent years, emphasis has been placed on the impact of motivation on staffs as a factor in getting people to put their best. For a catering industry organization to succeed, attempt must be made to mobilize the effort of all the workers on the industry. Many social

science findings reveal that people only put in their best if their needs are satisfied.

Managers should therefore ensure that conditions in the work place are such that it can provide a challenge to the employee. Such as the worker`s ability in terms of skill, experience, the availability of adequate machine, equipment and good conditions of service (Donglass Maegregor 1960).

Catering establishment exist for the purpose of rendering services to the society. For any catering establishment to be able to achieve the purpose for which it was set up, people need to be employed, people employed in the establishment need to work in order to make the establishment achieve the desired objectives.

Often time's employees of catering establishment are not adequately motivated towards organizational effectiveness. This constitutes a major problem.

Motivation like any other issue in life has its problems; some of them are discussed below: The first problem to consider in this work is the attitude of the management in organization towards the motivation of their workers. Some catering organizations see it (motivation) as being theoretical in nature, "a paper work" which should be avoided as much as possible. Others see it as an extra cost in running their business or achieving their goals and also a reduction in other margin. A lot of catering organizations are not aware of what motivation of a worker is, either through the dearth of knowledge of management or ignorance on their parts especially in the private sector.

Another problem in the resource to motivate a worker. Most catering industries in Nigeria are owned by private individuals who have limited sources of income generation and as such find it difficult to remunerate their workers, let alone motivate them. For example, training and development of workers is capital intensive, especially when doing that overseas. Only a few organizations embark on such in venture.

Another confusing issue is what motivates each worker. Human beings are complex and dynamic in nature. What motivates worker A may not motivate worker B. for some, increased salaries and wages

motivates them, while some are motivated by placing in high positions or training them abroad.

In view of this, it becomes a problem for the catering industry to know exactly what motivates their workers.

STUDY AREA

This study is designed to look at the impact of staff motivation on catering personnel productivity, using Mr Biggs Sapele Road, Benin City as case study.

Thus in this course of the study, questionnaire were distributed to junior and senior worker and the administrative department. The study also covered areas like meaning of motivation, theory of motivation, technique of motivation, purpose of motivating in the work force, benefit of motivation and problem of motivation in the work place

OBJECTIVE OF THE STUDY

The aim of this study is that its findings will be of assistance to the management of Mr Biggs Sapele Road, Benin- City. It would also be of benefit to catering establishment that would find the research work useful. Research student would also appreciate some of some of finding as a basis for further research.

RESEARCH HYPOTHESIS

Employees perception of monthly emolument does not significantly influence workers satisfaction.

The opportunity for training and development does not significantly enhance workers productivity.

There are no significant motivational techniques put in place in the establishment.

Individual bonus does not significantly improve the performance of employees.

CONCEPTUAL CLARIFICATION

A lot of research and writing have been carried out in the field of motivation by management specialist, owing to the complexity of modern industry and commerce and the new generation of people that make up the organization. It will continue to attract the interest of management experts. Motivation is variously defined.

Usually one or more of the following words are included in the definition. These are desires, needs, wants, aims, drives and motives.

Technically, the term motivation, according to Donnel et al (1984) can be traced to the Latin word "Movere" which means to move. A motive is an inner state that energizes or moves and direct activities or channel behavior towards goals. Motivation is defined as the driving force that energizes human behavior. Motivation process starts with needs; these needs cause motives which lead to accomplishment of goals.

According to Campbell and Pitchard (1979) motivation is a label of determinants of the choice to expand a certain task and the choice to persist in expanding effort over a period of time holding constant the effect of appreciating in the environment?

Maslow (1954) studies into human motivation led him to propose a theory of needs based on hierarchical model with the basic needs at the bottom and higher needs at the top. This theory is based on the fact that human beings have needs, it has a considerable influence in the development of management theory in the realization of motivation as an important tool of management theory. Many studies have been conducted to find out easy ways of motivating workers to obtain the maximum co-operation from them.

There is therefore no catering industry (organization) that does not apply motivational; factors to induce productivity of its workers.

According to Aghato (1988) motivation is not only reward and punishment but it includes ideas, expectations and experience when it comes to motivation, people mostly act on perception not reality, therefore motivation is an important determinant of human behavior.

Motivation is concerned with "why" of human behavior, what it is energizes, activates or moves that direct or channels behavior towards goals, it is therefore that force within an individual that incites or impels him or she to put his best for higher productivity.

The will to work" which presupposes a desire or want to be satisfied. This was amplified by saying that motivation as the drive and effort to satisfy

human want or goal. However, these definitions have been inspired by the background of persons involved, there is no gain saying the fact that a common denominator underlines all of them which is the will to contribute action to a given process without being told to do so for some reward. Motivation has often been called an intervening variable. Variable and internal and psychological processes which are not directly observable and which in tune account for behavior.

THEORIES OF MOTIVATION

Me Biggs have a lot for its staff and so motivate its employees in different ways. Two categories of motivation namely content and process theories.

ABRAHAM MASLOW, HIERARCHY NEED`S THEORY

Abraham Maslow`s hierarchy needs theory postulates that people in the work place are motivated to perform by a desire to satisfy a set of internal needs. Such as psychological needs, safety needs affiliation, love and social needs for self-actualization.

PSYCHOLOGICAL NEEDS: These physiological needs are classified as primary needs. They are first on the hierarchy because they tend to have the highest strength. They are fundamental needs that every worker tends to attain or satisfied. They are basic needs that help to sustain life itself; they include food, water, clothing, shelter etc. until these basic needs are satisfied, most of a person`s activity will probably be at this level, all other needs will provide motivation in the hierarchy.

Once physiological needs are satisfied, the security or safety need become predominant. According to Edwin Fippo, as soon as one need is reasonably satisfied, a second need becomes apparent. The person forgets that he or she had been starving; now he is concerned about a need, which was formerly of less significance.

The needs in the second level of Maslow`s hierarchy of needs is essentially the needs to be the free from physical danger and fear of loss of property, food, clothing, shelter. In other words, it is a need for self-preservation. If an individual`s security is in danger, every other thing seem unimportant.

SOCIAL NEEDS: Social needs involves the "need to feel needed", these are often satisfied through social interaction in which people give and receive friendship and affection. In catering industry, such needs are operationalized by a concern for interacting frequently with co-workers, employee, supervision and acceptance by others. When social need becomes dominant, people will strive with great intensity to achieve this goal. Some of the advantages of social need are generation of new ideas, problem solving techniques from the implementation of complex task in whatever situation one finds oneself.

ESTEEM NEED: This focus on the need for an individual to feel important and receive recognition from others. Such reinforcement leads to feeling of self-confidence, independence prestige and being useful in the catering industry. The moment these needs become relevant to an individual, he continuously seeks satisfaction of them. In other way round, or the disadvantages of this, is the thwarting of these needs will produce in the individual a feeling of inferiority complex or weakness, and helplessness which in turn gives rise to basic discouragement.

SELF ACTUALIZATION NEEDS: This is the highest level of needs and has lowest priority. It is referred to as the desire for self-fulfillment and achievement, self-realization of one's potentialities.

According to Maslow (1954) he stated that self-actualization is the desire for self-fulfillment namely the tendency for one to become actualized in what one is potentially capable of self-actualization.

The implication of Maslow`s view for management is seen in the fact that a satisfied need lose its motivational character or potential, therefore management in catering sector strive to put in place other programs that are aimed at discovering needs and satisfying those needs.

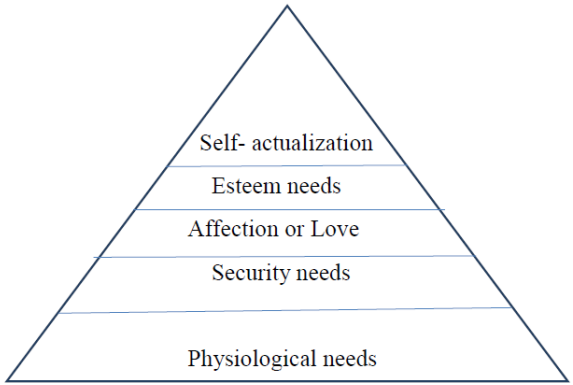

Figure 1: Abraham Maslow, hierarchy needs theory DOUGLAS MACGREGORIS THEORY THEORY X AND THEORY Y

Philosophers have long been fascinated and puzzled concerning the apparent contradictory and nature of human beings

This philosophical observation and the managers have been introduced into management literature by Douglas Macgregor (1960) on his work; “the human side of enterprise” it is two sets of assumptions, the theory x and theory y deal with impression of leader over their subordinates. The theory x holds that motivation of employees can be obtained through authority, fear and employees had to be closely watched if result must be obtained. This involves telling people what to do and punishing them if they fail to do it. This follows the belief that people are by nature lazy and do not like work.

Accompanying this philosophy is the belief that people are motivated by money, fringe benefits and the threat of punishment. Managers who accept through the only x assumption attempt to structure control and closely supervised their employees or

workers. This manager feels the external control is clearly appreciated for dealing with unreliable and irresponsible x assumption.

The traditional assumption to Macgregor in theory x are as follows:

The average human being has an inherent dislike for work and will avoid it, if he can.

Because of this human feature of dislike for work, most people must be coerced, controlled, directed and threatened with punishment to get them to put forth adequate effort toward the achievement of organizational objectives.

The average human being preferred to be directed, wishes to avoid responsibilities, has relatively little ambition and wants security above all. The criticism level against this approach by some scholars is that it tends to encourage authorities in staff development of individual along negative line.

TECHNIQUES OF MOTIVATING STAFF

After looking at all the theories of motivation, we may ask what they mean to managers in catering industries especially to the management of MR. Biggs. Infact motivation of Mr. Biggs is done in the following ways:

SALARIES AND WAGES: it is the prerogative of the personnel department to ensure that the salaries and wages paid to workers in the catering sector compare favorably with those paid to employees in other similar catering industry.

The department in catering organization must ensure that the wages paid are such that can satisfy the immediate psychological needs of the staffs.

According to Ubeku (1975), the management must take sure that wages satisfied the immediate psychological needs of the workers as it motivates them to carry out their jobs so well as to achieve higher needs such as esteem and self-actualization needs.

PROMOTION: Promotion in catering organizations refers to the assignment of an individual to a position of more responsibilities, which require the application of his particular

educational experience. In Mr. Biggs fast food and restaurant, passing suitable tests are applicable merit and length of services are put in consideration in carrying out promotion. According to Herzber (1981) based on the belief that those factors that de-motivate workers are quite different from those that motivate workers tend to be associated with the work environment example, non-promotion policy and administration working condition. He further grouped these factors that related directly to the work itself as opposed by the work environment. Herberzy (1981) maintained that true motivation occurs only where both the motivation and maintainers factors are present.

WELFARE SCHEMES: Schemes in the sense is looking after the physical needs of the employees. This state schemes and the proposed social security Act (1973) is not applicable to the catering industry, because most catering organizations are owned by private individuals. The catering industry has their individual welfare schemes or they provide voluntarily such as canteen, transport services.

Mr. Biggs fast food and restaurant have its welfare schemes for its workers such as housing allowances, transportation, medical facilities and fringe benefit. The fringe benefit allied to welfare includes: subsidized group life insurance, providing meal and like birthday gift. I.e. birthday gift package is given to any staff when celebrating his or her birthday.

Particularly for the managerial level, workshop, seminar and visitation to other African countries are provided based on the improvement of managerial education.

TRAINING AND DEVELOPMENT

Mr. Biggs provide a well-planned and systematic training and development workshop for its new employed staff to enable them acquire the necessary skill for the performance of their various jobs and provide opportunity for their advancement in the field.

PURPOSE OF MOTIVATING WORKERS

The purpose of motivating in catering establishment is a major issue to examine carefully; some of the purposes of motivating workers are discussed below.

The first purpose to consider in this work is to retain the service of existing catering workers in the establishment. When talking about retainment of workers, it has to do with giving the worker in the establishment.

Another purpose of motivating workers is to boost high increase in productivity. When such workers are motivated, they are serious and are determined to work harder thereby enhancing higher yield of production.

Another purpose of motivating, hard-working staff are productivity staff, such hard working staff need to be motivated to keep them in the establishment for that establishment to achieve its goals.

Motivation also helps to attract new catering workers. To maintain a good reputation in the market place and to satisfy their feeling of paternalism.

BENEFITS OF MOTIVATION

Motivation like any other issue has its benefits. Some of the benefits are discussed below;

PARTICIPATION: Participation style of leadership is also a benefit of motivation to a staff in an organization when management allows the supervisor and the junior employees to participate in company`s decision making, it will give them a sense of belonging and therefore energize them to put more effort to increase productivity.

FRINGE BENEFITS: Fringe benefits attached to basic pay which is also a benefit of motivation. This induce individual to work to the best of their ability. Such fringe benefit may include housing allowances, transport allowance, shift allowance, Christmas bonus, leave allowance etc.

DIVISION OF LABOR: Specialization on job by individual is also a benefit of motivation; other benefits of motivation include training and development, human relation, competition etc.

MONEY: Money is the major mechanism for industries. Money is in the form of pay or bonuses. Even though it is somewhat fashionable, it is still one of the benefits of motivation, because it has been and it will continue to be an important one.

Benefits of motivation of employee in an organization bring about increase in job performance, job satisfaction, reduced labor turnover, reduced absenteeism, standard and quality output, reduced boredom and friction, enhanced intrinsic satisfaction on the job and conflict elimination among employee and management. In fact a motivated employee is a productive honest and loyal employee.

METHODOLOGY

Consequently, a survey method was used to gather data from the respondents through the administration of questionnaire. Information was also gathered through oral interview conducted with some staff of Mr. Biggs fast food and restaurant.

POPULATION OF THE STUDY

The target population of the study is the staff and management personnel of Mr. Biggs, Sapele Road, Benin City.

SAMPLING TECHNIQUE

The sample selection diligently carried out using random sampling method. This is a representation of the population for this research, forty (40) respondents was selected to represent the staff and management of Mr. Biggs, Sapele Road, Benin City.

DESIGN AND ADMINISTRATION OF INSTRUMENTS

Questionnaire: This is the main research instrument used in carrying out this research work. It is divided into two parts, Sections A and B. Section A relates to questions about the bio data of the respondents. Such questions are sex, marital status, educational background and their age.

Section B consists of the four relevant research questions, each having sub-questions to help extract the needed information about the main question.

QUESTIONNAIRE ADMINISTRATION

A total of 40 questionnaires were distributed, completed and retrieved from 50 staff randomly selected in Mr. Biggs, Sapele Road, Benin City. For effective analysis, clarity and easy comprehension, the data obtained are tabulated and percentages

worked out to reflect the proportion of the responses.

VALIDITY OF THE INSTRUMENT

The research instrument was made by the researcher to make sure that the research instrument measured what it is supposed to measure. For the purpose of validity, a draft of the questionnaire was submitted to my project supervisor as well as two other experts in the content area. Taking into consideration their judgments and corrections, the necessary amendments was made and copies were produced for administration in order to meet the objectives of the study.

METHOD OF DATA ANALYSIS

The various data and information were analysed using statistical tools such as one way ANOVA (Analysis of Variance).

ETHICAL CONSIDERATION

I obtained the consent of my respondents and assured them high degree of confidentiality by keeping the identity of the respondents secret and not requesting for their names while answering the questionnaire.

METHOD OF DATA ANALYSIS

In hypothesis formulated for the study, the researcher adopted the simple arithmetic percentage in part A of the questionnaire and one way ANOVA (Analysis of Variance) part A of the questionnaire.

$$\frac{\text{Number of respondents X } 100}{\text{Total number of respondents } 1}$$

RESULT AND DISCUSSION

Table 1 shows the distribution of the respondents according to their sex. It can be seen from the table that female constitutes the majority of the total respondents included in this study, while the female constitutes 62.5% and the male constitutes 37.5% of the respondents. This pattern of sex distribution may be an indication of the fact that there are more female than male in the establishment: hence the predominance of female in the study.

TABLE 1. SEX DISTRIBUTION OF RESPONDENTS

SEX	NO OF RESPONDENTS	PERCENTAGE
Male	15	37.5%
Female	25	62.5%
Total	40	100%

Source: Extract compiled from the data collected by the researcher

Table 2 shows the distribution of the respondents according to the age from the table. The respondents between the ages of 17-25 years constitute 50% of the total respondents used in this study. Following this group are those between the ages of 26-34 years and they represented 25% of the total respondents, 15% of the respondents are between the ages of 35-43 while 10% of the respondents are between the ages of 44-53 years.

There was no representation for the respondents between the ages of 54 years and above and this may be attributed to the retirement policy of Mr. Bigg's fast-food, it is noticed that the main work force of Mr. Bigg's fast-food is between the ages of 17-25 years as extracted from the data analyzed.

TABLE 2 AGE DISTRIBUTION OF RESPONDENTS

AGE	NO OF RESPONDENTS	PERCENTAGE
17-25	20	50%
26-34	10	25%
35-43	6	15%

44-53	4	10%
54 and above	-	-
Total	40	100%

Source: Extract compiled from the data collected by the researcher.

Table 3 (iii) shows the distribution of the respondents according to the educational qualification from the table. Those that have primary school certificate represent 15% respondents, 25% respondents have secondary certificate, and 52.5% respondents have National Diploma while those with HND/BSc as certificate 7.5%.

TABLE 3 DISTRIBUTION OF RESPONDENTS ACCOPRDING TO EDUCATIONAL LEVEL.

Primary	5	15%
Secondary	10	25%
National diploma	21	52.5%
HND/BSC.	3	7.5%
Total	**40**	**100%**

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Source: Extract compiled from the data collected by the researcher.

Table 4 shows the distribution of the respondents according to their marital status from the table, 85.5% of the respondents claimed that they are single, while 7.5% claimed that they are married while 5% claimed that they are divorced and non among the respondents claimed to be widow/widower.

This distribution shows that there are more single people in this study which can be seen from the age distribution of the respondents used in the study.

TABLE 4 DISTRIBUTION OF RESPONDENTS ACCORDING TO MARITAL STATUS

MARITAL STATUS	NO OF RESPONDENTS	PERCENTAGE
Single	35	87.5%
Married	3	7.5%
Divorced	2	5%
Widowed/Widower	-	-
Total	40	100%

Source: Extract compiled from the data collected by the researcher.

Hypothesis 1: Employees perception of monthly emolument does not significantly influence workers satisfaction.

Table 5: ANOVA Analysis of monthly emolument influences that workers satisfaction

Item	Mean	S.D	Mean Diff.	Df	T	Sig (P)	Decision
1.	2.39	0.24	1.26	47	0.602	0.03	Significant
2.	3.74	0.31					
3.	4.01	0.32					
4.	3.12	0.28					

(α=0.05)

Table 5 shows the T value of 0.602 and P value of 0.03. Testing at alpha level of 0.05, the P value is less than the alpha value so the null hypothesis which state that Employees perception of monthly emolument does not significantly influence workers satisfaction is rejected. Therefore Employees perception of monthly Emolument significantly influences worker satisfaction.

Hypothesis 2: The opportunity for training and development does not significantly enhance workers productivity?

Table 6: ANOVA Analysis of opportunity for training and development enhance workers productivity.

Item	Mean	S.D	Mean	Df	T	Sig (P)	Decision
Diff.							
1.	4.08	0.32	1.17	51	0.815	0.02	Significant
2.	2.91	0.27					
3.	3.52	0.30					
4.	3.46	0.29					

(α=0.05)

Table 6 shows the T value of 0.815 and P value of 0.02. Testing of an alpha level of 0.05, the P value is less than the alpha level to the null hypothesis which states that "The opportunity for training and development does not significantly enhance workers productivity" is rejected. Hence the opportunity for training and development significantly enhances workers productivity.

Hypothesis 3: There are no significant motivational techniques put in place in the establishment.

Table 7: ANOVA Analysis of motivational techniques on the establishment.

Item	Mean	S.D	Mean Diff.	Df	T	Sig (P)	Decision
1.	3.69	0.30	1.69	43	0.561	0.6	Not
2.	3.74	0.31					
3.	2.83	0.27					
4.	4.52	0.34					Significant

(α=0.05)

Table 7 shows the T value of 0.561 and P value of 0.6. Testing of the alpha level of 0.05 the P value is greater than the alpha level, so the null hypothesis which states that "There are no motivational technique put in place in the establishment retained.

Hypothesis 4: Individual bonus does not significantly improve the performance of employees

Table 8: ANOVA Analysis of individual bonus on the performances of employees.

Item	Mean	S.D	Mean	Df	T	Sig (P)	Decision
			Diff.				
1.	3.22	0.28	2.73	53	0.785	0.04	Significant
2.	4.79	0.35					
3.	3.32	0.29					
4.	2.06	0.23					

(α=0.05)

Table 8 shows the T value of 0.785 and P value of 0.04. Testing of an alpha level, the P value is less than the alpha level, so the null hypothesis which states that "Individual bonus does not significantly improve the performance of employees" is rejected. Therefore individual bonus significantly improves the performances of employees.

CONCLUSIONS AND RECOMMENDATIONS

There is the need for catering establishment in Nigeria to motivate their employees as this will go a long way to improving and enhances their performance.

This study examines the impact of motivation on catering personnel productivity. A study of Mr Bigg's, sapele Road, Benin city, thus, if workers are

motivated, they will put in their best. It is the contention of this study that impact of a motivation is an important phenomenon in the organization.

In this study, such factors like monthly emolument, individual bonus and training gotten from the organization were found to have positive relationship. And it was discovered that such factors as limited resources, poor salary and working condition, communication problem and non-involvement of workers in decision making etc. are some of the factors that are responsible for lack of motivation.

Based on the findings of this study, the following recommendations are:

The catering establishment should always review wages and salaries of catering personnel to reflect the economic realities of the moment. This will help to motivate them thereby enhance productivity too.

Management should endeavor to allow the catering staff to contribute to organization decision or participate in management decision. This will boost employees moral and motivation initiatives and lead to increased productivity through worker commitment.

There should be good human relations between management and subordinates. Human relation is a way of looking into organization management, which takes into consideration workers feeling, perceptions, ideas, sentiments etc. the major concept of human relationship is that a major task of management is to organize a team work, develop and sustain cooperation between workers in order to maximize productivity.

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THE BENEFITS AND SHORT COMING OF THE NEW MEDIA IN NIGERIA

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Abstract: *The new media is the trending form of modern day communication system of dissemination of information; it has helped revolutionalize the mass media industry in Nigeria and the world in general. It has become a powerful force to reckon with, due to its efficiency and efficacy in the manner of information processing, dissemination, storage and retrieval system. With the help of science and technology, the new media have succeeded in changing the media and the way people receive its output today. These papers examine the benefits and shortcomings of the new media in Nigeria. It postulates that though the new media have helped greatly the way information is been processed, distributed, stored retrieved and used in Nigeria, it is still not without some pitfalls or shortcomings in its usage by Nigerians. It is recommended that awareness campaign and sensitization by the government should be carried out on its citizenry on the usage of the new media for its interest national security.*

INTRODUCTION

The world today has witnessed tremendous advancement in technology and science which is visible in all areas or facets of human endeavor, the media is not an exception. In fact, the media is one of the major, if not, the major catalyst of evolutionary change witnessed in the globe today from education of politics, health, agriculture, science, information, sports, entertainment, technology, business, commerce, global economy, aviation, transportation, and domestic to international standard.

This new media has played a tremendous role in making the world a globalized village, making the

world a global economy, aviation, transportation from domestic to international standards, the media has played tremendous role in making the world a globalized village because any information can be accessed by just the click of your fingers and in a timing of seconds, this is a co-action or synergy between Mass communication studies, behavioral sciences, information technology and science.

This synergy of all these various studies have brought about what we call the New media which today is the major reviving force of the globalized world in which we all live as foreseen by Marshall McLuhan the media (McLuhan, 1968).

Nigeria as a country have very strong social-cultural ties which is embedded as a bedrock of the foundations of over 500 diverse ethnic settings within its geographical land territorial boundaries, the level of social interaction between individuals in the geographical area called Nigeria is very high, making the demand for the new media as well as the social media via the internet very high, making it a market destination for the media and telecommunication stakeholders both domestically and internationally, the fact is further emphasized on Nigeria communication commission report journal 2017.

Nigerians are very social people and they live to interact a lot, among themselves from family members to friends, class mates, course mates, a very good example is the Yoruba speaking people of western Nigeria, the level of interaction among family members especially in occasions is very high with this tribe or ethnic of people, the new media plays an important role in the integration and unionism of this class of people called the "Yoruba's" and other ethnic nationalities found within the boundaries of Nigeria.

The new media have been felt virtually almost all the citizenry if not all and thus any shortfall maybe caused or affected by other factors such as power, poor infrastructure (as in communication facilities in the locality or area) and access to modern communication gadgets. But, notwithstanding a majority of populace have access to the usage of the new media via the internet especially the youth which forms a major majority of the population of that country citizenry. Nigeria is the most populous country in Africa and the eight most populous countries in the world and the need of effective and efficient communication among its populace cannot be overlooked.

Nigeria more so, as a nation have a multi religious background whereby the north is predominantly Islamic religion while the Southern parts practice both Christianity and the African traditional religion. This was further buttressing (Adeline and Okechukwu, 2015) from what we have been examining from the beginning of this paper, we found out that Nigeria as a country have a very vast and diverse ethno-religious background and all the various stakeholders in these tribal and religious hamlets all have various interests; they all want to be protected, naturally all interests cannot be adequately catered for at the same time and mostly some own fundamental rights are been trampled upon. Take it or leave it, this makes news faster its gets to the audience through the media, this determines the effect on the nation or the people of the nation.

The mass media which serve as the informative nerve of a nation plays a strategic role in the Nigerian society, in other words, the said mass media have both old and new and in this context we are examining the new media benefit the Nigerian society as its short-comings are what this paper seeks to examined.

Definition of the New Media

The new media can be termed to be the media that is invoke by the new media we mean the media which is interactive, incorporate two-ways communication and which also involves some computing, new media is easily processed, stored, transformed, retrieved, hyperlinked and perhaps mast radical of all, easily searched for and accessed.

We can still further say that the new media is the interplay between the internet, technology, images and sound which produce an efficient result. In fact the definition of new media change daily and will continue to do so, this was further elaborated upon by (Brian, 2016), where he said that the new media comprises of the interplay of technology and the internet to bring about informative, entertaining as well as creative and efficient production for the media which comprises of visuals and audio.

The new media have a whole bunch of inter consecutiveness that makes it unique. The new media have the cyber culture which is the study of various social phenomena associated with the internet and other new forms of network communications, such as online communities, cell phone usage in various communities and issue of gender and identity in internet usage. In contrast,

new media is concerned with the new possibilities that network communication technologies and all form of computer present.

The new media uses computer technology as a distribution or distributive plant form this is digital and this definition must be revised every few years as computing technology advances. The new media is somehow or some what subjected to a software in other words, it can be manipulated by a software this allows automation for media operation to produce multiple version of the same object. For example in Facebook a post which comprises of pictures, audio and lettered words can be reproduce by sharing repeatedly by members of the platform again a picture can be altered or generated automatically by running algorithms that sharpen and colorize.

New media we can say is a combination of old data and new data; old data relies on visual reality, and new data relies on digital data. Due to its digital uniqueness the new media have the aesthetics that accompanies the early stage of every new modern media and communication Technology, instead of working on how digital computers functions as media creation, media distribution and telecommunication devices, the focus can be on aesthetic techniques that accompany every new media and telecommunication technology.

Furthermore, digital computing can be thoughts of as a way to massively speed up manual techniques that already exists, the modern digital computer can be though of as a faster calculation, new media as faster executive of algorithms previously executed manually or through other technologies. Now because of the advent of the new media people can interact with each other anytime and anywhere, so as a result of the evolution of new media technologies, globalization occurs new media will continue to evolve in the information technology age. This unique nature of the new media was further expatiated by America author Robert Logan in his book 'Understanding New Media' as was cited in (Brain et al) New media "very easily processed, stored, transformed, retrieved, hyperlinked and perhaps most radial of all, easily searched for and accessed.

The New Media and The Old Media

The new media as analyzed is the present form of media, that distinguishes the new media from the old media is that whatever media is Invoke in the globe in a particular time frame is the new media a distinction between new media and old media is

that: old media is for the most part mass media. In addition, each form of new media is lightly interactive, while mass media which comprises mainly of the old is not. Users of new media are active producers of content and information, whether sundry an avail or using internet collaboration tools. New media is that type of media that is native to computers interface, virtual worlds, virtual reality, multimedia, computer games, computer animation, digital video, special effects camera and interactive computer installation. On the other hand, old media can be regarded as the traditional media which can say includes print media of the such as books, newspapers, magazines, newsletters, scholarly journals, pamphlets, fliers, broad sides, bill boards etc. other traditional media of the electronic media includes radio, television, movies, CDS and DVDs, Digital hardcopy, video tape recordings, interactive video games, etc. The old media from what we have seen so far is the same as the traditional media, this traditional media which also is regarded as old media is characterized by the investment in and creation of content in other words the old media is analogue (Esposito, 2016) while the new media is Digital which have its own set of unique properties as examined by this paper, the dynamic text, interactively, user-generated content, and the emergence of the platform, upon which content erected by others would reside.

But today in our present day reality has shortened the distance among people all over the world electronic communication, according to the international journal of multifaceted and multilingual studies. Now, people can interact with each other anytime and anywhere "As a result of the evolution of new media technologies, globalization occurs" (Terry, 2002).0

From what Terry flew is establishing, the news media have helped turn the world into a global village whereby people can communicate and interact from all the four corners of the earth in a matter of seconds, machine have aided removing language barriers, because more social media platforms have sophisticated software that help translate any kind of language to any form in a matter of seconds making the world even more close by the day.

Convergence of the Old and New Media

By convergence we mean the window of opportunity for traditional media to align itself with the technologies of the 21st Century which the new media uses and that have brought about the

efficiency and uniqueness of communication between people of the world today. The digitalization of the media and information technology and the ensuring transformation of communication media are some of, it not the major contributors to convergence, the two authors Gershon and Fiddler superlatively emphasized on this. See (Gershon 2000; Fiddler 1997).

The new media through the help of digital technology helps to compress text, graphics, photos, and audio (Old media) to be transmitted affectively and rapidly across media platform. We can say that the convergence of the new media and the old media is the introduction of digital technology into media communications, it is the blending of old media (e.g. traditional media such as magazines, newspapers, television, cable, and radio) deliver content according to (Jenkins, 2001) he argues that convergence is not a simplistic statement of electronically retrieving information but occurs multiple levels enough pure processes, which are technological, economic, so and global and cultural convergence, from the above definition of (Jenkins, et al) we can see that the convergence of the old and new media with internet and computers further more (Serb, 2001) states that convergence involves marrying the slick format of television of the almost infinite, information providing capacity of the internet. The list definition is endless but one thing about the convergence theory of the old and new media is that it is the blending of the old media to internet and computers to deliver contents.

The New Media and the Social Media- The Linkage

The new media as well as known is the upspring of the old media this is the blending up of traditional media with computers and internet to deliver content on the other hand social media can be said to be a platforms of collective online communications channels which are dedicated to communicating-based input, content sharing, interaction and collaboration, that is a platform where an individual, organization or group of persons can create their own media channel for discrimination of its own actives for the public to see (Christopher, 2018) and in turn get relative feedback. The social media is becoming an integral part of life online as social websites and applications prolilferate, again apart from the fact that it is used to socialize and interact; social media is used t market products promote brands, and connect to current customers and faster

new business. Examples of social media sites includes Facebook, twitter, goggle (pronounced Goggle plus) is Google's social networking project, designed to replicate the way people interact offline more closely than in the case in other social networking services. Others are Wikpedia, Linkedin, Reedit, and pine internet. From the social media, while new media and social media, while new media offers a democratized way for reaching people at scale, the social media enable us to create a findable media object of value (Christopher et al).

The distribution of that content is limited only to our ability to create something potable and worth a consumer's time. So social media today is now an integral part of the Nigerians society a vast section of its population especially Facebook. See punch newspapers of November 17, 2017, where the minister of communications. Mr. Adebayo Shittu said about 75percent of Nigeria's ethnical and religious foundational background, especially its ethnicity which allows for social integration among its people, it ahs made the social media a powerful tool in the hands of Nigerians via the usage of sophisticated mobile phones, internet and computers which represents the new media for this process of communicative interaction and information dissemination process which is new to humanity and still continually evolving.

From what have been discussed in this paper, it can be seen that both the new media and social media are two separate concepts which are working together today for the edification of mass media, what is being felt in the communication industry in Nigeria today and the world all over is a nexus or synergy between this two concepts the new media and social media.

Benefits of the New Media

The concepts of the new media have been felt by a vast majority of the world's people, Nigerians inclusive, according to (Lohrey, 2018) New media has, and continue to change the way in which most small business operate. Unlike the one-way communication paths displayed by "Old media" formats such as television, radio and paper based publications; new media is technology is both digital and interactive. From connecting with customers to making it easier to compete with larger businesses, the advantages that the internet, electronic communications and social media provide most small business are as numerous as it users. For instance, Nigeria today with the help of Facebook advertisement, which is popularly called "Facebook

Ad" an entrepreneur can just put his/her business on the world map, just, with the click of his mobile phone (new media) in seconds his business is on the face of millions of people if not people this depends on the amounts f money the entrepreneur is willing to commit into the advertisement.

The new media a "cost savings" initiative as explain in this paper previously New-media advertising is often less expensive than advertising in traditional media perhaps the biggest advantage of using new media is that the lack of any barriers that prevent a small business from entering the digital arena for example establishing and running an online store cost significantly less than it is with old media, but it also allows business owners to reach a larger and heterogeneous audience. The internet also eliminates expensive travel with the help of the new media, a person in Nigeria today can run his/her purchases without leaving the home, office, school or church that is leaving where he or she is physically located to the point or place where the product or material is sold this is visible in our everyday life. For instance, people with the help of their mobile phones in Nigerians can make purchases from Jumia, Konga, Jiji, Pay portal. Again, this platform book flights both on an international and domestic scale, and more also make hostel reservation, today with the help of the new media, one can actually call for a cab or taxi with leaving the house with the coming into the transportation industry by Uber, Taxify etc.

Again, today with the help of the new media businesses now have wider, customer base in Nigeria, for instance Jumia have the largest retail sales today in Nigeria. This is due to its online presence in the country, an internet presence and email communication have the potential to expand a small business customer base exponentially, unlike the limited scope and time delay characteristic of traditional advertising methods, new media options allows not only for constant connection but also for connecting on a number of different levels of website, an email, newsletter and both participating in and advertising on social media sites such as Facebook, Twitter and Instagram are among the most common ways to help potential customers learn about the purchase products, main online business in Nigeria makes uses of this; example-Betnaija, Jumia, Jiji, pay Portal, Konga, Merrybet all of these carry out social media advertisement.

This also help sustain competitive advantages, business can use video technology both internally and to connect with the outside world, with this it

has enabled a faster customer service response, this also means customer service representative can interact with clients and associate on a more personal level. The new media home provided for a more flexible work options, an internet connection, a virtual private network, video conferencing, email and instant messaging provide flexible work options that can benefit both a business and it employees.

The new media have been the most popular tend for the last few years. It is now considered as part of everyone's life and that is used daily as a part of living. It gives professional online Networking and it is a valuable business tool, for instance the social media site Linkedin is a tool which allows users to put an online resume and their CV s on their profile. Making it easy for you instead of going through your business cards and remembering each person, you can easily look up their names and check their profile.

The new media is accessible anytime and anywhere. It is considered as a new tool, you can check the new as soon as it happens or at home to watch for the morning newspaper every day. Twitter, Facebook and online news serve in publishing the news in the same minute or even the same second you can also spread news that happened around you and share it with friends and other users, while in newspaper or TV you cannot do so.

Further, a very good benefit of the new media is that you can always stay connected with people all over the world. Old friends, families who live far away or colleagues. It has been easier for people to communicate with other, sharing the moments as it is seen by how Nigerians uses social media platforms like Facebook, Whatsaap, where child birth or delivery, new car (Whip Alert), child naming ceremony, child dedication, a marriage houses opening, burial ceremony etc. is posted on these social media or social network sites. Thus have made long distances between people shorter according to (Ahmad, 2016). The new media have helped in building communities since our world has different religion and beliefs. The new media as a foundation using the platform of the social media have helped in building and participating in the community of own religion and believes to discuss and learn about it. Similarly, people of different communities can connect to discuss and share related stuffs for example, game lovers can join game related communities, and car lovers can join communities related to cars and so on.

The new media have helped government of Nigeria to fight crime together with the security agencies; this is because of the new media power to share content. With the power of new media the people of Nigeria awareness level is unprecedented, the new media awareness and innovate the way people live. It is the new media which have helped people to discover, new and innovative stuffs that can enhance personal lives. From farmers to teachers, students to lawyers every individual of the society can benefit from the new media and its awareness factor.

With the help of the new media, it have helped for the education of noble cause a good example is non-governmental organization (N.G.O), Social welfare activities and donations for the needy people, it can be a good way help people in dire situation and who are in need of help.

The new media has aided connectively people from anywhere can connect with anyone regardless of the location and religion. The beauty of the new media is that it aids you to connect with anyone to learn and share your thoughts. The new media have enhanced the quality of education given benefit to both students and teachers due to the new media a student can do research on any given topic or discourse the study via the internet through the mobile phone or laptop using the YouTube platform a subsidiary of Google Company. It is very easy to educate from others who are expertise and professionals via the new media through social media, you can follow anyone to learn from him/her and enhance your knowledge about any field regardless of your location and educational background you can educate yourself, without paying for it.

Whether you have an offline or online business, you can promote your business to the largest audience example using Facebook advertisement or "Facebook Ad". The new media have a kind of formation that you update yourself from the latest happening around in the world. Most times, television and print media these day are biased and does not convey the true message with the help of the new media you can get the fact and true information by doing some research.

Short-Coming of the New Media

A very severe effect or negative impact of the new media is the way the new media through social media networks like Facebook, Tinder, Whatsaap says negative information about a person spreads faster. From 2006 onwards the growth of the Networks and other is unexpectedly very high. The

way technology is growing from progressed nations to under-develop countries every nation is utilizing the power of that new media to enhance life and use it for true bitterness of the people meaning it also affects the society in a negative way just like anything can be used for both good and bad. The new media also affect the Nigeria society in a negative way this is all about the usage and getting things done with the new media. Naturally it is in the hands of the user to it to its advantage but willingly or unwillingly, it can still have negative impact on the users.

The new media puts to treat vital information which should have been locked away from the reach of the wrong hand since there is a cyber-world it is liable to "Hacking" that is personal data and privacy can easily be hacked and shared on the internet, which can make financial losses and loss to personal life. Similarly, identifying theft s another issue that can give financial losses to anyone by hacking their personal accounts, severally in Nigeria personal Twitter and Facebook especially Facebook account have been hacked in the past and the hacker had posted materials that have affect the individual personal lives. This is a very negative issue associated with the new media (Ahmad, 2016). Leading to people coding and pass wording their personal data's account recurrently or from time to time to avoid accidents.

Again, most Nigeria youths are now addicted to the New media, that is you see people glued to their mobile phones especially and their laptops it has affected inter-personal relationship, marriage to the fact that couples in a matrimonial home stay glued to their phones instead of communicating to other spouse, this addictive part of the New media is bad and it disturbs personal lives, the teenagers are the most affected by this addiction, they get involved very extensively and are eventually cut off from the society. The attachment of the new media can also result to wastage of individual time that could have been utilized for productive tasks and activities.

Furthermore, with the aid of the new media, the government and security agencies now have access to people personal accounts which make the privacy almost compromised. You never know when you are visited by an investigation officer regarding any issue that you mistakenly or unknowingly discussed over the internet. The new media have been used as a tool to propagate, negative causes of people, that is the new media can be used to ruin someone's images and reputation according to Philip, 2014),

the new media can ruin your reputation when you display inappropriate photos display, photos which are not supposed to be seen by the public, due to negligence or over zealousness as the case may be not thinking clearly on the right perspective, or conceiving how the society may see it can lead to the damaging of someone of your own personal good name. This can be seen in the social media network Facebook in Nigeria where people post videos and pictures of the sexual partners who probably is the wife or husband of somebody else this sometimes in done out of spite.

Again, there have been reports on how an entire police station face embarrassment after one officer posted a photo online. In the photo, the officer allowed four girls in bikinis to pose on his police cruiser during a charity parade; the people department fired him. Sometimes employees have to be weary of what they post on their private pages this could affect company's reputation even your attempt to get relevancy may backfire.

Because of the viral nature of the new media, certain words which you say might come back to harm you, this is because anything you say in the reel world can quickly be posted on social media and it can go viral and explode on the internet in seconds. If you make one mistake and say wrong things, it can spread quickly across the social media like a plague and shatter your reputation. The bottom line is one have to be very careful what you say, both on and off the internet, with the digital nature of the new media people, people can go and review your profile and bring out certain information and hold on to it even years after or later even your personal profile could leak onto your professional ones (Philip et al) again (Howes, 2012) says that "the" new media have through the social media platforms like Facebook, Twitter, Instagram, e.t.c serve as a platform for disrespecting others. Peoples see it as an avenue to express their haunting feeling; these platforms are into the right place to work out your problems with people. It is no different than yelling insults at someone in public. This is true that is sets people attention but that is not the kind of attention people want.

Again, the new media allows people to tag you in questionable photos without you prior consent, this is very wrong and it is common trend away social media users especially Facebook in Nigeria. Also, the new media efficiency have been taken advantage of in an unwholesome manner by the Nigeria youth; they use it to glamorize drugs and alcohol, leading

to health issues on the part of Nigeria youths (Bilah et al). The excessive usage of the new media can also have negative impact on the health of Nigerians, for instance, continuous focus on the screen of mobile phones, laptops and desktops have an harmful effect on the eyes over long period of time, since exercise is the key to lose of weight, most of the people get lazy because of the excessive use of social networking sites which in result brings disorder in the routine life (Philip et al)

The constant use of the new media by people of the world have led to serious infidelity in relationships and marriage, most people have used the social media platform to propose and marry each other. However, after sometimes they turn to be wrong in their decision and part ways. Similarly, couples have cheated on each other by showing the fake feeling and incorrect information. With the rise in the usage of new media, the average Nigeria youth have taken to fraud and scam, they involve in the act of defrauding women in other countries especially widows, less privileged they even partake in contract scams, defraud unlatching citizens of other countries and this have given the country "Nigeria" a bad name in the international community with the combination of sophisticated mobile phones, laptops; the internet and social media platforms, dating sites, contract sites, some Nigeria youths have used the advantages which one new media provide to their own advantages and the detriment of these people losing their hard earned money to these unscrupulous Nigerians, thereby creating negative image for the country as a whole. They are now termed those boys "Yahoo boys".

The new media have increased prostitution into an unimaginable height in Niger according (Adamu, 2016), for many commercial sex workers in Nigeria, the internet and the new media has becomes a blessing as it is increasingly becoming a major avenue for them to meet clients and patrons. Findings show that the prostitutes majorly use social media including Twitter, Facebook, Eskimi, Badoo, Tinder, 2 go, Tango, Blackberry messenger and clique to advertise themselves to likely patrons other directly or through agents. While some of these social media sites forbid numbers from uploading and displaying nude photographs, others including Facebook, Blackberry and Twitter do not really give their members such restriction apart from emphasizing its rule against infringement or privacy.

In his article "How Nigeria sex workers resort to social media" by Mohammed Adamu, Bisi

a resident of Egbeda, told a correspondent who has posed as a client that "the use of social media is even better because some men are very shy to approach a lady physically". But on social media, they are bolder and encouraged to speak their minds because it is just like a blind data, where they are not physically with the woman". Like from what Bisi have said in the above write-up, it is not far from the truth, she like many of her colleague, has adopted a strategy to make it easy for them to meet with a client for sex over an agreed fee or price, sometimes this fee or price is paid in advance and the location or hotel is fixed, planned or even booked online in waiting, we can see that restriction to this practice of prostitution is limitive.

Students also now are in the practice of prostitution with the new media via the social media they can chat up men who prefers or like them and they will decide on the meeting point either hostels, or their private apartment or hotels, sometimes these personalities are total strangers and these ladies are been ended up used for money making, rituals, kidnapped, rapped and have a bodies mutilated. See the cae of late Cynthia Osokogu the onbly dauther of General Frank Ogokogu (rtd). Who's body was discovered in a lago morgue a month after she was declared missing, was murdered by her Facebook acquaintances, these acquaintance Okowumo Nwabifo and Oliseloka Ezike have been sentence to death by a Lagos State high court in Igbosere. Cynthia Osokgu was allegedly killed on July 22, 2012 at Cosmilla Hotel, Lakeview Estate, Festac Town Lagos see Vanguard August 21, 2012 and March 23, 2017.

Furthermore, the new media has now been used as a platform for bullying of other users for instance because of the way the new media shortens distance and reduces the barrier of time, the way married women are harassed by men and young men alike in the social media sites is very unpleasant, one can send nude pictures of himself or herself to somebody without the consent of that person, this is bad.

In the light of this, the new media have brought in to the world unprecedented development to the communication and information industry but not without some major deficits which have been analyzed in this paper.

CONCLUSION

From the above discussion, it can be seen that the new media has tremendous benefit to the Nigeria society, improved communications, business image,

create awareness and other benefit but not without soe deficits and shortcoming to the Nigeria society in general. One with the present development and fast growing pace of new media in Nigeria the Nigeria government should consider ways of sanitizing and creating awareness to the public about the way and manner of usage of the new media as well as the benefits and shortcomings in other to balance the retrospect of the usage in the individual life of the citizens of Nigeria.

RECOMMENDATIONS

The government of Nigeria should set-up bodies to create awareness in the usage of the new media among citizen of the country, this is to guide against future malicious uses of the new media among the citizenry.

The government should put in place measures, like laws to restrain people on social media cite from destroying other people's image or corporate image.

The government should inculcate studies or courses that tend to educated on the usage, importance as well as effects of the new media on the lives of people in the educational curriculum.

The government should use the national orientation agency to mobilize people on the effect and impact of the new media due to their usage.

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AN ASSESSMENT OF THE ROLE OF THE MEDIA IN THE FIGHT AGAINST CORRUPTION IN NIGERIA

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Introduction

Corruption remains a symptom of a poorly functioning state as witnessed in most developing countries such as Nigeria. Indeed, those who give and receive bribes can drain a nation's wealth; leaving little for its poorest citizens. Highly corrupt countries like Nigeria often face particular challenges even when controlled by reform-minded rulers.

The history of corruption in Nigeria is strongly rooted in the over 29 years of military rule. All the military regimes subdued the rule of law, facilitated the looting of the public treasury, prohibited free speech and instituted a secret culture in the running of government business. The period of this military regime witnessed a total reversal and destruction of every good thing in the country (Rihadu, 2006). Corruption became the dominant guiding principle for running affairs of the country. When military seized power from democratically elected governments, pervasive corruption was cited as the justification. It is clear that military regimes were worse than the civilian regimes as far as corruption was concerned.

The highest ever promulgated by the military in Nigeria was Decree 4 of 1 984, which succeeded in rolling up defamation, sedition, and proscription laws — all in one (Malunzen 1 ***995).*** Apart from other laws such as defamation, sedition and contempt of court, there were other laws against the practice of journalism that are contained in the penal code.

During democratic process, political activities assumed a dangerous dimension as contestants see their victory as the ticket to loot and amass wealth. The civilian administration of 19'79 — 1983 was

bedeviled with wanton waste, poetical thuggery and coercion, disrespect for the rule of law and free for all looting of' public funds through white elephant projects. Despite the presence of EFCC, ICPC and other enforcement agencies during Obasanjo's regime, the administration was not spared of corrupt acts. Specifically, corruption became legitimized, especially during the Babangida and Abacha regimes (1985-1998), with huge revenues, but wasteful spending, and nothing to show in terms of physical developments (Nwanka, 1 ***999).***
A critical element of a country's anti-corruption program is an effective media. Media, in this case is either Print or Broadcasting Media. The media raises public awareness about corruption, its causes, consequences and possible remedies. The persistence of' transparency international (2002) in setting Nigeria among the
Bottom five **nations in its annual Corruption Perceptions Index (CPI) since 1995 is an indication that** media has not performed this role effectively (Sowumi, et al 20 1 2). This study is of relevance not only because it brings to the fore the role of The destructive impact of corruption in the lives of nations throughout the old is acknowledged. Corruption is perhaps the most important factor that is impeding the accelerated socio-economic transformation of developing or Less Developing Countries (LDCs) of the world. In fact, it is recognized by development scholars that the level of reduction in corruption has a very direct link to the level of economic development of nations in the world.
The media and Civil Society groups have been identified as the two very important weapons to fight the scourge of corruption worldwide. In Nigeria, the independent press, by which we refer to the newspapers and the newsmagazines, have been actively involved in checking the excess of governments and as well as others in positions of authorities. Of course, the story of the Nigerian mass media, especially the printed press, Carl he said tot he a story of struggle since the late nineteenth century when the first newspaper iwe Iroyin was established in Abeokuta, present day Ogun State. The coming of newspapers like the Comet of Mr. Au, the Egyptian, the \Vs African Pilot founded by the late Dr. Nnamdi Azikiwe and later the Nigerian Tribune of late Chief Obafemi Awolowo. Among others, notched up the opposition to colonial struggle especially against perceived undue dominance, bad governance, injustice and

corruption of the time. So, from the struggle against colonial lordship, civilian misgovernance of the first republic, military editorship lo the seeming lackluster performance in the current civilian dispensation, the Nigerian print media, especially privately owned, could be said: to have indeed come a long way.

Corruption is coined from the Latin word; corruptions which in essence means o destroy'. Wikipedia, the free encyclopedia offered that Corruption is essentially impairment. of integrity, virtue or moral principle; depravity, decay, and/or an inducement to wrong by improper or unlawful means, a departure from the origna1 or from what is pure or correct, and/or an agency or influence that corrupts. The Encyclopedia listed different types of corruption.

The most focused and far-reaching war against corruption in Nigeria could be said to have started during the regime of the erstwhile president of Nigeria, Chief Olusegun Obasanjo especially with the establishment of the two Anti-graft bodies The independent Corrupt Practices and Related Offences Commission (ICPC) and the Economic and Financial Crimes Commission (EFCC).

The establishment of the two bodies provided great impetus for the press to perform the constitutionally ordained role of effusively watching over the activities of the government so as to ensure efficient survive delivery. Despite the strident criticism that the war was biased and the agencies were being used to witch-hunt enemies of the government, the press still provided great support to the antigrafi agencies in its activities. A search through Nigerian Newspapers and Magazines in the last nine years of new democratic experiment show that corruption and corruption related matters are among issues that take up sizeable percentage of spaces available in newspapers and news magazines. Major Nigerian Newspapers usually carry between five to ten corruptions related new stories per edition. Most of editorial opinions and news features also deal with issues of lighting the scourge of corruption and enthroning transparency in government businesses. News Magazines such as the News and Tell and some newspapers including The Guardian, the Nation, Punch. Tribune. Vanguard. This Day and indeed virtually all Nigeria's independent dailies have been in the fore front of exposing corruption in high places through. Obtaining hard facts through painstaking investigative journalism.

THEORETICAL FRAMEWORK: AGENDA SE TTING THEORY

The ability of the media to pre-determine what issues are important gives the media an edge to tight corruption since they can easily lay emphasis on the atrocities being committed by public figures in the country. According to Folarin, (200:75). Agenda Setting Theory does not ascribe to the media the power to determine what we actually think, but it does ascribe to them the power to determine what we are thinking about'. The theory is relevant to this paper because the media can utilize the elements of this theory through increasing the frequency of reportage of corrupt activities in the country; giving prominence to corrupt activities through headline display, picture and layout in newspaper, magazines, film, graphics, or timing on radio and television. The power of the media to expose corrupt acts through the elements of this theory will go a long way in reducing corrupt acts in the country. If public figures know that their corrupt acts will he give a lot of publicity, they are likely to have a rethink before stealing public funds

CONCEPT OF CORRUPTION

According to Salisu (2000:68), the simplest definition of corruption is that 'it is the misapplication of public resources to private ends'. For example, public officials may collect bribes for issuing passports or visa, for providing permits and licenses , for authorizing passage of goods at sea/airport, for awarding contracts or for enacting regulations designed to create artificial scarcity. Macrae (1982:28) on the other hand sees corruption as "an **arrangement** that involves an exchange between two parties (the demander and the supplier) which (1) has an influence on the allocation of resources either immediately or in the future; and (ii) involves the use or abuse of public or collective responsibility for private ends." Stemhei-g (2000:43) relates corruption with bribe when he states that a "bribe is an incentive offered to encourage someone to break the rules of the organization he nominally represents and deliver an (unfairly) favorable outcome." Corrupt acts are regarded as criminal by many high-income countries because the bribe-recipient's betrayal of trust with his employer, when practiced systemically by high-ranking public officials, compromises the

envelopment of fair and efficient markets" (Boatright, 1999). in broader terms, Windsor and Getz, (2000: 11 2) define corruption as "socially impermissible deviance from some public duty or more generally some ideal standard of conduct"

CAUSES OF CORRUPTION IN NIGERIA

Several reasons have been adduced for corruption in Nigeria, one of which is the sudden disappearance of good moral and ethical values. Nwaobi (2004) affirms

that Nigeria must be one of the very few countries in the world where a man's source of wealth is of no concern to his neighbours, the public or the government. Wealthy people who are known to be corrupt are regularly courted and honoured by communities, religious bodies, social clubs and other private organizations. This implies that people who benefit from the largesse of these corrupt people rarely ask questions. Sociological and/or cultural *factors* such as customs, family pressures on government officials and ethnicity constitute potential causes of corruption.

The most annoying thing is that honest and dedicated public servants, who have not accumulated dirty wealth, do not command much respect from the society. These attitudes serve to encourage a new-breed of public servants who engage in corrupt practices. A weak enforcement mechanism (e.g. lack of judicial independence; weak prosecutorial institutions) is another major cause of corruption in Nigeria.

The forces, which determined corruption. often weak as some, if not most, of the law enforcement agencies are themselves 'corrupt. In addition, rulers, politicians and civil servants are highly corrupt, and professional organizations may be in capable of sanctioning their members (Sowumi, et al).

Before now the process of gaining power in Nigeria is either by armed force through coup de tat. This element of force or corruption on peanut the political class of today. What they do to the cabinet in the party is to imposed their candidate on the party and the electorate without political due process.

Over-centralization of power, lack of media freedom to expose scandals, the impunity of connected officials, and absence of transparency in public fund management.

Ayoola (2008) is of the opinion that if democracy is to survive and be a fruitful concept, the role of the media in sustaining it through anti—corruption crusade couldn't he overemphasized He stated

further that certain issues must be placed at the forefront of such endeavour, Primary of these, is the proper understanding of the concept of democracy by all, and the nature of the media practice that can nurture democracy and create favourable environment for it to thrive, lie Further noted that the immediate challenges before the media right now
was to crave ft)r a conducive environment for democracy to take root and become sustainable through the enthronement of a culture of freedom of speech and freedom of expression; government accountability and qualitative civil society in direct participation in governance

FACTORS AFFCT1NG MEDIA PERFORMANCE IN COMBATING CORRUPTION

How effectively media work and report on corruption depends on a number of critical factors such as freedom of media professionals to access, verify' and publish accurate information, and independence of media houses and their ability to access independent sources of financing. Competition, outreach and credibility of media are other important factors affecting media performance (Nogara, 2009). Each of these is examined accordingly as shown below:

• **Freedom of expression** — Media freedom of expression is essential to investigate and report incidences of corruption in a professional, effective and ethical manner. Freedom House, which monitors the free flow of information to and from the public, measures press freedom in terms of the degree to which laws and government regulations influence news content; the degree of political influence or control over the context of the news system; the economic influences on the media exerted either by government or private entrepreneurs, and the degree of oppression of the news media. Press freedom is positively correlated with lower levels of corruption (Brunetti & Weder, 2003)

• **Access to information -—** Access to information is at the heart of transparency and public accountability. Information flows may facilitate public oversight of government and increase the accountability of politicians for bad conduct. In most countries, citizens receive the information they need through the media, which serve as the

intermediaries that collect information and make it available to the public. Without reliable access to information, the media are severely limited in their capacity to. Exercise their public accountability function. Laws and regulations, such as "Official Secret Acts" and similar devices, are often used by governments to limit press access to sensitive information for reason of national security in order to balance the citizens' right to know and the State's right and duty to protect is security. **Ownership**- Private Ownership is often associated with higher levels of government it accountability and performance. Research has shown that government ownership of media restricts information flow to the public with negative effect on citizens' rights, government effectiveness, and corruption; alternatively, increased private ownership of the media-through privatization or encouragement of entry can advance political and economic goals. Competition from private media assures that alternative views are supplied to voters and prevents state- owned media from distorting the information they supply too heavily so that voters obtain, an average, unbiased and accurate information. Studies carried out found strong evidence that competition in the media has a significant impact on the reduction of corruption, and competition can even be a stronger determinant than freedom of expression

• **Credibility** — People's trust in independent media is essential to compel action against corruption From the authorities or the public. Media reputation in this regard is hard to establish, Journalists need to earn pubic trust and confidence by with this state of affairs the mass media are called into play because they are the only medium through which the proceedings of these anti-corruption bodies can be disseminated. Additionally, te mass media on their own have the responsibility of society servicing. Thus are the mass media playing their role well?

To find that out, we are set to assess the role of the mass media in this area

MEDIA AND THE CURRENT FIGHT AGAINST CORRUPTION IN NIGERIA

Efforts to rid the country of corruption have formed basis of military coups in the past. One remarkable effort that deserves a mention is the reasons advanced by Chukwuma Kaduna Nzeogwu in his hid to justify the 15th January, 1966 coup that

overthrew the first government in the country declared:" Our enemies are the Political profiteers, the swindlers, the men in high and low places that seek bribes anti demand 10%, those be that have corrupted our society and put the Nigerian calendar back by words and deeds".

Corruption since Nzeogwu rendered this thought— provoking statement has remained recalcitrant and could be likened to Wole Soyinka's Ogbanje child in his epic poem "Abiku" who kept reincamating, visiting untold hardship and discomfort to the parents.

Because of the severe consequences of corruption on the nation's image both locally and internationally, and the negative pressures it is exerting on the nation's economy, subsequent administrations have no option to design one campaign or the other to fight corruption. The present administration led by Gen. Muhammadu Buahri is no exception. In the president's thought, if the nation does not kill corruption, corruption will kill the nation.

One too that has been proved veritable over the years in the successful mounting of any public campaign is the mass media. The mass media' of communication can be referred as the channels of communication through information, knowledge, ideas, culture, and norms are passed or communicated to a heterogeneous audience that are sparsely distributed and spontaneously receive this message. The mass media can be print which include newspapers and magazines, among others, or the electronics which comprises the radio or television. There is also a recent brand of the mass media which to as the referred as the new media. The new media, according to wikipedia.org, refers to content available on demand through the internet, accessible on any digital device, usually containing interactive user feedback an1 creative participation. Common examples of, new media include websites such as online newspapers, blogs, wikis, video games and social media. One of the defining characteristics of the channel of mass media is dialogue. The new media transmit 'content through connection and conversation. 1t enables people around the world 'to share, comment on, and discuss a wide variety of t-opics**.** The question that agitates the mind here is: Why should the mass media be adequately deployed in the current fight against corruption?" The answer is not far-fetched. It is in controvertible that the media play a critical role in a country's development. The media were at the forefront of the struggle for independence across

African countryman Burke conferences. A typical example is Nigeria where late elder statesman, Chief Nnamdi Azikiwe and other nationalists deployed the media maximally in their struggle for independence, because of the notable roles of the mass media in a nation's development; a notable scholar Edmund Burke conferred the media with the title of Fourth Estate of the Realm". Though not constitutionally guaranteed, the media checkmates other arms of the government such as the executive, legislature, and judiciary. The media is also referred 'to the 'watchdog" of the society because it serves as the mirror with which the masses keep a tab on the society, basically the ruling class. 'Without the media, the society cannot function properly, and anything that affects the media negatively touches the heart of the Society. It is important to note that the media has made immense inputs in political reforms and nation building. The media has been deployed to effect political changes such as the collapse of Union of Soviet Socialist Republic (USSR), agitations for political reforms in China and pro--democracy struggles in Nigeria.
The roles of the media in any society cannot he over emphasized. They include carrying of ideas; presenting representative pictures of the society; classifying the values and goals of the society; monitoring., the government and making it accountable to t he people ; promoting the concept of accountability, integrity, honesty, fairness and equity**.** Others are giving voice to the voiceless; agenda setting, fostering national unity and integration; promoting society's culture and the systems and promoting sustainable national interest at all times. It is unambiguous to note here that if the current. Fight against corruption to succeed, we media should be deployed effectively.

In addition to this, for media men to discharge *their* duties effectively in this current fight against corruption, the media ethics should be upheld religiously. It is open secret that the ethics of the media of recent have been eroded embarrassingly Webster New Collegiate Dictionary .defines ethics as the discipline that with what is good and bad with moral duty *and* obligation; a set of moral principles and values; the principia or conduct governing an individual or 'group; and conforming to accepted professional standard of conduct.

The ethics of the media are some principles and codes of conduct that guide the journalist in the

discharge of his duties and are as important as inner directives for the individual decision— making in various situations that arise in the course of performing his professional duties.

The Nigerian Press Ethical, Codes of Conduct include the respect for the truth respect for the freedom of the individual; the respect for constituted authorities; avoidance of publication of bad ignite in language and pictures; against would have been substantially achieved. In the words of late Moshood Ahiola. publisher of the defunct" Concord Newspapers", "if you fail to pay your workers, someone else vil1 pay them and they will work for the person". Also the current fight against corruption must succeed, journalists should not promote sectional interest. They should see the entire country as their *constituency*. People who have been previously convicted for corruption should be celebrated on the front pages of newspapers or accord prominence on the electronic media. They should he treated as corrupt persons and not saints because sometimes whatever the media accords prominence is regarded as serious issues by the public. The media should not promote issues that would affect the psyche of the public negatively. If these codes of conduct are religiously upheld our current fight against corruption will achieve remarkable victo-ry.

Conclusion

The role of the media is critical in efforts against corruption. As a result, there must be careful structuring of the relationship between anti— corruption officials and,. in many cases, there must also be efforts to develop or enhance the capabilities of the media to ensure that they can function effectively as recipients of information about corruption, appraise such information in an independent manner, use it meaningfully as the basis of further communications and disseminate it to the general public.

Recommendation

Some of the critical issues that will enhance the role of media in curbing Corruption are as Follows: The autonomy of the media is essential to enable it to assess Government information critically and objectively and to ensure its reports are credible to the population as a whole. 'Thus. *Nigerian* Government contacts with the media must be transparent, and *they* must no(compromise the essential autonomy of the media, either in practice or in public perceptions.

For the media to assess ant—corruption effort'

critically and independently they must possess adequate technical, legal, economic and other expertise. Training, awareness— raising and technical briefing of media personnel in anti—corruption efforts may also be useful.

Passage of freedom of Information Bill is not enough; efforts need to be made to reverse this act to suite public needs. This will give legal cover to the media's contributions towards the anti—
corruption campaign.

the media should he encouraged to develop and enforce adequate standards of conduct regarding their professional competence and objectivity so that they should avoid any temptations of accepting gifts envelopes, fare or any other support that would interfere with their free reporting. It is essential to raise awareness on the part of the media of the causes, costs, levels, types and locations of corruption in the country, as well as to explain the on—going efforts of all stakeholders against corruption. Moreover training in investigative journalism as area of specialization is imperative for journalist in the war against corruption.

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