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Conflict Management as a Tool for Restoring Discipline in Kenyan Public Secondary Schools

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Abstract

Conflict is a part and parcel of human organization all over the world. Therefore, potential for conflict exists because people have different needs, values, views and goals. In schools, internal conflicts occur because sometimes administrators, teachers and students have different perceptions and attitudes towards certain issues. The study examines how conflict management is used as a tool for restoring discipline in Kenyan secondary schools and it is guided by human needs theory. The study employed mixed methods approach which embraced both quantitative and qualitative methods to collect data from secondary students, headteachers and teacher counselors. This study has concluded that failure to train headteachers and teacher counselors on conflict resolution; management skills and a lack of clear communication among all the stakeholders constitute some of the causes of conflict in secondary schools. The study has recommended that conflict management and peace keeping skills should be incorporated into teacher education syllabuses.

Key Words: Conflict, Discipline, Management, Students, and Tool

Introduction

Conflict occurs when the objectives, goals, values, or needs of individuals or groups clash (Weeks, 1992:33; Kriesberg,1973:17; Pruitt and Rubin, 1994:11). Diverse human interests and needs are sometimes incompatible with social needs; religious beliefs, and group goals of others. The result is often violence. In Kenyan public secondary schools, there are various causes of conflicts. Some of the common causes of conflict in public secondary schools in Kenya and other parts of the world include a lack of dialogue between head teachers and students, unsatisfied needs, peer influence, culture shock and a lack of role models among others. These factors may cause students to either leave school in order to avoid an annoying situation, or result to anti-social behavior as they look for escape routes. Riots and demonstrations and particularly in public secondary schools can be seen as collective escape valves for a collective frustration and especially when the school is the source of that frustration. In order to develop desirable behavior in students, teachers in Kenya use any methods available to identify the causes of such conflicts so as to manage them and where possible resolve them. Some of the methods used by

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teachers to manage conflicts are counseling, suspension, expulsion, detention, imposition of fines, and caning among others.

The current study has employed Burton's human needs theory in order to explain the causes of deviant behavior in schools. According to Burton (1990:2), conflict is related to human relationships at all societal levels. The importance of this theory to conflict management in schools is that it focuses on ineffective institutions which are unable to satisfy the basic human needs. Whenever, such non negotiable needs such as food, accommodation, identity, and recreation are not met, conflict in schools is inevitable and particularly among adolescent population. These categories of students are trying to establish their autonomy from adults aggressive and prone to violence. Gurr (1970) supports this view when he cites grievances of people who feel deprived of what they perceive as values to which they are entitled. Such people are likely to be frustrated and to engage in irrational and deviant behavior.

Bell (1992) and Baptiste (1990) also maintain that in any school community all over the world, there is potential for conflict because conflict is part and parcel of human organizations. Mulu (2008) too has observed that disparities in wealth, natural resources, technology and power among social classes and ethnic groups cause grievances, animosity and conflict. Thus, it appears that potential for conflict exists because people have different needs, views and values.

Discipline in Kenyan public schools

The public concern about conflicts in Kenya's educational institutions has been often reported in the media. In addition, numerous studies have vividly underscored the pervasiveness of this problem. Conflicts in educational institutions have largely been attributed to lack of management skills, especially in conflict management and resolution. Conflicts have persisted in Kenyan secondary schools, middle level colleges, and tertiary institutions even though there have been various legislations that serve as guidelines for management and administration of educational systems. Yet, in spite of these policies, there have been increased cases of conflict between 1980 and 2008 (Ministry of Education 2008). The number of conflicts in public secondary schools alone increased from 22 (0.9%) in 1980 to 300 (7.5%) in 2008 (Ministry of Education, 2008). Often, conflicts in schools are mostly manifested in riots which result in destruction of property and occasionally death and rape especially of girls in co-educational boarding secondary schools. For instance, on July 13th, 1991, male students at St Kizito Mixed Secondary school invaded the girls dormitory and raped more than 70, with 19 girls losing their lives in the scuffle (Perlez, 1991).

Further, on March 28th, 2006, mass rape again, of about 15 girls occurred against Kenyan school girls of Kangubiri Girls Secondary School in Nyeri district, in Central province (Wanyama, 2006). In March, 2000, twenty six girls were killed after a dormitory fire razed Bombululu Girls Secondary school in Coast province (Ochura, 2014. On March 25, 2001, 68 students were burnt to death and scores injured by two students at Kyanguli Secondary School in Machakos District, Eastern province (Rowan, 2001). This happened when two students poured petrol on the dormitory and set it ablaze for unknown motives.

Other forms of school indiscipline include bullying. Ngigi (2010) gives the following breakdown about bullying: In May 2006, a 15 year old Form One learner, Samuel Gituro, of Nyeri High School in Nyeri district, Central province succumbed to injuries caused by a bully. In June 2006, students of St. Marys Boys' High school in Taita Taveta District, Coast Province, went on the rampage demanding to be allowed to bully Form One students. Later in the month, Moyale High school in Moyale district, North Eastern Province, was closed after students protested the suspension of 11 bullies from the school.

Indeed, Snodgrass (2005), Egbochuku (2007), Giddens (2006), Kambo (2012) Kibui (2013) and Beauchamp (1993) maintain that violence and bullying in particular, is a worldwide problem and it often leads to negative lifelong consequences both on the students who bully and on their victims. It creates a negative atmosphere on the general school climate and on the right of the students to learn in a safe environment without fear. Further, conflict among students has been associated with drug abuse. Students who abuse drugs tend to be irrational and violent. This study therefore, sought to establish the extent to which drug abuse was prevalent among secondary school students.

Approaches to conflict management

The origins of human violence are as complex as the solutions needed to solve them. Thinkers, historians, and scientists have explored this issue for centuries, but answers remain elusive. The roots of a violent act are multiple, intricate, and intertwined. The mix of factors varies according to the individual and the circumstances. Understanding violence, after it has occurred is difficult; trying to assess a threat and keep it from being carried out is even more of a challenge. That is why it is essential to learn the proper skills needed to manage conflict (Lincoln, 2002:11). The conflict management field understands that although all conflicts cannot be resolved, learning how to manage conflict can decrease the odds of nonproductive escalation. Conflict management involves acquiring skills related to conflict resolution, self-awareness about conflict modes, conflict communication skills, and establishing a structure for management of conflict in an environment (Coleman, 2006, and Deutsch, 2006).

According to Forret (1925), Sanford (1964), Hanson (1991), and Thomas (1976), strategies for conflict resolution vary according to the different philosophical bases of those involved. Generally, these bases encompass the win-lose, lose-lose and win-win approaches to conflict resolution. When conflict no longer interferes with the ongoing activities of those involved, it is concluded that it has been effectively managed. Conflict management is therefore, the process of removing cognitive barriers to agreement. Depending on the situation, conflict management techniques often focus on changing structure, changing process or both. Sometimes structural modifications are not very creative, and the response to conflict is simply more rules leading to hardening of the role structure. Such efforts can appear to improve the situation outwardly but not without revolving the underlying problems. Given the negative effects of unresolved conflicts, it was important to establish the extent to which managers of educational institutions at secondary level of education were prepared to handle conflicts.

Objectives of the study

The primary goal of the study was to establish the preparedness of secondary school teachers in conflict management as a tool for restoring discipline in Kenyan secondary schools. The specific objectives sought to:

1) establish the prevalence of drug abuse in secondary schools
2) determine the types of conflict experienced in secondary school settings.
3) examine readiness of headteachers in conflict management strategies.

Research Design

To achieve these objectives, the he study used a descriptive survey design with a mixed methods approach. Data was collected and analyzed using qualitative and quantitative techniques. Purposive and random sampling techniques were used to select the respondents. Using simple random technique 16 different categories of schools and 649 students were selected from four (four) administrative regions of Kenya out of eight (8) namely Central, Eastern, Nairobi and Rift Valley. The student age ranged from fourteen to eighteen years. Sixteen (16) headteachers and sixteen (16) teacher counselors were purposely selected. The study used questionnaires and interviews to collect data from the targeted participants. Self-administered questionnaires were thought to be suitable because they allow uniformity in terms of questions which are asked to all sampled population. Interviews were also used to provide clarification of issues in the questionnaires. Data was analyzed using descriptive statistics such as percentages, frequencies, means and cross-tabulation and chi-square test at 0.05 level of significance.

FINDINGS AND DISCUSSIONS

The first objective tapped information on prevalence of drug abuse in secondary schools by category of school and gender. The results are presented in Table 1.

Table 1: Rate of Drug Abuse by gender and school category among secondary school students by gender and school category

School category	**Boys Boarding**		**Girls Boarding**		**Mixed Boarding**				**Mixed Day/Boarding**			
Respondents by gender	Male		Female		Male		Female		Male		Female	
Aware of drug abuse	N	%	N	%	N	%	N	%	N	%	N	%
Aware	89	56.7	57	32.1	47	51.6	25	51.0	66	66.0	26	35.6
Not aware	68	43.3	121	67.9	44	48.4	24	49.0	34	34.0	47	64.4

(Primary data, 2013)

The analysis presented in Table 1 shows that 56.7% of the students in Boys Boarding Secondary schools and 32.1% of Girls Boarding Secondary Schools respectively were aware of drug abuse in their schools. In Mixed Boarding Secondary Schools, 51.7% of boys were aware of drug abuse in schools, while 51% girls were aware of drug abuse in mixed boarding secondary schools. Boys and girls in Mixed Day and Boarding Secondary Schools who were aware of drug abuse in their secondary school formed 66%, and 35.6% respectively. These findings indicate that more boys compared to girls in all categories of schools might have been tempted to abuse drugs.The responses by head teachers on the awareness of drug abuse among students are similar to those of students.

These results confirm that drug abuse is a problem in all categories of secondary school and this may explain why indiscipline is prevalent and especially among single-sexed boarding schools for boys and

mixed boarding schools. Individuals who are under the influence of drugs are not able to reason and are also more likely to act irrationally.

To determine whether there were any statistical differences on awareness of drug abuse in different types of secondary schools, data was subjected to chi-square test of significance. The findings are presented in Table 2.

Table 2: Chi-square test on the rate of drug abuse in different categories of schools

	Value	df	Sig. (2-sided)
Pearson Chi-Square	41.744(a)	12	.000
Likelihood Ratio	43.780	12	.000
Linear-by-Linear Association	.005	1	.946

(Primary data, 2013)

The data contained in Table 3 show that the chi-square test values on different categories of schools were (χ^2=41.744, df =12, p<0.001). Since the p-value is less than 0.05, then it means that there was significant statistical difference on the rate of drug use in different types of schools. The analysis indicates that awareness of drug abuse was higher in Boys' Boarding and Girls' Boarding Schools than in Mixed Boarding, and Mixed Boarding and Day Schools .

After analysing awareness of drug abuse among different categories, chi-square analysis was also performed on the awareness of drug abuse among male and female students. The findings are summarised in Table 3.

Table 3: Chi-square test on the rate of drug abuse among boys and girls

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.459(a)	4	.000
Likelihood Ratio	31.840	4	.000
Linear-by-Linear Association	18.368	1	.000

(Primary data, 2013)

The findings presented in Table 3 show that the chi-square test values for differences in boys and girls were (χ^2=31.459, df=4, p<0.001). Since the p-value is less than 0.05, then it means that there was significant statistical difference on the rate of awareness of drug abuse between boys and girls in secondary schools. The analysis in this study indicates that boys are more likely to abuse drugs compared to their female counterparts.

Types of conflicts experienced by students in secondary schools

Given that indiscipline behavior among students in Kenyan secondary students has been reported from time to time, the second objective sought to identify different types of conflicts that are experienced by students. The findings on headteachers responses on the types of conflicts/problems they experience from students are presented in Table 4.

Table 4: Headteachers' Responses on Disciplinary problems prevalent among secondary school students

Disciplinary Problems	N	Mean
Threats	14	2.3571
Rumours	14	2.7857
Verbal fighting	14	2.3571
Physical fighting	14	2.0000
Isolation by peers	14	2.7857
Theft	14	3.0714
Teasing	14	2.5000
Rudeness	14	2.7143
Peer pressure	14	3.5000

The data summarized in Table 4 indicate that threats had a mean score of 2.3571, rumours (M=2.7857), verbal fighting (M=2.3571), physical fighting (M=2.000), isolation by peers (M=2.7857), theft (M=3.0714), teasing/insults (M=2.500), rudeness (M=2.7143), and peer pressure (M=3.500) are types of conflicts found among students in secondary schools. These results have suggested that peer pressure, theft, isolation by peers and rumours, rudeness, insults, threats verbal and physical fighting in that hierarchical order are most common conflicts among students.

After dealing with Head teacher's information on types of disciplinary problems prevalent among secondary students, analysis on guidance and counseling teacher's responses on types of discipline problem among students was done. The pertinent results are contained in Table 5.

Table 5: Guidance and counseling officers' view on disciplinary problems in schools

	N	Mean	Std. Dev.
Threats	16	2.1875	.91059
Rumours	16	2.8125	.91059
Verbal fighting	16	2.8125	1.04682
Physical fighting	16	2.3750	.71880
Isolation by peers	16	3.1250	.88506

Theft	16	3.1250	1.08781
Teasing/insults	16	3.1875	1.10868
Rudeness	16	3.1875	.98107
Peer pressure	16	4.0625	1.23659

The findings in Table 5 show that the most prevalent disciplinary problem was peer pressure (M=4.0625) followed by rudeness and teasing (mean 3.1875) respectively, theft and isolation by peers with (mean 3.1250) respectively. In relative terms, head teachers and guidance teacher counselors seem to be more aware of the disciplinary problems that confront students. However, both head teachers and guidance and teacher counselors have identified peer pressure, rudeness, teasing, theft and isolation by peers as the most common triggers of disciplinary problems.

Head teachers' readiness in conflict management

The third objective sought to find out the preparedness of head teachers in respect to conflict management skills. The findings showed that the majority of teachers (59.6%) had no training on conflict management. This is an indication that a great number of the teachers lacked training and the necessary knowledge in conflict management. This deficiency may explain why there is a lot of indiscipline among students in public secondary schools in Kenya.

Existence of knowledge for conflict management skills in schools

The study further sought to establish if time was allocated to conflict management skills in schools. There is evidence that students at secondary level of education are in a turbulent stage of life and if not guided they are prone to give into untested peer influence which is not always positive. The results further showed that over 40% of the students had not been guided and counseled on how to manage conflict.

To get further insight about head teachers' preparedness to manage conflict, they were requested to indicate whether they had ever heard about of peer mediation in schools as a tool of conflict management. The pertinent data showed that head teachers (44.1%) had not heard anything about peer mediation, while 42.3% had heard about it but had no knowledge of what it was all about. Only 13.6% knew exactly what it was about. These findings indicate that peer mediation as a tool of conflict management is not common among the head teachers in secondary schools. Lack of knowledge of peer mediation may explain why conflicts are common in secondary schools since students are not provided with the necessary knowledge to handle and manage their own challenges and those of their colleagues.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study findings have indicated that there were more riots (56.6%) in boys' boarding schools. Also the chi-square test analysis indicated that the rate of drug abuse was higher in boys' boarding schools and girls' boarding schools than in mixed boarding and mixed day and boarding schools. Bullying is also common in boys' boarding schools (45.8%) than in the other categories of schools. The study established that only 13.6% of the headteachers knew about peer mediation. In addition, 68.3% of the secondary schools did not have peer mediation programs. In addition (59.6%) of the teachers had never attended any training in conflict-management skills.

Conclusion

The study established that violence is rife in secondary schools in Kenya. Nearly 60% of teachers had not attended training in conflict management skills therefore do not understand the value of peer mediation. Consequently, an overwhelming majority of head teachers (88.3%) did not have such programs in their schools. This means that students are not guided well on how to manage social-emotional problems associated with adolescence.

Recommendations

The study makes the following recommendations.

a) Head teachers and teacher counselors should be trained in conflict management skills that can help students and members of staff who may have social and emotional challenges.
b) Students should be taught essential life skills which can help them to manage the adolescent social-emotional problems.
c) Teachers should involve students in conflict resolution because students have more information on the causes of conflict and can play an important role in coming up with solutions to the problems they encounter.
d) Students should be sensitized on the importance of seeking help from elderly persons who have had experience and challenges in life rather than from their peers.
e) Schools should hold regular forums in which all the members of staff and students can share ideas on the welfare of students as well as members of staff. Such forums will make students cooperate during resolution of school crisis.

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ATTITUDE TOWARDS KISWAHILI IN URBAN KENYA

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Abstract

The present paper Attitudes Towards Kiswahili in Urban Kenya aims at observing, identifying, classifying and analyzing language attitudes regarding Kiswahili in urban Kenya in order to show how they impact on Kenya's language policy generally and on language planning in particular. Data for this paper was collected by means of library research, field visits, interviews, observations and discussions. This work, being field based, used tape recorders also and the information recorded was transcribed and analysed focusing on specific items of the interview schedule. This work purposively selected its sample and was conducted with the participation of 100 respondents. Using the sociological theoretical framework and the social psychological theory, the paper has found out that the majority of urban Kenyans have positive attitudes towards Kiswahili mainly for integrative reasons and not for instrumental reasons.

Key words: Language attitude, Kiswahili, English, Instrumental orientation, Integrative orientation.

1.1 Introduction

This paper presents the results of a public opinion poll about the attitudes of Kenyans towards the use of Kiswahili in urban Kenya. First the study was interested in situations in which Kiswahili is considered to be more appropriate and second, what Kiswahili's relative position is to English and other Kenyan languages.

In this paper as we examine the issue of the use of Kiswahili in urban Kenya we shall talk as linguists and not educationists. The paper refers to attitudes towards Kiswahili because it is the language with which most Kenyans are familiar, and yet there are many other languages (Mukhwana 2008, 2010). This aim arises out of the realization of the fact that language contact situation serves as an effective catalyst in bringing out beliefs, values, prejudices and contradictions of a speech community (Mukhwana, 2010). In the urban Kenya case, the diversity in speech between speakers of English, Kiswahili, mother tongues, and Sheng/ Engsh (Kenyan slangs) might lead one to assume that the people of urban Kenya have good reasons for the choice of either English, Kiswahili, mother tongues or Sheng/Engsh. The diversity in speech in the urban areas is the essence of this paper on language attitudes in urban Kenya. This paper is valuable in that it will help locate significant Kiswahili language problem areas, describe and analyze this interesting linguistic behavioral phenomena, and suggest variables which play a vital role in determining language attitudes towards Kiswahili in urban Kenya.

1.2 Theoretical Framework

In this paper, two theoretical frameworks are used for data analysis and they are the Sociological theory and the Social psychological theory.

1.2.1 The Sociological Theory

The Sociological theory is mainly associated with Fishman (1972). The major contribution of Fishman's approach to language study is his concepts of domains of language behaviour. This theory helps people know who speaks what language, to whom and when in a speech community that is characterized by widespread and relatively stable multilingualism like Kenya (Kembo – Sure 1996, Abdulaziz 1982). According to Fishman's Sociological theory, language behaviour is determined by spheres of activities which are organized into specific sets of culturally determined role relations which are understood to belong to specific spheres of activity. Thus, to Fishman, proper language usage dictates that only one of the theoretically co – available languages or varieties in a multilingual setting will be chosen by particular classes of interlocutors on particular kinds of occasions to discuss particular kinds of topics (Fishman 1972: 15). In general, the Sociological theory is an attempt to show that language behaviour is a powerful marker of intricate social relationships and roles and an indicator of social goals and the large scale value laden arena of interaction that typify every speech community. This is the way the theory has been applied in this paper on attitudes towards Kiswahili in urban Kenya.

1.2.2 The Social Psychological Theory

In this paper the Social psychological framework that we have used is that by Lambert (1963). According to this theory, an individual successfully acquiring a second language gradually adopts various aspects of behaviour which characterize members of that linguistic cultural group's members. The motivation for one learning a second language is thought to be determined by his or her attitudes and by his or her orientation toward learning the second language. Lambert (1971) later explained that peoples' attitudes are directed by two types of motivation: integrative and instrumental motivations. The question that arises therefore is: What motivates urban Kenyans to either accept or refuse to accept Kiswahili in the various domains of the language's usage?

These two theories have been helpful in handling the issue of language attitudes towards Kiswahili in urban Kenya.

1.3 Methodology

The present study is both a qualitative & a quantitative one. The research employed the quantitative methodology in analyzing the content using frequencies and percentages of responses from respondents and which represent the criteria of data analysis and interpretation. Qualitative methodology was used to gain a better understanding of the nature of the attitudes given towards Kiswahili in urban Kenya.

After determining, by use of income, place of residence, educational levels and expenditure, who belongs to what class in urban Kenya, a total of 100 residents who fall into the category where purposively selected from 5 Kenyan towns. They served as the basis for the data analysis in the study of language attitudes in urban Kenya (tables 1 and 2 are representative of the data).

The primary dependent measure was the subjects' responses to the main question:- "What is the attitude of the people of your town towards Kiswahili?" On testing variables that include place of birth, length of stay in urban Kenya, age, sex, marital status, occupation, language of birth, educational level, types of

schools attended against language attitudes towards Kiswahili in urban Kenya, the following results were recorded:

1.4 Results

A look at the above variables in relation to the topic under investigation indicates that language attitudes towards Kiswahili in urban Kenya are the domain of the male youths (see table below)

Table 1. Age and Sex of respondents in urban Kenya

Age	Total No.	%	Male	%	Female	%
Under 20years	4	4	2	50	2	50
20 – 29 years	20	20	12	60	8	40
30 – 39 years	38	38	30	79	8	21
40 – 49 years	26	26	19	54	7	46
50 – 59 years	8	8	6	75	2	25
60 years plus	4	4	2	50	2	50
TOTAL	**100**	**100**	**66**	**61**	**34**	**30**

The above tendency implies that the male youths more frequently respond than female and the aged when it comes to the issue of language attitudes (in this respect to Kiswahili) in urban Kenya. Another point that clearly comes out from the above variables is that regardless of the education levels and types of School attended, the respondents have similar disposition as regards the issue of language attitudes towards Kiswahili in urban Kenya. In the investigation, the occupational phenomenon variable can be broken into two: white collar and blue collar respondents.

When language attitudes towards Kiswahili were measured with the samples of 100 residents of urban Kenya, there was a clear tendency for the interviewees to reject Kiswahili in terms of social mobility but not its role in national social contacts where it clearly comes out as a national language. The attitudes, while not frankly aversive, were reported to be somewhat uncomfortable and uneasy in contact with Kiswahili speakers. In terms of linguistics affective responses, the most prevalent attitude reported by the respondents was 'sympathetic.' Very few respondents indicated an attitude that can be called favourable to Kiswahili.

About the variable of age and maturity, and sex as determinants of language attitudes towards Kiswahili in urban Kenya, the study notes that several urban estates have reported that regardless of age, men tend to show a more positive attitude towards Kiswahili than do women. Over 70% of men respondents favoured Kiswahili compared to about 40% women. A possible explanation for this difference could be an implication that the underlying language feelings are similar but men are more subject to national social pressure to have this kind of language attitude.

The variable of age has been investigated and its relation to attitudes towards Kiswahili in urban Kenya is such that older people were consistently more accepting in their attitude towards Kiswahili than were the youth. As a general rule, a linguistic continuum exists relating to age and maturity towards Kiswahili in urban Kenya. The current evidence provides some basis for logical separation of general attitudes towards Kiswahili on the one hand and attitudes towards Kiswahili in terms of what it can offer economically and socially on the other hand. The people of urban Kenya may be perfectly willing to choose Kiswahili on the basis of personal merit, but nevertheless note its socio-economic disadvantages

compared to a language like English. In order to gain some understanding of the respondents' attitudes towards Kiswahili in urban Kenya in terms of social advancement, one question was asked: "What language do you think will be of greatest use to you in your local business, career or profession?" In answer to this question, 60% of the respondents indicated Kiswahili. It is evident form this result that even though a comparatively small percentage of respondents have a positive attitude towards Kiswahili when it comes to issues of social advancement, a larger majority still consider it the language of business in urban Kenya.

One of the most conspicuous differences in language attitudes towards Kiswahili in urban Kenya is related to age. Younger people tend to have more pronounced negative attitude towards Kiswahili than do old people. One of the reasons for this attitude may be that young people do not have everyday and more natural contact with Kiswahili peers such as at places of work, at casinos and hotels. Another fact is, of course, education. Young people are generally better educated. Our young respondents, for instance those in which young people were interviewed with one or both parents, also suggest that they resent sometimes – bigoted attitudes of their parents about Kiswahili in urban Kenya. The young upper and upper middle class people also tend to have different attitudes towards Kiswahili as opposed to older people because they have different language contacts and experiences. The language of educational instruction in Kenya is English and not Kiswahili as was the case during the Kenyan colonial period(see Whiteley 1969).

The paper has noted, from its results that in local business, the language attitudes towards Kiswahili in urban Kenya are remarkably favourable. It seems likely that different value set controls the attitude towards Kiswahili in business encounters in urban Kenya. On the basis of this data, Kiswahili seems to be emerging as a more favourable language, especially in national business spheres. This notion of positive attitudes towards Kiswahili is statistically established and is significant (80%). In urban Kenya's multilingual setting, people associate each of the languages used there with a different set of functions in the society. Besides the value of national solidarity typically being associated with Kiswahili, the people of urban Kenya have an attitude that they have to adjust to Kiswahili to succeed in local business.

In Nairobi, for example, the value of solidarity is associated with Kiswahili. Thus, the language attitude that is associated with Kiswahili in Nairobi is that of Kiswahili being used as an instrument which Kenyans use to group themselves together or to separate themselves from others. This is the binding or separating function lf language. Thus, the solidarity value attitude towards Kiswahili by the people of urban Kenya makes the language an instrument that allows Kenyans to participate in certain activities and enjoy certain privileges. Therefore to the people of urban Kenya with such attitudes towards Kiswahili, the language has a symbolic function. Kiswahili symbolizes identity whereby it symbolizes being a member of the Kenyan nation. In this sense, Kiswahili functions like the Kenyan national flag or the Kenyan national anthem or even a national holiday like Jamhuri day. This attitude towards Kiswahili in urban Kenya stems from the fact that in Kenya, Kiswahili is the national language which represents the political identity of this state. Therefore, Kiswahili symbolizes being Kenyan or holding Kenyan citizenship. Besides this attitude towards Kiswahili, it is important to note that language attitudes in urban Kenya can be elucidated through the application of the concept of social identity. The respondents in urban Kenya constantly compare languages in terms of what they can offer to their struggle for social identity. However, the upward moving and the good education attributes that go with English in Kenya

give rise to new measuring and redefining of the attitudes some urban Kenyans have towards Kiswahili(see Adegbija 1984).

The perceived inferior position of Kiswahili by some respondents in urban Kenya is based on the attitude that to them it has more disadvantages compared to English. Such people of urban Kenya have an attitude that will make them not to socially identify with Kiswahili because it is socially disadvantaged. The necessarily heavy reliance on English for many aspects of the life of urban Kenya, and the fact that English is the means of practically all advancement is reflected in the attitudes of some of the respondents towards Kiswahili in this experiment. There is, however an attitude of strong interest in Kiswahili as part of the cultural heritage of Kenya. When to use English, Kiswahili or even mother tongues and Sheng and Engsh is not so clear-cut and involves some unconscious weighting of factors: prestige, cultural romanticism, officialdom and intellectualism.

This result about language attitudes towards Kiswahili in urban Kenya is backed by the fact that it is impossible to argue that similarities in language attitudes are a factor of place or town of residence. Residents of Kileleshwa in Nairobi, by virtue of their stay in a posh residential area would be expected to have language attitudes that differ strikingly from those residents of low classes estates like Kangemi and Kawangware. Similarly urban centre may not be a factor in determining language attitudes towards Kiswahili in towns in Kenya (see table below).

Table 2. Individual Samples and attitudes towards Kiswahili.

a) In relation to national integration and
b) In relation to socio – economic advancement.

Estate	Total No. of respondents	National integration % (attitudes)	Economic advancement % (attitudes)
Nairobi	18	Over 82	Over 90
Eldoret	17	Over 83	Over 93
Mombasa	13	Over 78	Over 90
Kakamega	26	Over 90	Over 90
Kisumu	26	Over 94	Over 92
TOTAL	**100**		

One of the main aims of this paper was to find out attitudes the people of urban Kenya interviewed have towards Kiswahili. The respondents in urban Kenya were asked directly whether Kiswahili should be encouraged in Kenya if Kenyans as a nation hoped to advance economically. All the research questions were answered using frequency distribution which compared responses of the subjects in age groups, sex groups, ethnic group, place of residence among other factors. The analysis of the above has been done and has been referred to.

1.5 Types of Language Attitudes toward Kiswahili in Urban Kenya

In this section, the paper categorizes language attitudes in urban Kenya with respect to Kiswahili. As a result of the categorization, some impression has been gained on the attitude of the people of urban Kenya towards Kiswahili and by implication certain other features that characterize the Kenyan society where Kiswahili is a national language.

The questions for the present paper called on the interviewees to make arguments that might explain, "Why Kenya as an independent country should use Kiswahili language." The respondents on the average replied that Kiswahili is needed for Kenyan self expression. On the specific question of the use of Kiswahili an official language, most of the respondents tended to support the argument that Kiswahili would promote better national communication for all Kenyans regardless of their social, ethnic and academic backgrounds. But it was noted that most non – Nilotes opt for this argument and attitude more strongly than Nilotes. Speakers of Nilotic languages tend to gravitate toward the sentimentalist attitude of communicative enjoyment given by English.

Another attitude that came out clearly in support of Kiswahili stated that Kiswahili can provide national linguistic unity and identity. This attitude about Kiswahili is given by all the ethnic groups studied in urban Kenya although by slim margins by people of Luo ethnic group. This attitude about national linguistic unity and identity is held mostly by women among the Luo people in urban Kenya. Therefore in Kenya, the use of Kiswahili is for unifying the nation. The use of Kiswahili in all regions of the nation promotes ideological assimilation and national solidarity. This is the essence of the language attitude towards Kiswahili in urban Kenya. What is meant here is that there are cases in urban Kenya where a bilingual chooses to use Kiswahili language knowing that the listener would prefer Dholuo, Luhya or Kikuyu. Here, this language attitude is a symbol of national identity(Adegbija 1984, 1997).

The attitudes toward Kiswahili in urban Kenya are therefore of different types in different items of the questionnaire used. The attitudinal responses are situation specific. The respondents preferred the sentimentalist arguments and attitudes in the context of Kiswahili being used as a national language. This attitude was given because the respondents felt Kiswahili was their unifying and identifying linguistic badge as Kenyans.

From the attitude above, Kiswahili is seen by the people of urban Kenya as a Kenyan language that expresses Kenya's cultural heritage. On the other hand, the attitude towards English in urban Kenya is that it is a remote language that is based on a cultural heritage that is not Kenyan. Therefore the attitude most of the people of urban Kenya interviewed have towards Kiswahili is that this language must be known by Kenyans and used for the purpose of identification of Kenyan national culture. This kind of attitude holds that it is by the use of Kiswahili in Kenya that alienation from Kenyan culture can be avoided. This attitude about the use of Kiswahili by the people of urban Kenya is in itself a sign of growing national linguistic pride. Therefore, Kiswahili is in urban Kenya used for pleasure and identification with national linguistic culture (see table below)

Table 3. shows how language attitudes of ethnic groups in urban Kenya are distributed in favour of Kiswahili`s position as a national unifying language.

Ethnic group	No. of Respondents	%	% of language attitude
Dholuo	70	81.4	80
Luhya	11	12.2	90
Kikuyu	2	2.3	90
Ateso	1	1.2	50
Other Kenyans	2	2.3	50
TOTAL	**100**	**100**	

There is an attitude among a section of the respondents to the effect that Kiswahili language has shortcomings and deficiency as far as standardization of its vocabulary is concerned. This attitude is particularly in comparison to English which is felt to be a very polished language and so very effective in communicating information(see Ansre 1977, Kembo-Sure 1988). This attitude about Kiswahili's shortcomings is expressed mainly by the youth and from all the estates of cities studied. But most of the older people of urban Kenya feel that by emphasizing English, there develops a situation of alienation among the young people of urban Kenya. Of course, these older people are anxious for an education in English but they feel Kiswahili also should be given a chance. This attitude towards Kiswahili starts from the fact that those with and education in English only may have no respect for Kiswahili and yet some of the older people never had a change of getting education in English.

The above attitude by the older respondents of urban Kenya towards Kiswahili points to the fact that Kenyans should not be made to think all along that Kiswahili is inferior to English. To these older people of urban Kenya, the attitude is that Kiswahili is speedily developing and expanding in vocabulary, literature and use. Therefore, Kiswahili can also express technical and scientific concepts as well as English can. Because Kiswahili is a language which is growing, it should therefore be loved by all Kenyans of good linguistic and cultural will.

The positive attitude for Kiswahili by some respondents in urban Kenya becomes necessary because "without a people sustaining their national language, they cannot sustain their culture as a people with the same history." The attitude expressed here is that Kiswahili gives Kenyans delight. Due to this, Kenyans can express in Kiswahili whatever is deep down in their hearts and so Kenyans should be proud of it. This pride attitude towards Kiswahili is because Kiswahili is Kenya's cultural heritage and so its use will mean the Kenyans are proud to be Kenyans. Whatever attitude that is contained in this statement is that Kiswahili is equally as valuable as English because these two languages are both capable of effectively performing their roles as media of communication in their respective spheres and domains.

In spite of these very positive attitudes toward Kiswahili by the people of urban Kenya, the issue of social mobility and survival comes in. Arguments against Kiswahili are such that although it is a truism that people should be proud of their heritage, circumstances in Kenya's linguistic and educational policy circles are against this very noble fact. Economic times that go with job placement are against the people of urban Kenya who would have wished to opt for Kiswahili instead of English. There is no job security with Kiswahili. The attitude that there is lack of job availability and security with Kiswahili is because the Kenya government has all along history made sure that Kiswahili always remains subordinate to English; and given that people are now living in a 'global village,' only an international language like English would serve to give the people of Kenya job placement. Therefore, respondents with positive attitudes towards Kiswahili in urban Kenya find themselves in a kind of national bilinguistic conflict. This national bilinguistic conflict arises when Kiswahili can be interpreted to be in a state of suppression at the expense of English. The apparent Kenya government regard for Kiswahili as not important in the eyes of the people of urban Kenya who enjoy and would like to encourage the language makes the people of urban Kenya to have an attitude towards Kiswahili that can be called 'indifferent' but with a guilt feeling. Therefore, the people of Kenya may be enthusiastic about Kiswahili as their national

language and hence view it as their national linguistic hope, nevertheless realize the importance of English in relation to Kiswahili because English has international credentials (Ansre 1977).

In-as-much as it would presumably be easier for urban Kenyans to excel in Kiswahili, the attitude that a majority of the respondents hold is that the teaching of English will ease their children's integration into the children's new school environment. Being almost mostly native speakers of Kiswahili, urban Kenyans have an attitude that sees any move meant to encourage the use of Kiswahili in education as an insult and demeaning to their children (see Sindiga 1977). Therefore, urban Kenyans feel it is better for their children to be taught in English and not in Kiswahili, even if English proved to be harder to learn. This attitude is the kind of force of urban Kenyans' attitudes towards Kiswahili, and generally, attitude towards language in education. Therefore, a negative attitude toward Kiswahili is noted among urban Kenyans when it comes to the question of public education in Kiswahili. These urban Kenyans look upon Kiswahili as an inferior language in education and that the way to advance within the Kenyan society goes via good knowledge and use of English in education but not Kiswahili.

But some of the respondents in urban Kenya have positive language attitudes toward Kiswahili without questioning the attitude. These urban Kenyans approve of loyalty and respect for Kiswahili, particularly for good Kiswahili. They thus do not support deviants of Kiswahili by name – calling, like ***watu wa bara***, meaning up-country people who cannot properly coordinate their Kiswahili speech. This attitude is prevalent in the mostly native Swahili coastal towns.

Generally, in urban Kenya, the attitude that Kiswahili carries is that of a language that acts as a marker of ethno – linguistic group membership besides being considered important for national unity and development. This aspect of development comes in as an attitude towards Kiswahili because when a people is stripped of its identity, it is no longer able to function as a society.

From the results of the language attitude towards Kiswahili by some of the respondents in urban Kenya, the theoretical thesis that the present paper can advance is that prejudiced and hostile language attitudes by urban Kenyans are expression of their inner socio-economic and cultural needs or impulses created as a result of the people's historical experiences. The inner needs of urban Kenyans are manifested not only in prejudiced language attitudes but also in a variety of perceptual, conceptual and behavioral language styles. The urban Kenyans feel Kiswahili has to be defended against English, a language that causes cultural and linguistic insecurity. It is this insecurity issue that makes urban Kenyans studied have positive attitudes towards Kiswahili without which they feel they will be socially punished.

As has been pointed out, language attitudes towards Kiswahili by urban Kenyans vary particularly depending on the respondents' age. It clearly comes out that older generation of urban Kenyans are less adaptable to the linguistic environmental changes and so have language attitudes that depict them as less willing to face the current novel linguistic situations in Kenya where English is the language of wider national and international communication as opposed to Kiswahili which is generally accepted as a national language. This age factor is the reason why over 70% of the urban Kenyan respondents interviewed (10 out of 12) and who were 60 years and over, had language attitudes that favoured Kiswahili. This result is in direct contrast with the attitudes of the young respondents who appeared to welcome the linguistic wind that is sweeping Kenya and the world as a whole where English is the main language. Therefore, by the older urban Kenyans rejecting this linguistic truism situation where English

is held in high esteem, the respondents tended to have lingual – sociopolitical attitudes that are conservative and rooted in the history of Kenya. However, the study's interpretation of such language attitudes by the older people of urban Kenya is difficult; this is because these older people differed not only in age but also in the kind of experience they had when they grew up. It is therefore the suggestion of this paper that longitudinal study of language attitudes is needed to determine the effects of chronological age on language attitudes towards Kiswahili in urban Kenya.

Another demographic characteristic that the study set out to test in connection with language attitudes towards Kiswahili in urban Kenya was sex. However, there was no evidence that women actually matter in lingual socio – cultural matters pertaining to language in urban Kenya. This apparent male chauvinistic notion would be consistent with the Islamic faith generalization that women have no much say where men are. This attitude was prevalent in Islamic towns like Mombasa. And given that Mombasa is predominantly muslim town, this Islamic teaching about women has to be adhered to (**refer to Utenzi wa Mwana Kupona**). This notion explains why in Mombasa out of the entire population interviewed, only four were women. Furthermore, the women's history can be traced from the predominantly non Muslim up country tribes (Luo and Kikuyu). Overall, this result suggests that the language attitude towards Kiswahili is gender biased.

Other variables whose linguistic attitudinal relationship the paper sought in relation to Kiswahili in the urban Kenya were place of birth and current residence in the urban Kenya. In Mombasa it came out clearly that upcountry people who had stayed in Mombasa had language attitudes towards Kiswahili that were similar to those attitudes of indigenous coastal people; they both had positive language attitudes towards Kiswahili when it came to the issue of national cultural identity but this attitude changed when it came to the social mobility aspect. When it came to the issue of place of residence in urban Kenya almost all respondents had similar language attitudes towards Kiswahili. In fact the study's respondents from Mombasa's estates like Bamburi, Old Town and Kiembeni had language attitudes that did not differ from those expressed by their counter parts in Bombolulu. Therefore, language attitudes towards Kiswahili in urban Kenyan are found to be determined primarily by congruence in attitudes rather than by place of origin or residence in urban Kenya. What this finding points to is that people acquire the attitudes of the people with whom they interact or share certain societal standings like socio-cultural levels.

1.6 Conclusion

The result on the language attitudes towards Kiswahili in urban Kenya has shown that language is a skill that is reinforced by reward or extinguished by non-reward. So if there is no reward in preferring a certain language, there is less likelihood to keep preferring the language. Therefore, in language preference in urban Kenya, the reward is that of social approval from other people when one speaks in Kiswahili. This social approval is what makes urban Kenyans to have language attitudes towards Kiswahili varying from very positive to very negative. In other words, the language attitudes in urban Kenya are traceable directly or indirectly to social-economic incentives that Kiswahili can offer. This relationship is in direct agreement with the fact that when a person is rewarded he seeks to repeat the rewarding experience.

Overall, as Adegbija(1984) rightly put it while referring to Sub-Saharan Africa, the language attitude towards Kiswahili by urban Kenyans differed from correspondent to correspondent in two distinct and consistent ways. The main points of difference centred on:

a) The need to be one people, and
b) The need to advance economically. Of the two, the attitude about Kiswahili and the need to advance economically received less weight for more interviewees were against it. On the other hand, the need to be one people carried weight in terms of language attitudes towards Kiswahili in urban Kenya.

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Effect of Irradiaiton Dose, Microwave Power, and Storage Time on the Free Radical Concentration in γ-Irradiated Black Olive (Olea Europaea) Seeds

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Abstract

Dosimetric properties of irradiated black olive seeds cultivated in Turkey were investigated through Electron Paramagnetic Resonance (EPR) technique. In unirradiated samples singlet EPR signals which are results of polyphenol oxidation in plants were obtained. Two satellite peaks on the sides of the central singlet signal attributed to cellulose radicals were observed after the samples were irradiated up to 10 kGy. In order to describe the variation of EPR signal intensity with absorbed radiation dose, several mathematical equations were tried. Moreover time dependency of the intensity of the central EPR signal of the irradiated sample was analyzed to study the stability of the free radicals. Based on the results of the study, it can be concluded that EPR technique can be used to identify unirradiated and irradiated black olive seeds even after two months.

Keywords: EPR; Food Irradiation; Absorbed dose.

1. Introduction

Table olives are a traditional component of the Mediterranean diet and are largely consumed in the world [1]. Turkey has an important place in the world's olive production, having a 7% share of total olive and 17% of total table olive production [2]. Treatment of food by specific ionizing radiations to improve microbiological safety and storability is one of the most extensively studied technology of the 20th century [3]. Ionizing radiation has been widely used to sterilize both foods and drugs [4-9]. In this context, it is important to find methods distinguishing between irradiated and

unirradiated foods and drugs. Unlike alternative methods, controlled exposure to gamma radiation kills microorganisms in a single procedure that does not involve a quarantine period [10]. Since using radiation treatment is prohibited or limited in several countries, it is important to control irradiation. To control this, analytical methods such as thermoluminescence or chemiluminescence have been used to distinguish irradiated from unirradiated foods. In this context, electron paramagnetic resonance (EPR) spectroscopy is one of the established methods for identifying irradiated food [11-13]. In addition, EPR technique is simple, specific and rapid for detecting radiation processed foods [14]. What is more, European Committee of Normalization (CEN) has released EN 1787 standards for detecting irradiated foods by EPR spectroscopy for foods containing cellulose [15]. Unirradited samples of dry spices and some plants exhibit only one weak singlet EPR signal. Irradiation increases the intensity of singlet signal, and forms two weak satellite peaks [16]. The aim of this study is to find out whether black olive seeds have been irradiated with ionizing radiation through EPR technique. In this paper, the variation of EPR signal intensity of the irradiated black olive seeds versus microwave power (mW), irradiation dose (kGy), and storage time (days) was investigated.

2. Experimental

Seeds of black olives cultivated in Marmara region, Turkey were used in this paper. The seeds of olives were scraped clean of soft tissue and powdered in a grinder. Almost the same weight of sample (≈30 mg) for each irradiation dose was placed in EPR quartz tubes. Powder of black olive seeds was irradiated at 0.5, 1, 1.5, 3, 7, 10, 12 and 15 kGy by a ^{60}Co-γ ray source at room temperature. After the irradiation, all samples were kept in plastic bags, and left in the dark at room temperature. EPR measurements of all samples were taken 2 days after irradiation to avoid any short-lived paramagnetic species. The EPR spectra of both irradiated and non-irradiated powder of black olive seeds were recorded at room temperature with a bruker EMX model spectrometer operating at microwave power 0.499 mW, microwave frequency of 9.8 GHz, modulation amplitude 0.104 mT, magnetic field modulation frequency 86 kHz. The g factors were calibrated by comparison with a DPPH sample (g=2.0036).

3. Results and discussion

3.1 EPR spectra of unirradiated and irradiated black olive seeds

EPR spectrum of unirradiated black olive seeds recorded at room temperature were given in figure 1. The EPR spectrum of unirradiated sample exhibits a sharp and clear singlet EPR signal centered at 2.0088 without any hyperfine structures. This g value obtained compares well with those reported in the literature [17-19]. The origin of this singlet line is not clear. However, the signal observed before irradiation can be attributed to semiquinone radicals produced by oxidation of polyphenols naturally present in plants [20-22]. The presence of these radicals in plants has also been attributed to photosynthesis, drying and other natural process [23]. Although irradiation produced no effect on the shape of this singlet signal, it caused a significant increase in signal intensity in the studied dose range.

Olive seeds irradiated to increasing doses up to 10 kGy show extra signals compared with the unirradiated samples. Figure 2 (a) and (b) show olive seeds irradiated at dose of 7 kGy and 10 kGy respectively. After irradiation at a dose of 10 kGy, while any change in g- factor not produced, a significant increase in signal intensity of single central line was observed. Additionally, two weak satellite peaks marked with axes on the sides of central signal attributed to cellulose radicals were observed at g_1= 2.0262 and g_2= 1.9894 with a separation of 6 mT [24-26]. These new signals observed at the right and the left of the main EPR signal with an intensity of 1:2:1 are the evidence of

radiation treatment [27]. EPR signals of the irradiated black olive seeds are distinguishable from the signals of unirradiated sample.

Firstly, the intensity of central singlet EPR signal of both unirradiated and irradiated samples as a function of the microwave power was investigated in the range of 0.1-20 mW at room temperature. While the curve belongs to unirradiated sample starts to saturate almost at 3 mW, 10 kGy irradiated sample saturates at almost 4 mW (Figure 4). As it is seen from the figure, microwave saturation features of unirradiated and irradiated samples are different from each other. These results also indicate that the origin of the radicals present in unirradiated and irradiated samples is different.

3.2 Dose-response curve

Aside from qualitative detection, EPR can be used for dose estimation [28]. Therefore, the effect of increasing radiation dose on the spectra of olive seeds was studied. Samples of black olive seeds irradiated in the dose range of 0.5-15 kGy were used to construct dose-response curve. Variation of peak-to-peak central singlet signal intensity with the applied radiation dose is presented in Figure 5. It is seen, the experimental and calculated data was found to agree well with each other. The g-factor and line widths do not change in the studied dose range. It is observed that the intensity of the central EPR signal increases gradually with the increase of irradiation dose. Several mathematical functions were tried to describe evolution of the central EPR signal with absorbed radiation dose. Linear, exponential and polynomial functions are frequently used for this purpose [29-31]. In these functions, I and D are used for EPR signal intensity and treated irradiation dose in kGy, respectively and other parameters are constants to be determined. If the values calculated from these mathematical functions together with correlation coefficients are taken into consideration, the dose response curve of olive sample is explained best by polynomial function (r^2=0.9979). It should be noted that no attempt has been made to force the regression through zero. The numerical results of the fitting are presented in Table 1. Dose-response curve of the irradiated sample is seen to be quite compatible with linear, exponential and polynomial functions.

3.3 Radical decays at room temperature

Tests were carried out to investigate whether storage had an effect on the free radicals concentration [32]. The powder of black olive seeds irradiated at a dose of 10 kGy was studied to determine the effect of storage on the signal intensity of radiation-induced free radicals. Samples were kept in the dark at room temperature over a period of 60 days, the EPR spectra were recorded periodically during this storage time and results are shown in figure 6. It can be clearly seen that the signal intensity of the main central signal decreases rapidly in the first 10 days then it decreases more slowly. As it is seen, the decline in the signal intensity is about 29% during the first 10-day period and about 73% over a 60-day period. From the experimental spectrums recorded 26 days after irradiation, no satellite peak was detected. The results indicate that EPR spectroscopy could be used to distinguish irradiated black olive seeds from non-irradiated ones during the storage time.

4. Conclusions

Non-irradiated samples of black olive seeds represent a singlet EPR signal. After irradiation of the samples with gamma rays up to 10 kGy, two satellite peaks, with a separation of 6 mT, at the left and right of the main EPR signal were observed. The presence of these satellite peaks can be used as evidence of irradiation treatment. Irradiation up to 10 kGy makes these satellite peaks more visible. In addition, irradiation up to 10 kGy increased the intensity of the main signal without any changes in g-factor. The EPR signal intensity of the main signal was found to depend on the absorbed radiation dose. It can be concluded that, irradiation causes an increase in the amount of free radicals. The powder of black olive seeds irradiated at a dose of 10 kGy exhibited a singlet and

observed to be stable for 60 days. It was also found that samples irradiated at a dose 7 kGy and 10 kGy exhibited different microwave saturation features. These results indicate that the origin of the radicals present in unirradiated and irradiated samples is different.

The analyses clearly revealed that EPR technique easily enables us to identify and distinguish radicals that are naturally present and produced after irradiation with gamma rays in black olive seeds. Additionally, EPR measurements are non-destructive and require minimal time for sample preparation. However, further studies are needed to identify radiation sensitivity of foodstuffs. The investigation of radiation sensitivity of the black olive seeds can be helpful for similar studies.

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Figure Captions

Figure 1. EPR spectrum of unirradiated black olive seeds recorded at room temperature.

Figure 2. (a) EPR spectrum of 7 kGy irradiated black olive seeds recorded at room temperature.
(b) EPR spectrum of 10 kGy irradiated black olive seeds recorded at room temperature.

Figure 3. (a) EPR signal intensity of unirradiated black olive seeds as a function of square root of microwave power.

(b) EPR signal intensity of 10 kGy irradiated black olive seeds as a function of square root of microwave power.

Figure 4. Dose-responce curve of black olive seeds.

Figure 5. EPR signal intensity of black olive seeds irradiated at a dose of 10 kGy as a function of time.

Table 1. Mathematical functions calculated for dose-response curve of gamma irradiated black olive seeds.

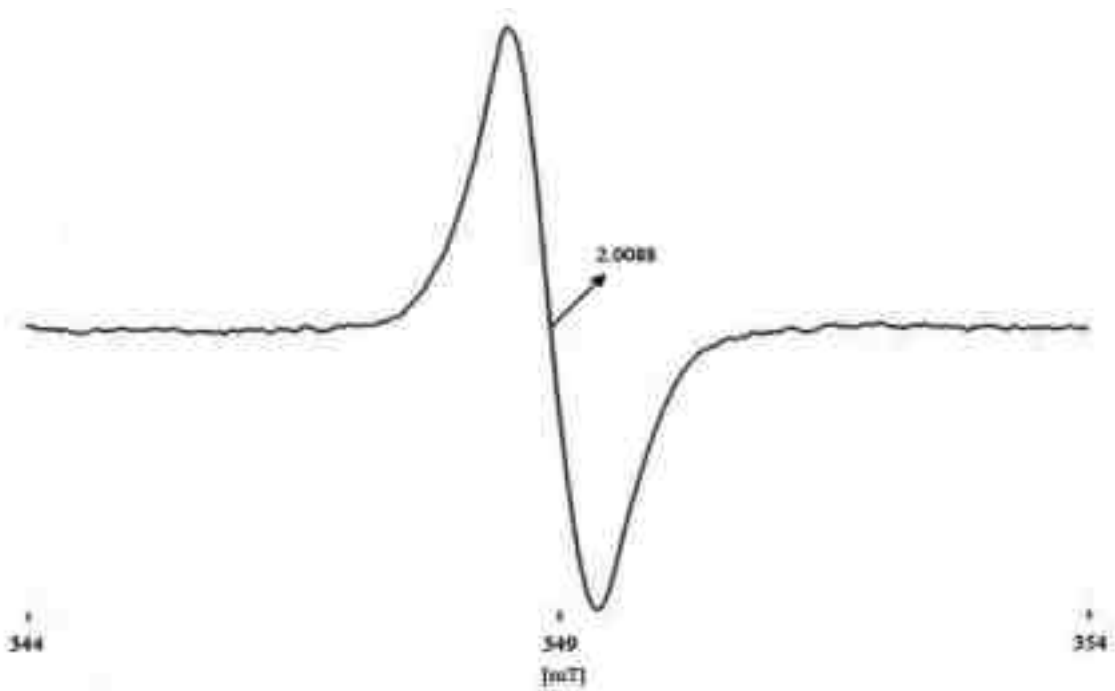
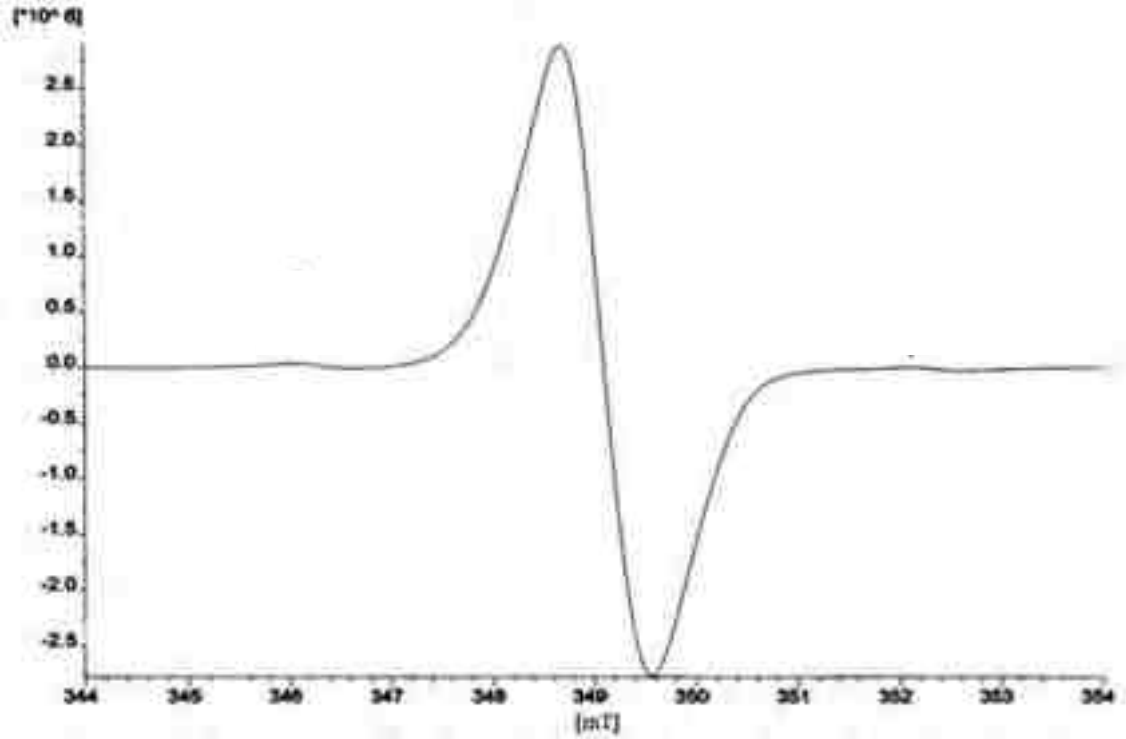
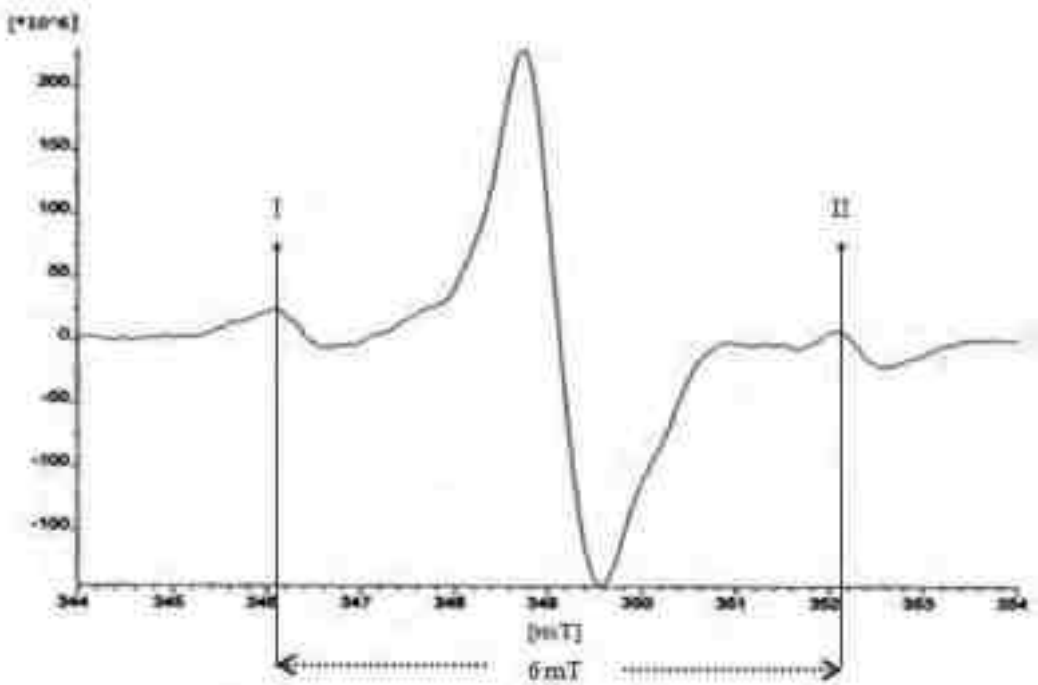


Fig.1


[*10^6]
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
344
345
346
347
348
349
350
351
352
353
354
[mT]

(a)


I
II
[mT]
6 mT

(b)

Fig. 2

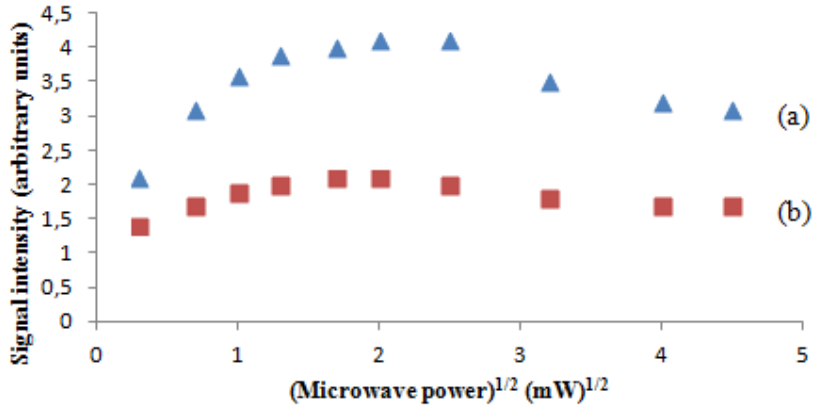

Signal intensity (arbitrary units)
4,5
4
3,5
3
2,5
2
1,5
1
0,5
0
0
1
2
3
4
5
(Microwave power)1/2 (mW)1/2
(a)
(b)

Fig. 3

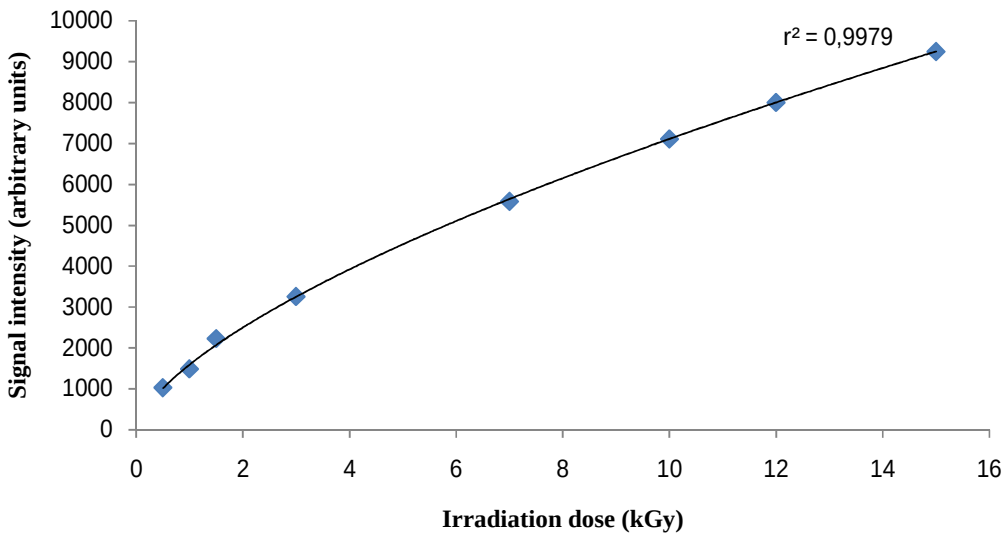

Signal intensity (arbitrary units)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
2
4
6
8
10
12
14
16
Irradiation dose (kGy)
r² = 0,9979

Fig. 4

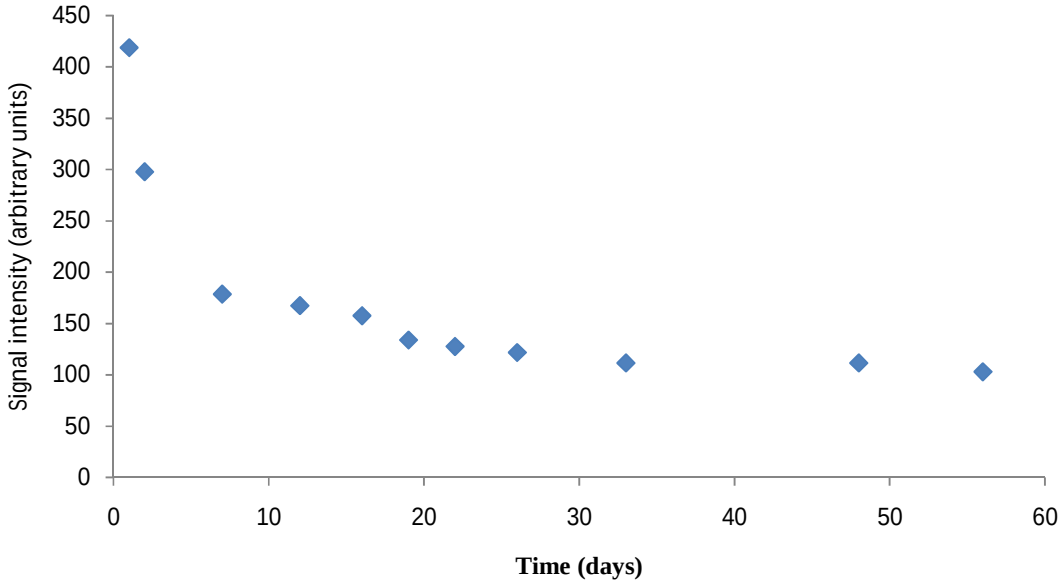


Fig. 5

Table 1

$I=a(D)+b$	a=563.84 b=1221.9	r^2=0.9875
$I=cD^f$	c=1598 e=0.6481	r^2=0.9977
$I=-gD^2+hD+j$	g=15.923 h=794.15 j=834.35	r^2=0.9979

ANCHORING ON CONTROVERSIAL ISSUES AND FUNDAMENTALS

"An Associative Review for Growth, Unemployment and Inflationary Thoughts Reflecting Tanzania"

***Dr. Msaki Juda Leonard**

Ongubo John Momanyi

Mr. Kiwambe Reuben Y.

ABSTRACT

The paper provide a theoretical paradigm of available classical theories be linked to an empirical environment through a review of fundamentals in 3- associative economic and dynamics. The key methodology passes across by scrutinizing questionable values and interpretation aiming at social re-engineering to social economic re-engineering based on economic argument of the current platform. Therefore attracts more scientific and theoretical thought provoking attitude to re-orient our thinking mechanics on the 3-associative variables being growth unemployment and inflation. The core aspects of the theoretician are to stimulate a representative model and structure on the behavior of reality . . . .the present literature stimulates readers though reflections on "questioning aspect" of available theories as reflected to the present interpretation of 3-associate variables briefly to capture the ground to be re-thinked and be contributed by future scholars.

Therefore Robert Solow makes it clear that "It ain't what you don't know that hurts you; it's what you know that ain't true! (A Nobel Prize winner commented). . . Should we therefore re-think available theories? This becomes the beginning of research attitude and knowledge seed for new ventures.

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KEY WORDS:

Unemployment, Growth, An associate review, Dynamics Inflation, fundamentals, Exploratory, Paradigm, Pschodynamist, Self efficacy, Life, Disillusionment, GDP, Consumer Price Index Set, Scarcity, Re-engineering, 3- Dimensions, Dogma, Distributive effect.

CORE CONTENT

- Abstract
- Introduction to structure and key Variables
- Desperate Search For Economic and Financial empirical
- Variables -3 dimensions reflected Disillusionment
- Conceptualization of Re-definitional Aspect : Reengineering
- Tapping the power of Reflective Economics: Efficiency
- Quantitative window –dressed and 3- dimensions
- Tanzania, Kenya, Uganda-2004, (2000b)
- Millennium –Variation: Macro-Economic Indicators Analysis
- Average Analysis of Ratio ($R_2 – R_7$). . . . . From equation 1
- Qualitative – Quantitative 3- Dimensions Questioning
- Output requirement /Active Macroeconomic Distribution Ratio
- Millennium- variation: Macroeconomic indicators analysis
- Average Analysis of Ratios: $R_2 – R_7$ East Africa
- Conclusion
- BIBLIOGRAPHY

METHODOLOGY

Theoretical Paradigm review in the context of Present Economic and Social changes, where by the current paper tries to absorb critical Questioning.

I. Introduction to Structure and Key Variables

The central constraint to be discussed is the understanding and review of the core variables that almost distort the key parameters of economic pace in negative or positive sense under developmental connotation. The structural face under discussion is not only a total review of variable doctrines but a paradigm shift to re-thinking aspect on growth rates, inflationary concepts and employment focus in the world of finance and economic predictions.

The paper therefore acts parallel in thinking of the 3- dimensions per what has been devoted by economists towards modeling and quantifying in number. Systems the vanability of the variables being a phenomenon of the economy . . . . 6% as the growing rate of the economy in Tanzania seems to be less meaningfully to the rural natives as to the lecturer in economist . . . . . it is frightening due to poverty paradigm not only in rural areas but clear incidence in urban, that the side of lecturer who takes the scientifically, fails to discuss the model and assimilate in the empirical perspectives, as the numbers could not be translated to his real life needs and games from such rate of growth (6%).

The present literature therefore with all reasons, takes the readers to read and create "own dialogue" as a study in contrast through own values interpretation of 3- dimensions of economics and finance.

II. Desperate search of Economics and Financial Empirical: Psycho dynamism

The hunt for personal economics and finance has been one of any core strength during studies. This cannot be done without critical review of the existing dogmas . . . . This creates a room for review and synthesis of technical bases in economic and finance to accelerate the pace of research and knowledge base building. If man designed to understand what he doesn't understand . . . . . therefore one should always stay passionately curious!

Defining a learning process through desperate search becomes a process by which experience produces a relatively enduring change in an organism's behavior or capability which can be measured (measured – value) by changes in performance. Simulating an economy being a growing organism, changing in economic performance through the 3-dimensions variables offers an opportunity for the economy (an organism) to learn through changes in performance . . . . . *what is an economy? Who has to learn? Who has to perform? What should be the metric value to measure performance of organism?* This therefore takes the journey of analyzing and re-construction of theories through re-thinking mechanism . . . . The present literature therefore through economics and finance aims at 3-dimensionsof intelligence, being analytical intelligence, practical intelligence and creative intelligence through the field mentioned.

Intelligence in this paper means the ability to acquire knowledge, to think and reason effectively and to deal adaptively with the environment. Economist always has their own concept, experience and at last end-up with non-distorted is perception. This is the middle path of the roots between experience and incongruent self concept.

The critical part is to question how our dogmas, principles and theories become fully functioning as integrated between self concept and experience in phenomenon. Therefore there is a desperate case confusion perspective between assimilation, which is the process by which new experiences in economic

or financial variables are incorporate into existing schemes and accommodation being the process by which new experiences cause existing schema to change. Think of uneducated – rural based grandma, being an economist you want to tell her that Tanzania is growing at an average rate of 6% annually . . . . vis-a – us telling her that her cows have increased this morning as one cow has given birth of a calf and the number now is no longer two but three . . . . Where do you see the real rate of growth interms of output or wealth? The present theories and dogmas being a psychodynamist, the author tries to reflect the cause of the behavior in a dynamic interplay of inner forces that often conflict with one another but focus on unconscious determinants of behavior.

III. Variables – 3 Dimensions Reflect on the Environment Disillusionment Contexts.

Bandura (1997) highlighted that "A key factor in how people regulate their lives is their sense of self efficiency: their beliefs concerning their ability to perform the behavior needed to achieve desired outcome" how do we sense inflation rates? By reading news papers or by buying necessary commodities? What should be our desired rate of economic growth? 6% or 10% from 6% can we feel it is a desired rate of change? Can numbers reflect the truth in people's lives? What "life"? A largely process of adaptation to the circumstances in which we exist? We always are disappointed in some body or something existing (disillusionment). Think on fuel prices in Tanzania and reasons from economist theories. . . . What percent of population takes up the theory of inflation? How do we reflect the number given in our concept of life, lower confidence theory and risk adverse attitude theory in people and government machinery? Think on growth rate for example from the theorist Harrod Domar that *"Growth rate slows down if there is a decline in employment relative to population and the poor rate of growth of the capital stock"* Domar takes the theory which sanctioned the overtrading significance of the capital accumulation in the overtrading significance of the capital accumulation in the quest for enhanced growth. . . . Where do we stand from this theoretical perspective amongst the economic variables? Economist uses numbers as part of arguments not substance in the community! How can one measure greedy level in economic resources Vis-a Vis wealth levels to be re-distributed back to the most poor?

How should our economic variables be used to secure peace and harmony. . . . Philosophically numbers are there to harmonize the world (distributive effect). Can economic and financial variables measure both material dimension, social dimension and spiritual dimension? Where is the qualitative assessment to probe the 3-dimension variables in our society? In our economic variables, assessment structure and methodology in number do we really integrate material, social, cultural and spiritual measurement in terms of 3-dimensions variables? How can we increase local domain satisfaction? What should be the impact assessment to the level of growth – inflation and unemployment? What should be effective tools in monitoring positive and negative change mechanics? (Beyond quantitave indicators), takes all to indigenous developmental approach in measuring and interpretation therefore qualitative nature. Development for that case is not purely an economic phenomenon, it goes beyond . . . . . encompasses more than material and financial dimension of people lives. . . . A call for re-organization and re-adjustment of entire economic and financial and social systems to suit particular society its now an evidence in Europe and America based on their economic failure behavior paradigm. Why this so is it because of classical finance and economics theorem are losing power to predict? Why failing role in employment in USA, Africa, and everywhere. Where is the balance theorem for policy maker, theorist and imperialist?

Global financial systems and institutions have been growing so complex, that they become increasingly paradoxical and challenges in terms of cost, practice and regulatory frame work. . . . Leave alone prediction powers attached, for the policy make and practitioner to identify and assess risks in dynamic variables. It is in this aspect the current literature calls for theoretician to re-think on the dogmas in finance and economics not playing with number crunching dynamics to confuse the society but to re-engineer the concepts to be able to translate and transform people's needs (reflecting on their own environment) . . . . Currently for poor people promotion of growth rate is not the top priority! But feeling and translate growth rate from 6% to 10% in their lives make sense what then should be model to translate the whole dynamics to where the society wants to reach tangibly.

IV. Conceptualization of Re- definitional Aspects and Re- engineering the Theories.

Mwalimu Julius K. Nyerere conceptualized the concept of poverty back in 1970s that *"Poverty is not the real problem of the modern world. For we have the knowledge and resources which enable us to overcome poverty. The real problem- the thing which create misery, wars, and hatred among men- is the division of mankind into rich and poor"*. Redefining the concept makes sense to be able to turn useful in time and environment. John Maynard Keynes concludes by saying that: *"it is idea, not vested interests which are dangerous for good or evil"* in their article Rethinking Growth Roberto Zagha et al (2006) comment that , *"Economist are re-reconsidering what they really know about growth and how to go about formulating policies in the absence of reliable models"* . . . . developing countries experience a years of negative per capital growth roughly once every three years , where in East Asia the average is one –half (1 and 1/2) that rate . . . what should be a reciple for economic performance? Should we avoid downtrends and keep growth steadily? What should be the right diagnosis in future? We all philosophies whenever we attempt to handle abstract ideas in theories and it matters so much whether we do it well or badly. Keenly there is a space of difference between reading economics and finance, understanding economics and finance and doing economics and finance! Feedback should be for social-economic value.

Questioning the literature, central problem becomes not to modernize the philosophy in the sense of technical, social economic perspective, rather re-thinking, re-engineering or reorient of sort for growth, development and prosperity of community, where numbering is not the solution but fitting on peoples and opportunities and be able to predict and explain the whole dimension in terms of people's needs and solutions . . . . We need to re-think!

The summary through economic developments in the context of GDP gross domestic product and inflationary developments in Tanzania by the bank of Tanzania indicates that "the real GDP growth rate of 7.1 % and the economy is expected to continue growing at rates above 7% in short and medium terms despite inflationary pressure and various external stock including high oil prices. Prospect for higher growth in 2008 was based on fundamentals are anchored needs multiple review of growth employment associated with the rates of inflation. . . . the level of expansion in economic activities thinking on the same limited base of sectors of economy does not offer much in terms of predictive power of the theories behind economics of scale and economics of scope vis- as- vis economies of scope.

Describing the theory behind productivity, inflation and growth prediction based on the above cost side relates economies scale vis-a vis economies of scope as "the degree to which average unit cost to produce or offering service falls as its output of production increases and the degree to which cost synergies generated by producing product or services respectively. Small and middle scale industries which serve as engine for economic growth are not only few but they not developed since their

establishment. The Guardian touches a challenge of unemployment as being quoted that among 600, 000 or 700, 000 youths who are not counted for the labour market in Tanzania only 40, 000 are employed according to government sector. (*The Guardian 20th February 2008, p.5*). Investing on youths without critical forecast of the market is an investment with delayed opportunity.

V. Tapping the Power of Reflective Economics: Improving the Economic Efficiency

The Daily news of October 18th 2011 p.1, furnishes on an alarming increase of inflation in terms of food and energy prices touching 16.8% which increase financial strain and making life even harder. The sharp rise from 14.1% in August, which is an increase of 2.75 in a single month. How should we narrate the rates focusing on job creation, investment climate in Tanzania, exchange rate discussion and the essence of policy control mechanism? How can one control other factors which appear to be uncontrollable? Much need to be re-thinking in terms of monetary and fiscal policies.

Thinking on the current linkages between unemployment, rate of inflation and growth no single solution can serve the distorting apparatus. Though central bank of Tanzania (BOT) tries to focus on short- term measure of proposing tight monetary policies which would not solve the central part of the problem. . . . Through East African region Uganda has the highest inflationary rate and the lowest rate is possed to Rwanda 28.3% and 8.8% respectively. Energy in Tanzania has possed a sensitive part of the economic dynamics where serious investment on the sector needed. Oil prices cannot be controlled through market theories; innovative decisions to create own sources of energy are critical. Farmers are unable to meet the high transportation cost of agricultural produces, where there is both – because soaring in food and fuel prices . . . less investment, less productivity, less employment. . . . Less economic growth more creation of economic gaps and poverty variables. Productivity boosting can lower inflation for a long period. Essential goods need to be made available to lower scarcity which prevails the shooting price levels. Recent experience from Rwanda shows the practical side of the above, as tracking and tame down the rates through productivity and the right investment on the core aspects of the economy. Rwanda economy protects itself from inflationary distortion through natural methodology economics. . . .How? A good harvest of food products which takes 1/3rd of consumer price Index sat consumed in the country is made available locally.

Do we need supermarket imported brands in Tanzania? Having the "imported basket" could mean having imported inflation and having exported job vacancies from Tanzania perspectives . . . where should we invest and grow? Rwanda suffers from the range of 8.8% inflation due to imported drivers being fuel supplies contaminated by inflationary prices from the neighbors for the remainder of 2011 but appears to be the lowest amongst East African economies. Tanzania needs to re-think on economic fundamentals associating with growth, unemployment and inflationary drivers. Rwanda reflection takes it all on reduction and regulation of fuel tax to mitigate imported inflation and fuel ice related transportation costs being a significant part of economy consumer price index set. Generation of inflows and investment climate for the country economic performance is also significant to the most necessary sectors to generate not only outputs and inputs but to regulate high rate of unemployment and re-generate possible avenues of growth variables.

Tapping the power of reflective economics, thinking is an inflectual habit to a problem and should a response. The absence of problems drives us to the direction not to think. . . . Having so many economic problems we need to re-think on existing fundamentals . . . . An association review and reflecting learning process may help the economic re-engineering.

In the world of economics and finance long term winners are the one who can strategically sustain their growth by edging out from their core fundamental theories by an extension of innovative usage of their resources, policies and human capital into existing or new markets . . . aligning innovation with economic cydes. Sustaining commitment to investment in not only resources but also human capital to discharge productivity and efficiency should be our key economic challenge. Maximization of labour efforts to boost growth through exploitative of self motivation spirit for self employment can be a central mechanism to discharge negative patterns of unemployment and inflationary dynamics. . . . One might question the problem of labour incentives economy in the context of limited level of output based on short supply of capital in Tanzania.

How can re-distribution of economic variables (resources) be done to rescue the situation? How can we sustain an optimum level of investment to serve our 3- dimensions status under discussion?. . . . it appears our class – models are almost failing. . . it appears our class- models are almost failing . . . . Alvin Toffler comments therefore *"The illiterates of the future are not those who cannot read and write but those who cannot learn, unlearn and re-learn"* controversies in economics and finance brings an opportunity to re-think and learn at the practical levels of our fundamentals though prominent theories and dogmas much needs to be researched in the blurred era of economics and finance objectively. The models and theories existential failure is not only in Africa but also Europe and America which calls for re-thinking mechanism to translate key issues into reality of today. Economic diagnosis is not a medical diagnosis it is an economic theory re-engineering for better conceptualization.

VI. Quantitative Window – Dressed and 3- Dimensions Economic Problems

In economic theory structural and cyclical unemployment are usually regarded as disequilibrium phenomenon in the sense that they reflect excess labour supply to existing wages (Campbell and Brue, 1995) Discussing the parameter of "existing wage" appears to be abstract as it does not concentrate in fractuating demand value through price and availability . . . . This becomes even complex while measuring the integration process measure and exchange rate as inflationary rates . . . . Assumptions in such prulistic operation hide the reality on the ground and thus become complicated in driving the policy systems and solutions through strategies . . . . how can one explain comfortably the essence of inflation, growth or unemployment with assumptions frame work been as an assignment to be ignored? The challenge for example though Africa has been exposed to an average growth Index of 6% the challenge of the continent is that it faces unmanageable and countries are facing a downturn. The rates of unemployment should be linked to growth and inflation rates as a 3- dimensions analysis. Further one can re-consider the pattern and fundamentals based 3-economies in East Africa – The main economic indicators to review economic drive, efficiency and effectiveness. Whether or not crowding out does not occur depends upon whether or not the "ceteries paribus" assumptions hold and on the values of interest elasticity's. This becomes a controversial platform in current macro economy structures . . . increase in investment and government expenditure does not necessarily imply an increase in public output, neither does it always imply a reduction in efficiency focusing on calculated data (estimate) what real efficiency accumulates to economies by observing fundamentals data and trendy pattern? How do the data focus on pro-poor situations? Do they interpret them? Right to the 3- Dimensions and other multiple variables what can be re-considered?

Population growth and associated parameters are now be-reconsidered to increase labour force . . . . Will it stimulate growth of the economy does large labour force means more productive workers? More contain serious conditions for creating employment for the natives . . . . to support their production, market and income distribution. Absence of such opportunities hampers economic growth. Africa needs more action than a more advocacy.

The formular remains that, how governments manage their internal affairs, determine the extent to which their people benefits from globalization . . . but also the people (labour) should have knowledge, skills and competence to be associated to fundamental social and economic development. One can question based on statistical comparisons , indicators and economic policy reforms as a major influence on economic performance in 3-countries . . . . Why such big differences? The theory of economic dynamics does not take it all subjected to empirical changes, though the impact could be viewed marginally in the power of statistical and econometric substance…Policy mechanisms should be reflected not only quantitatively but also qualitatively in positive and negative lives of the people.

Table 1: Tanzania, Kenya and Uganda Macro – Economic Indicators Comparatively

GDP 2000 (ACTIVE PERIOD)	**KENYA**	**TANZANIA**	**UGANDA**	**SUB-SAHARA AFRICA**	**INDICATION**	**CORECTION**
GDP (mill.const. $ US)	9876	6419	7728	362493	DIFFERENCE	Δ_S
GDP/capital 2000 :1995 $ US	322	182	332	617		
Current international Dollar	1003	501	1152	1797		
Av. Annual Growth in GDP	↑↓	OUTPUTR	EQUIRM	MENT ↓↑	DIFFERENCE	Δ_S
1999-2000						
TOTAL	2%	3%	6%	2%		
Per capital	-1%	0%	3%	0%		
Percent of GDP By :						
Agriculture(2000)	20%	45%	42%	17%		
Industry (2000)	19%	16%	19%	31%	DIFFERENCE	Δ_S
Services (2000)	61%	39%	38%	53%		

Income distribution Gini coefficient (o = perfect equality)	ACTIE NEEDS	MACRO – AND PER	ECONM FORMAN	IC DIST CE	RIBUTIONS	
(100 = perfect inequality)	45	38	37	N/A	DEFFERENCE	Δ_S
Percent of total Income earned by 20% of population rich	51.10%	45.50%	44.90%	N/A	DIFFERENCE	Δ_S
Earned by poorest 20% of population	5.60%	6.80%	7.10%	N/A	DIFFERENCE	Δ_S

Source: Dr. Msaki J. L Reconciled from URT (2004) GOK (2001) - Economic Reports

VII. Qualitative and Quantitative 3- dimension Questioning and Interpretations

The above table provides data to be interpreted for example why 20% of the poorest of population income is at the tune of 6.80% against 5.60% in Tanzania and Kenya respectively? Are poor people empirically working quite harder in Tanzania than Kenya? Are more poor people are employed in Tanzania than Kenya? What cultural and social fundamentals are we having from such figures? In comparison the GDP per capital, 2000 (in 1995 US dollar) Uganda appears the best with 322$ US in comparison to Kenya 322$ US and last Tanzania 183$ US. Is it the question of economic efficiency or labour force contribution? Or less inflationary rate or exchange rate? Why that Tanzania is stood last in terms of GDP in million constant US $ as from 9876, 6419, 7728 among Kenya, Tanzania and Uganda respectively? Good and better macroeconomic variables management attracts investment and donor supporting in terms of aid and debt relief.

From the table one should create enough questions on the differences focusing on the particular focus (example Tanzania) fundamentals of the micro-economic issues. Are these estimates why econometricians do not narrate on errors in figures or assumptions on such fundamentals practically? Semboja Haji and MFPD, (2002) concludes that *"Despite the good policy performance and the significant macro- economic gains the East African countries have not managed to overcome their largest development hurdles such as eradication of object poverty and youth unemployment and underemployment"*. Basically, the fundamentals could be decorated by statician (quantitatively) and sometimes the figures do not show the truth about the qualitative nature of people's problem and some important parameters are window – dressed such as distributional efforts in terms of growth to the 3 – dimension problems

Table 2: Average Analysis of Ratios ($R_2 – R_7$) From Equation 1 in East Africa

Classifications (Average)	**R_1**	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**R_7**	
Output (Average) **(Million)**	GDP 8007	GDP 8007	GDP 8007	GDP 8007	GDP 8007	GDP 8007	GDP 8007	
Distribution (Active) **(Average) Percentage**	Industries 18	Service 46	Agriculture 35.6	Poor income 6.5	Rich income 47..2	Inequality 4.0	Income level Rich- poor 47.2 – 6.5	
							a	**b**
Ratio Equation 1	444.83	174.1	224.9	1231.8	169.64	200.18	169.6	1231.8

Source: Dr. Msaki J. L. Calculation on Average Ratios from Table 2 Indicators.

The average scores show the difference especially on average GDP to inequality (ratios – R_6) and GDP to Rich income (R_{7a}) and GDP to poor income (R_{7b}). The aggregate effect is much as we approach the East African community were some countries are more industrialized and some with less industrialization "rich" to "poor" incidence is yet to be measured concretely to create a distributional wealth equitably, answering equation 2, 3, 4, 5 and more critically the 6^{th} on per – capital management, to focus on per – capital growth, Tanzania, Uganda, Zambia, Angola, Malawi, and Rwanda. . . . Rwanda appears to come out of the jungle by creation of fast tracking growth in terms of GDP. Its fiscal policy and monetary policies have gone through transformation focusing on qualitative management than quantitative observation and theoretical ventures private sector has been quite active in spearheading macro – economic indicators in relation to macro. . . . This need to be learnt by other countries. Internal savings are crucial for sustainable economic growth to re – focus on 3 – dimensions Tanzania is among of countries with potential growth and better environment whether social – economic fundamentals and peace which can be re – enforced to re – engineer economic drives such as voluntary savings to achieve better GDP category. Internal savings as opposed to external savings which flow to developing countries like Tanzania in the form of aid, FDIs and loans play a crucial role in sustainable economic growth of these countries. The challenge is how to mobilize taxes in Tanzania as make the economy dependant.

Technically the figures appear static and enhances static evaluation empirically the economies are dynamic in nature (Δ_s) / t. This literature therefore provide an insightful journey in the context of 3-dimension macro - economic variables for Tanzania to re-think on policy issues and some reflections from somewhere else. Industrialization for Tanzania appears to be weak and even its core contribution

from agriculture is less than 50% around 45%. Therefore macro – economic institution need to be reconsidered as it support 80% of the population, the output os still small in terms of GDP in million constant at US $ for 2000, Tanzania stands to be the last from Kenya (9876 mill.) and Uganda (7728 mill.) . . . . Tanzania (6419 mill.). Basically the theories do not extensively explain a differential note and pitch between active Macroeconomic Distribution and output requirements dynamics (↑ ↓) vide, table 1 figure. Where the ratio for each economy needs a mentainance of high level ratio of Output Requirement (production). . 1

Active Macro-economic (Distribution)

A controversial comes from recategorization; w How? Who is poor? Who is rich in each of the economies? Why 20% estimate the rich: poor at the constant note of 20: 20? Practically we perceive Africa in terms of income distribution to have more poor people inclined to pareto ratio 80:20 from table 1, table 2 is recreated based on simple ranking methodology, to scrutinize the best and the worst in terms of variables (selected) . . . . . this is the qualitative re – orientation from quantitative controversies on the fundamentals to reflect a 7- dimension fundamental indicators, where by 1- dimension inflation was not taken on board. For the present study employment (sector wise) and growth (GDP) were analysed based on 2000 - 2004 figures to reflect the East African economies, to focus on equation 1, perception (distribution) a scale of the best to the worst viz (B) to (W) respectively. The average is indicated by (A) see table 3 analysis:

$\left(\Delta_s / t\right)$ . . . All figures are exposed to change with time…Dynamic Variation Approach.

Table 3: Millennium – Variation: A Macro –Sectoral Economic Indicators Analysis

ECONOMY(E)	INEQUALITY (100- GINI)	RICH INCOME [20%]	POOR INCOME [20%]	AGRICULTURE (2000)	INDUSTRIES (2000)	SERVICES (2000)	2000 GDP
KENYA	45%	51.10%	5.60%	20%	19%	61%	9876
	1-R	1 - R	3 - R	1 - R	1 - R	1 - R	1 - R
TANZANIA	38%	45.50%	6.80%	45%	16%	39%	6417
	2 - R	2 - R	2 - R	1 - R	2 - R	2 - R	3 - R

	37%	**44.90%**	**7.10%**	**42%**	**19%**	**38%**	**7728**
UGANDA	**3 -R**	**3 - R**	**1 - R**	**2 - R**	**1 - R**	**3 - R**	**2 - R**
INTERNATION THEORY	**UGANDA (B) KENYA (W)**	**UGANDA (B) KENYA (W)**	**UGANDA (B) KENYA (W)**	**TANZANIA (B) KENYA (W)**	**KENYA/UGA (B) TANZANIA (W)**	**KENYA (B) UGANDA (W)**	**KENYA (B) TANZ (W)**

Source: Dr. Msaki J. L Review and Analysis: Ranks from Table 1: URT/GOK 2001/2004

Table 3 above; shows individual Economic variation and performance ranks, where 6 parameters could be interpreted roughly being (6 – P), bellow

1. Who attracts more investors, donor and market essentials fundamentally?

2. Are poor comfortable in the above economic and social distribution? who has the best in terms of poor income earners (at 20% of population)?

3. Where in 3 – economies rich – (at 20% of population) enjoy much of GDP? The income needed to be re- distributed over the concerned population in quality and quantity.

4. What is the rate of economic productivity? Who has got the highest in GDP? And why?

5. Who suffers most among the three economies in terms of quality inequalities?

6. How does the GDP per capital distributed among the individuals? (national wealth equity)

CONCLUSION

From table 3, more interpretation is done on the ratios between output requirements and active macroeconomic distribution based on the economic gain – the GDP which is expressed in equation 1 comparison. What are the qualities of our fundamentals? What is the labour force participation and unemployment rates in rate of population growth a prospects or a challenge? Seers (1969:3) perhaps puts up a basic question methodology by seeing and visualizing the meaning of development in the context of 3 – dimensions as he asserted that "what has been happening to poverty, what has been happening to unemployment, what has been happening to inequality? If the above dimensions have been happening to propose the sense of declining from high level, then beyond doubts this will be the essence of development for a particular country. Tanzania illustrates or demonstrates a mismatch between ideology and opportunity that is somehow corrosive amongst East African countries as commented by the political economy of economic growth in Africa (2000), Cambridge University Press.

Table 3 of the literature shows an analysis of Tanzania parameters in comparison to other East African countries. Sub- Saharan countries have much to reflect on the dimensions through numbers

(quantitative approach). To conclude the present objectives of development in which the economic need to re – focus: . . (More on people's lives and touches)

- Increase the availability and widen the distribution of life sustaining goods and services such as food, shelter, health and protection to all members of society.

- Raise levels of living including and in addition to higher income, provision of more jobs or employment opportunities better education and training with more attention to humanistic and cultural values . . . [this is what *Dr. Msaki J. L. (2011)* calls hybridization concept of economics] needs to be institutionalized.

- To expand the range of economic and social choices to individuals by freeing them from servitude and dependence in relation to other people, Nation state and forces of ignorance and human misery.

Tanzania has prospects and positive opportunities to restructure the controversies and fundamentals by re – reconcetrating on core economic drives, focusing on people's choices not political drives. The concept of growth, unemployment and inflationary mechanism (notably currently inflationary high tide has reached the extent of 60% in Tanzania), needs both political will and economic science policy formulation to capture the core transformation, to reflect Tanzania economy creatively in reality. The present paper therefore creates a fundamental platforms in both theoretical and empirical re – thinking and research needs by academics practitioners, through theoretical paradigm review and questioning mechanisms.

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Contrariety and Change: Problems Plato Set for Aristotle[*]

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I

Plato and Aristotle both believe that contrariety is fundamental to the analysis of change. At *Phaedo* 70e4-71a10, for example, Socrates says that all things that have an origin (ἔχει γένεσιν) and that have contraries (ἐναντίαι)[1] come to be (γίγνεται) from (ἐκ) contraries. Thus if something comes to be larger, it must previously have been smaller, and vice versa. Other illustrations include coming to be weaker, faster, more just, and better from the contrary conditions. "Everything," Socrates says, "comes to be in this way: contrary things from contraries" (*Phaedo* 71a9-10). Aristotle expresses a remarkably similar view at *Physics* I.5, 188b21-26:

> [A]ll things that come to be, come to be from contraries (ἐξ ἐναντίων), and all things that pass away, pass away into contraries or intermediates (εἰς ἐναντία καὶ τὰ τούτων μεταξύ). And the intermediates are from contraries. For example, colors come to be from pale and dark (ἐκ λευκοῦ καὶ μέλανος). And so all of the things that come to be by nature are either contraries or things that come to be from contraries.[2]

Although the *Phaedo* offers different examples and says nothing about intermediates,[3] there are enough similarities between what the *Phaedo* and the *Physics* say to commit both Plato and Aristotle to the idea that all things have their origins in contraries.

If we wish to understand Plato's and Aristotle's accounts of change, then, we must first understand their accounts of contrariety. Their accounts differ on a number of points. They disagree profoundly on the ontology of contrary features. Aristotle formulates a definition of contrariety; Plato never does.[4] They even disagree about what features count as contraries: largeness and smallness, for example, are star examples of contraries for Plato, but Aristotle denies that these features are contraries at all (see *Categories* 6, 5b14-29). We believe that the story of how Plato and Aristotle came to hold their views on contrariety is fascinating and well worth telling. In this paper we tell the first part of the story, Plato's, and give a brief sketch of some of Aristotle's reactions.

II

We begin with the *Phaedo* version of the theory of forms:

> I'm going to try to explain to you the kind of cause I have been concerned with. I go back to those oft-mentioned things and proceed from them, laying it down that there is something beautiful itself by itself (τι καλὸν αὐτὸ καθ᾽ αὐτό), and good, and tall, and all the rest. If you grant me them and agree that they exist, I hope from them to explain *cause* to you, and to show you how the soul is immortal. ... Consider, then, whether you agree with me on what comes next. For it seems to me that, if anything is beautiful other than the beautiful itself (αὐτὸ τὸ καλὸν), then it is beautiful for no other reason than that it shares in (μετέχει) that beautiful. And I say this about everything. (100b3-c6)

Thus Socrates begins by positing the existence of forms corresponding to the features beauty, goodness, tallness, and "all the rest." Then he appeals to these forms in explaining why certain objects have the features in question. Suppose, for example, that Helen is beautiful. Then according to the *Phaedo*, what makes her beautiful is her sharing in the beautiful itself: she is beautiful precisely *because* she "shares in the beautiful itself." Moreover, her sharing in the beautiful itself is the *only* thing that, according to the

theory, can make her beautiful: she is beautiful *for no other reason than* that. According to the theory, then, Helen's sharing in the beautiful itself is both necessary and sufficient for her being beautiful.

Since Plato seems to say so clearly here,[5] it is commonly supposed that he believes that for any object and any feature, the object's sharing in the form corresponding to the feature is both necessary and sufficient for the object's having the feature. There are, however, good reasons for thinking that *Phaedo* 100bc overstates Plato's real view, at least in the *Phaedo*. First, a case can be made for the claim that the *Phaedo* restricts the scope of its theory to forms for *contrary* features. Only forms for contraries are mentioned in Socrates' initial list at 100b6, and no forms for features other than contraries are mentioned elsewhere in the dialogue.[6] In any event, since we are interested here simply in contraries, we shall consider the theory only in its application to contrary features and leave open the question of its applicability to other features.

More importantly, at least for our purposes in this paper, there is reason to think that in the case of the features it considers with regard to which things change, the *Phaedo* does not in fact accept the claim that sharing in a form is sufficient for having the corresponding feature.[7] Consider the discussion of comparatives at 102a-103a. Here what is taken to be in need of explanation is the fact that Simmias is both larger than Socrates and smaller than Phaedo (102b4-5). At 102c10-11, Socrates tells us that in such a case—"when he is between the two of them" (102c11)—"Simmias has the name of being both small and large" (ὁ Σιμμίας ἐπωνυμίαν ἔχει σμικρός τε καὶ μέγας εἶναι). We take it that "having the name of being both small and large" here is periphrastic for "is both small and large." If so, Socrates is telling us that if Simmias is both larger than Socrates and smaller than Phaedo, then Simmias is both large and small. In this case, then, Simmias is said to have the feature largeness in virtue of being larger than Socrates. And although, as we shall see, mention is made of Simmias's sharing in the large itself in the explanation of his being larger than Socrates, other things—Socrates, in particular—must be mentioned as well. So in this case, sharing in a form is not sufficient, by itself, for having the corresponding feature.[8]

In cases in which an object's sharing in a form is sufficient for its having the corresponding feature, we shall say that the object has the feature *unqualifiedly*, or that it has the feature *without qualification*, or that the feature is predicated *unqualifiedly*. So, for example, since sharing in sickness was sufficient to make Plato sick on the day of the *Phaedo* (59b10), he was unqualifiedly sick on that day. In other cases, where a more complicated situation—like Simmias's being larger than Socrates—is required in order for an object to have a feature, we shall say that the object has the feature *qualifiedly* or *with qualification*. Simmias's being large is an example of one, but not the only, variety of qualified predication in Plato. In the next section we shall look at just enough of the details of *Phaedo* 102cd to explain how this kind of qualified predication—being large relative to something else—differs on Plato's account from being unqualifiedly large. After that, we shall briefly describe some other varieties of qualified predication in Plato.

III

Plato explains what makes Simmias larger than Socrates in two different ways whose connection with each another, and with the earlier discussion of sharing in forms, is unfortunately not obvious. According to the first explanation,

> [Simmias] surpasses Socrates ... because Socrates has smallness relative to (πρός) his (viz., Simmias's) largeness.[9]

According to the second explanation, when Simmias is compared to Phaedo, who is larger than he is, and Socrates, who is smaller,

> Simmias has the name of being both small and large when he is between the two of them, submitting his smallness for the largeness of the one (viz., Phaedo) to surpass, and

presenting his largeness to the other (viz., Socrates) as something surpassing his smallness.[10]

These two explanations raise a number of questions that Plato does not answer. Even though we may assume that Simmias's sharing in the large itself is part of the explanation for his largeness, Plato does not tell us how his largeness is related to the large itself. Both explanations use the language of "surpassing," the first in stating the fact to be explained, the second in explaining that fact; we assume that in the first explanation "[Simmias] surpasses Socrates" is a stylistic variant of "[Simmias] is larger than Socrates."[11] The second explanation has it that the fact in need of explanation is Simmias's having the name of being large. And, as before, we assume that "having the name of being large" is periphrastic for "being large"; we also assume that "being large" here is elliptical for "being large relative to Socrates."

Even on these assumptions, the two explanations differ both in how they describe the fact to be explained and in how they explain that fact. The first has Simmias's being larger than Socrates as the fact to be explained, the second has Simmias's being large relative to Socrates as the fact to be explained.[12] More importantly, the first description depicts Socrates' smallness as something he has relative to someone else's largeness, while the second apparently depicts it as something that he has independently of any comparison with what anyone else has but that may be compared to what others have. These two explanations of why Simmias is larger than Socrates[13] are hard sayings whose interpretation is beset with difficulties we shall not deal with in this paper.[14] For our purposes, it is enough to note that on either explanation, Simmias's sharing in the large itself is not, by itself, sufficient for his being large. In addition, Socrates must share in the small itself, and Socrates' smallness must be appropriately related to Simmias's largeness.

According to the *Phaedo*, then, an object may be large in either of two ways. If a thing is large simply because it shares in the large itself, we say (following the conventions introduced in the previous section) that it is *unqualifiedly* large. If it is large because it is larger than something else, or large relative to something else, we say that it is *qualifiedly* large—qualified by a relation to or a comparison with something else. Although many features (e.g., beauty, hotness, and heaviness) admit of comparison, it not clear whether or to what extent Plato intends us to generalize from the cases of largeness and smallness that we have just considered. Suppose, though, that we have a feature to which the *Phaedo* account applies. The conditions for having the feature unqualifiedly and for having it relative to something else are different enough to allow one and the same individual to have the feature relative to something else but to lack the feature unqualifiedly. Purple is lighter than indigo, for example, but purple is not a light color. Although Claremont is cooler in the summer than Death Valley, it still gets unbearably hot. For this reason, we take it that features predicated without qualification are different from features whose predication is qualified—not just for features predicated in comparison, but for all varieties of qualified predication.

IV

In addition to the predications discussed in the previous section, which involve **Individual Comparison**, there are several other kinds of qualified predication in Plato's writings. Qualified predication may also involve:

Sortal Comparison. According to the *Hippias Major*, the most beautiful ape is ugly relative to human beings, the most beautiful pot is ugly relative to maidens, and the most beautiful maiden is ugly relative to the gods (289b). Apes, pots, human beings, and maidens are accordingly "no more beautiful than ugly" (289c).[15] We are familiar with many examples involving this sort of qualification. Someone can be large for a jockey, small for a football player; fast for a football player, slow for a sprinter; and so on.

Here we have a variety of qualified predication in which something is said to have a feature (e.g., beauty) relative to one kind of thing (e.g., maidens), and the contrary feature (ugliness) relative to things of another kind (gods). The difference between these qualified predications and predications involving comparatives is clear from the fact that if Socrates is five feet tall and Thelonius is an inch taller, Thelonius is tall relative to Socrates but short for a human being. Similarly, even if Claremont is large relative to La Verne, it is not large for a city in Southern California.[16]

Earlier in the *Hippias Major* it is affirmed that just people are just by justice (287c1-2), that wise people are wise by wisdom (c5), that good things are good by the good (c4-5), and that beautiful things are beautiful by the beautiful (c8-d1), in language close to that of the *Phaedo*.[17] So the *Hippias Major*, like the *Phaedo*, allows for the possibility that things can have features unqualifiedly, as well as by sortal comparison or in relation to other things.

Pure Relation. *Republic* 479b3-4 asks, "And again, do the many doubles appear any the less halves than doubles?" Apparently the idea is that a group (e.g., six dice) may be called *double* in relation to one group (e.g., three dice) and *half* in relation to another group (e.g., twelve dice).[18] Although there are obvious similarities between this case and the qualified predication of largeness and smallness,[19] the predication of double and half involve no comparatives: although the group of six is half in relation to the group of twelve, it is not *more* half, and although it is double in relation to the group of three, it is not *more* double.

Respect. An object can enjoy a feature in one respect and the contrary feature in another respect. At *Republic* 436ce, for example, Socrates says that we should describe a spinning top as at rest with respect to its axis but in motion with respect to its circumference. And in the *Symposium* a man can be beautiful with respect to either or both of two parts of himself: his body and his soul (210bc).

Perceiving Subject. According to the theory of vision of the *Timaeus* and the "Heraclitean" theory of vision of the *Theaetetus*, what is white for one perceiver can be black for another. And what is beautiful for one perceiver or from one point of view or under one set of circumstances can be ugly for (from, under) another.[20]

V

In dealing with the *Phaedo*, it is important to bear in mind its limited agenda. Plato's principal focus is on the issue of the immortality of the soul, and although Socrates claims that to allay the worries of Simmias and Cebes on this point requires a "complete investigation" of the causes of coming to be and ceasing to be (95e8-96a1), many issues arise that go unaddressed because they do not directly affect the main point at issue. So, for example, as we have seen, the *Phaedo* is not clear on the range of features for which there are corresponding forms. In addition, the *Phaedo* distinguishes between plain ("safe but stupid," 105c1) and fancy ("more elegant," 105c2) explanations of certain phenomena. Thus we can explain why the stove is hot in the plain mode by appeal to the hot itself, and in the fancy mode by appeal to fire (105c1-2). But the *Phaedo* is silent on the question of the relation between these two modes of explanation, and on the question why certain features (e.g., largeness and smallness) apparently lack fancy explanations. Still other unanswered questions have to do with the *Phaedo*'s sketchy treatment of qualified and unqualified predication; we take up some of these in the next few sections.

VI

Plato's acceptance of the varieties of qualified predication described in section IV above introduces complications in understanding his claim that contraries come to be out of contraries.

Some Platonic contraries—e.g., life and death, odd and even—are mutually exclusive: no object can exhibit both at the same time. Since no object can exhibit both members of a pair of exclusive contraries

at the same time, it follows that no object can have one such contrary at one time and the other at a later time without changing during the interval. For example, the number of members in a group cannot be even at one time and odd at the next unless the membership increases or decreases in size. But many Platonic contraries are not exclusive in this way. Simmias is large relative to Socrates and at the same time small relative to Phaedo; a maiden is beautiful relative to pots and at the same time ugly relative to gods; a spinning top is in motion with respect to its circumference and at the same time at rest with respect to its axis.[21] This illustrates Plato's willingness to admit the possibility of compresence for contraries as well as for non-contrary features (like health and beauty, or largeness and justice) that anyone would expect objects to be able to have at the same time. Whenever contraries can be predicated of the same object at the same time, it is possible for something to have one of the contraries at one time and the other at a later time without changing in the interval. Simmias will be large if we compare him to Socrates in the morning and small if we compare him to Phaedo in the afternoon, but his size does not change during the day. This raises questions about how to understand Plato's claim that contraries—as he conceives of them—come to be out of contraries, and about how much this claim can help us in understanding change and coming to be.

Republic IV includes a claim about incompatibility for contraries that seems to offer some help:

1. **Exclusion**: Nothing can be in contrary states or do or suffer contraries at the same time, in the same respect, and in relation to the same thing. (*Republic* 436b8-c1; see also 436e8-437a2 and 439b5).

This principle tells us that whenever contraries are predicated, they must be predicated either of different objects or of the same object at different times, in different respects, or in relation to different things. For example, a man who is standing still and moving his arm requires a division in the object of the predications of rest and motion: part of him is at rest, part in motion (436c). Similarly the collection of Musketeers is both odd and even: odd prior to D'Artagnan's joining them, even afterwards. A top can be at rest and in motion at the same time: at rest with respect to its circumference, in motion with respect to its axis (436d). And Simmias is both small and large: large in relation to Socrates, small in relation to Phaedo.

As far as we know, Plato nowhere explicitly sets out conditions that distinguish contraries from non-contrary features, but Exclusion might be used for this purpose. We see no reason why Plato should not accept the following as a partial characterization of contrariety:

2. **Contrariety**: Two features are contraries just in case no single object can be or do or suffer both features at the same time, in the same respect, and in relation to the same thing.[22]

This condition does partially characterize contrariety: it counts genuine contraries as contraries. But it seems inadequate in at least two respects. First, since no single object can be both hot and warm at the same time, in the same respect, and in relation to the same thing, (2) classifies hotness and warmth as contraries. This seems odd both in counting hotness and warmth as contraries and in allowing that hotness has more than one contrary.[23] Second, since no act can be both unjust and virtuous, virtue and injustice count as contraries according to (2). This seems odd, too: injustice is a species of vice, the contrary of virtue, and virtue is the genus of justice, the contrary of injustice.[24]

Since (1) and (2) are not sufficient to define a notion of contrariety that is adequate for use in the analysis of changes involving qualified predications, it is natural to ask whether these conditions are more helpful in the case of changes that involve unqualified predications. We think the answer is no. On the plainest reading of *Phaedo* 102c10-d2, Simmias has the largeness that makes him larger than Socrates and the smallness that makes him smaller than Phaedo at the same time and independently of any comparisons to Socrates and Phaedo. If so, he is unqualifiedly large at the same time as he is unqualifiedly small, and these unqualified predications are not contraries at all, let alone contraries with respect to which Simmias could change. The text of the Phaedo does not make it clear whether this is

correct, or—if it is correct—whether it warrants generalization to the conclusion that only qualified predications are contraries. But this conclusion does seem to be warranted by Exclusion (1). The wording of this principle and the examples Plato uses to illustrate it (the spinning top, and the man who stands still while moving his arms at *Republic* 433c-e) suggest that if Exclusion gives a necessary condition for contrariety, then contraries are qualified rather than unqualified predications.

VII

Worse still, Plato's acceptance of qualified predications of contraries threatens to make change incoherent, as he himself seems to have realized. At *Theaetetus* 155ad, Socrates introduces three general principles governing change:

3. If a thing has a feature (e.g., a certain size or number) at t_2 that it lacked at an earlier time t_1, then between t_1 and t_2 it came to have that feature (155b).

4. If a thing remains the same with respect to a feature (e.g., if it remains the same in size or number) between t_1 and t_2, then it does not come to have another, incompatible feature at t_2 (e.g., it does not come to be larger or smaller in size or number at t_2 than it was at t_1) (155a).

5. If nothing is done or happens to a thing (e.g., if nothing is added to or subtracted from it) between t_1 and t_2, then it remains the same (e.g., in size or number) between t_1 and t_2 (155b).

These claims seem to be obvious truths about change generally or quantitative change in particular. According to 155bc, however, when applied to everyday occurrences, the claims seem to imply a contradiction. Suppose that in January Socrates is large relative to the boy Theaetetus, that Socrates neither gains nor loses any of his substance during the course of the year, and that Theaetetus grows so much that by December Socrates is small relative to Theaetetus. Then Socrates has a feature in December that he lacked in January: smallness relative to Theaetetus. By (3), he must have come to have that feature between January and December. But by (4) and (5) he didn't: Since he neither gained nor lost any of his substance during the year, it follows from (5) that he remained the same. And if he remained the same during the year, (4) tells us that he could not have come to be smaller than Theaetetus.[25]

Puzzles of this sort show that for some contraries that belong to things relative to something else, an object that has one of the contraries at one time can have the other at another time, without having changed. Plato can appeal to Contrariety to avoid this result in some cases. For example, in the dice puzzle, the group of six dice is larger by half relative to one group and smaller by half relative to another, and according to Contrariety these two features are not contraries. But we can easily modify Plato's example to provide a case in which the group of six dice passes from contrary to contrary without changing. Suppose we compare the group of six to a group that increases in size from four members to twelve. Then the group of six is first larger by half and then smaller by half relative to one and the same group. According to Contrariety, being larger by half and being smaller by half relative to one and the same group *are* contraries. But even though these features count as contraries, the group of six, which was earlier larger by half than the second group, can be smaller by half later, without undergoing any change. And Contrariety does not help with the original growing-boy puzzle at all: even though it was Theaetetus and not Socrates who changed, being large relative to Theaetetus and being small relative to Theaetetus qualify as contraries according to Contrariety, since Socrates cannot be both small and large relative to Theaetetus at one and the same time. Analogous cases can be constructed for relative and for comparative predications involving temperature, color, and other features.

VIII

Plato's problems in the *Phaedo* and the *Theaetetus* are not problems for us. To explain why Simmias is larger than Socrates and smaller than Phaedo, we introduce numerical measures of quantities: if

Simmias's height is six feet, Socrates' is five feet, and Phaedo's is seven feet, then Simmias is larger than Socrates and smaller than Phaedo because six is more than five and less than seven. So an obvious question to ask is why Plato didn't do what we would do in dealing with the issues raised in such passages as the *Phaedo*'s tortured discussions of qualified largeness and the *Theaetetus*'s puzzles of the dice and the growing boy? Why didn't he use numerical measures to analyze the fact that Simmias is smaller than Phaedo and taller than Socrates? Instead of worrying about how, without changing in size, Socrates was at one time larger than Theaetetus and at another time smaller, why didn't he give numerical measures of Socrates' and Theaetetus's heights at the relevant times? Why did he attach so much importance to the fact that one group of dice is smaller by half than a second group and larger by half than a third when he could have counted the dice in each group and compared the numbers?

It is easy to answer such questions unsympathetically. One unsympathetic answer is that Plato's apparent lack of interest in numerical measures in dealing with quantitative features like largeness and smallness betrays a remarkably inadequate and primitive notion of measurement. Another unsympathetic answer is that Plato was merely kicking up sand by presenting spurious puzzles he could easily have avoided. We certainly agree that ancient Greek measurement theory and practice were less sophisticated than our own. We also agree that Plato knew that some of these puzzles can be used to support sophistical positions.[26] But we also think that Plato was concerned with issues involving such qualified predications as relative magnitudes that could not be resolved simply by assigning numerical measures to lengths, temperatures, weights, volumes, and other quantities. And we think there was reason to suppose that these issues must be resolved if numerical measures of such quantities are to be as theoretically and practically useful as we can now assume them to be.

In the *Statesman*, Plato says that the importance of the art of measurement derives from its application to practical crafts like weaving and clothes making (*Statesman* 284ab). Plato typically describes the successful practice of any practical craft as depending upon the avoidance or correction of excesses and deficiencies of various items. And in many cases the craftsman's task is to secure or maintain desirable relations between quantities. Thus the musician must avoid adjusting the strings of his lyre too tightly or too loosely. The physician must keep his patient from being hotter or colder than he should be. Like an athletic trainer, he must know whether the improvement of one man's condition requires him to eat more, less, or the same amount of food than another.[27] Disaster ensues, Plato says, if the craftsman disregards

> due measure (τὸ μέτρειον) by [applying] greater power to things that are too small [for it]—[too much] sail to a boat, [too much] food to a body, and [too many] principles (ἀρχαί) to a soul.[28] (*Laws* III, 691c1-3).

If sufficiency, excess, and deficiency are crucial in the practice of the crafts, the usefulness of a measurement system will depend upon the help it provides in determining whether a given quantity is too much, too little, or exactly just enough of what is required for the purpose at hand. And no measuring system can help with this unless we can find out what is enough and what is too much or too little for each given purpose. Thus Plato says the crafts, including statesmanship, depend upon the possibility of establishing standards (μέτρια) relative to which quantities can be called excessive or deficient (*Statesman* 284ac). In order to determine whether, e.g., a given amount of food is sufficient for the physician's purposes, it will not do to find out whether it is larger (smaller) than just *any* smaller (larger) amount.

> [T]he more and the less are to be measured relative (πρός) not only to each another, but also to the attainment of a due measure (πρὸς τὴν τοῦ μετρίου γένεσιν). (*Statesman* 284b1-c1).

The same holds, we suppose, for large and small amounts. A large amount of food would be large not just relative to *any* small amount; for the purposes of the physician, it would be large relative to the

amount required to establish or restore the required bodily state. This makes it natural for Plato to think that an adequate theory of the crafts[29] must explain what it is to be larger and smaller, more and less, half, double, equal, etc., and what it is to be qualifiedly large, small, etc. But it must also account for the standard measures relative to which these comparatives and qualified predications of quantity can be used to characterize the excesses and defects that the various crafts must avoid, and the sufficient amounts they aim for.

It seems clear that the introduction of a system of numerical measures without an account of the due measures and of what it is to be large and small, etc., relative to them would have little to offer in answer to Plato's concerns about quantities in the crafts. For example, it would not help a doctor to know how to measure temperature in degrees without knowing how to use the resulting numbers to establish whether the patient's heat is medically deficient or excessive. Because of these concerns, we suggest that Plato would not think it illuminating to solve the puzzle of the growing by applying numerical measures of size. In order to satisfy Plato, a solution would have to specify and justify the choice of a due measure to which the heights of Socrates and Theaetetus could be compared, and then observe that although Socrates was no longer larger than Theaetetus, he had the same height relative to the due measure.

IX

A related point holds for the theoretical crafts of mathematicians and scientists who investigate problems without concern for practical application.

In our scientific theorizing, we are accustomed to the unqualified assignment of numerical magnitudes to distances, speeds, temperatures, and other quantities including physical constants (like the speed of light) whose values are thought to be fixed by nature independently of the conventions we employ in measuring them.[30] But many of the numerical measures used for such purposes represent magnitudes as multiples or fractions of specified units. Other numerical measures represent magnitudes by locating them in relation to specified members or bounds of a series. Where *x* and *y* are reference points, a magnitude may be represented by a number whose significance is explained by appeal to such qualified predications as *larger than x* and *smaller than y, in between x and y*, etc. For example, one way to construct a scale is to fix and assign numbers to its end-points, mark and assign a number (half way in between the first two numbers) to the midpoint, mark and assign numbers to points that lie half way between the mid-point and each of the end-points, and so on. That is to say, the meanings of typical numerical measures are established and can be explained in terms of qualified predications of magnitude.

The metric system illustrates how closely numerical and qualified measures may be connected. The meter was first defined in 1791 (on the recommendation of a committee of the French Academy of Sciences) as a certain fraction of the arc of the meridian, eight years before surveyors could complete a numerical measurement of that arc segment.[31] Before the surveyors even started their work, the meter unit was used to define such units as the gram—the weight of a fraction of a cubic meter of pure water at a specified temperature.[32] There are two ways to think about this. Because the meter was defined as a fraction of an arc to which no numerical measure had yet been assigned, we can think of such expressions as "ten meters" as shorthand forms of qualified (relational) predications of length. And we can think of relative measures of distances as essential to the meanings of numerical measures of weight in the metric system. Alternatively, we might think of uses of qualified measures as parts of a process the French Academy of Science went through to develop numerical measures whose subsequent use would make their humble origins in qualified predications of length less and less crucial to our employment and understanding of them.

Although this last view may be more congenial than the first to the practices of recent science, ancient theoreticians appear to have been more interested in qualified predications of magnitudes than in the numerical measures they could be used to establish. For example, even though Aristarchus, Hipparchus, Archimedes, and other ancient astronomers could and sometimes did estimate astronomical distances in numbers of stades,[33] they appear to have been far more concerned to determine proportions— e.g., of the diameter of the heavens to the diameter of the earth, and of the apparent size of the sun to the circumference of the zodiacal circle—than to find unqualified, numerical measurements of these quantities.[34]

We don't know why the determination of proportions and ratios took precedence over numerical determinations of quality. But Aristotelian biology illustrates a principled reason why the determination of a suitable measure for use with qualified predications of magnitude could be just as important to a theoretician as to a practical craftsman, and why it should be of considerably more interest to the theoretician than numerical measurements.

Aristotle says there are biological kinds[35] that differ from one another by more and less, excess and defect (e.g., at *Parts of Animals* I.4, 644a16-21 and 644b8-15). For example:

> Among the birds, the differentiation relative to each other is in the excess and the deficiency, or according to the more and the less (ὑπεροχῇ καὶ ἐλλειψει καὶ κατὰ τὸ μᾶλλον). For some are long-legged, some short-legged, some have a broad tongue, and some a narrow one; and similarly for the other parts. (*Parts of Animals* I.12, 692b3-7)

In his discussion of this passage, J. Lennox points out that the importance of such qualified predications derives from Aristotle's interest in classifying animals by features that can explain important facts about how they live:

> [A]t least in regard to living things, the “essence/accident” distinction is a distinction between those features which are required by the kind of life an animals lives and those which aren’t. If a crane is to survive and flourish, it must have, not simply “long” legs, but legs of a certain length, defined relative to its body, neck length, environment, feeding habits, and so on. (Lennox 1987, 356)

Thus Aristotle says the reason certain birds are long-legged is that they live in marshes. If their legs were too short or too long in relation to their neck and body sizes, they would not be able to walk with their heads high enough to see, bend down to find food well enough to flourish, etc. This, says Aristotle, is an example of nature making organs correspond to their functions, rather than making a function correspond to its organ (*Parts of Animals* IV.12, 694b12ff). Birds who live different sorts of lives in different environments will have legs that are short in comparison to marsh birds with crane-like life styles. Given Aristotle’s explanatory aims, then, qualified predications of size are crucial. Unqualified numerical predications of size are useless without reference to qualified magnitudes.

Lennox also suggests[36] that the *Philebus*’s discussion of quantity (*Philebus* 16d-18d and 22c-25b) is plausibly read along similar lines. Here Plato is concerned with what sorts of units are to be chosen for investigating items of various degrees and kinds of complexity. The usefulness of numerical measures depends upon what they tell us about qualified, rather than unqualified, predications of quantity—e.g., about how large or small a given quantity is relative to a unit or to positions in a series bounded by measures that are appropriate to the investigation at hand.

The moral of all of this is that with regard to theoretical as well as practical crafts, it would be reasonable for Plato think that a proper treatment of the puzzle of the growing boy would require not an appeal to unqualified numerical measures but an account of due measures and qualified predications of size made relative to them.

X

We think that much of what Aristotle says about contrariety—in *Metaphysics* X, for example—can plausibly be read as part of an attempt to develop a foundational account of measurement that would, among other things, make use of the insights in Plato's treatment of contrariety and, and the same time, respond to some of the difficulties with that treatment. We lack the space in this paper to argue for this story or to develop its details at any length, but we conclude with two brief suggestions about how Aristotle might have responded to some of the problems Plato set for him.

Consider the means at Aristotle's disposal for dealing with the growing-boy and dice puzzles from the *Theaetetus* (see section VII above). According to *Categories* 7, 8a31 ff.,

> **6**. A feature, F, is a relative (πρὸς τι) feature if what it is to be F—the being (τὸ εἶναι) of the feature—consists in its being related in some way to a feature, G, whose being consists in its being related to F.

For example, what it is to be double depends upon what it is to be half, while what it is to be half depends upon what it is to be double. Following Porphyry (*In Aristotelis categorias*, 125.25-29), we take Aristotle's point to be to distinguish the relative features of an object from features it possesses just in virtue of what belongs to it essentially or accidentally. To illustrate the distinction, recall Plato's groups of dice. One of them contained six dice. This quantity belongs to it non-relatively, just in virtue of its composition. By contrast, *larger* (*larger by half*) and *smaller* (*smaller by half*) are relative features. By itself, a group of six is neither larger nor smaller, larger by half, nor smaller by half. But it is larger by half than a group of four, and smaller by half than a group of twelve.[37] Recall Plato's observation that measurements in terms of relative largeness and smallness (πρὸς ἄλληλα μεγέθους καὶ σμικρότητος) are worthless to the practical craftsman because what makes something larger is just its relation to what is smaller, while what makes something smaller is just its relation to what is larger (*Statesman* 283d). So characterized, relative largeness and smallness fit (6) above so well that Aristotle's characterization of relative features could easily serve as a generalization of Plato's observation.

Since one thing's possession of a relative feature (*larger* or *smaller by half*, in this case) depends upon the possession by something else of a correlative feature (*smaller* or *larger by half*), what has a relative feature can lose it, and what lacks a relative feature can come to have it by virtue of facts about other things. To bring it about that our group of dice is no longer larger by half, we need only add some dice to the group we were comparing it to, or compare it to another, larger group. If we'd like our group to become larger all we have to do is subtract dice from the group of twelve, or compare it to another, smaller group. Thus, as Porphyry observed, relative features "come into and out of being without their subjects being affected" (Porphyry, 125.29). This is what we take Aristotle to mean when he says there is no change with regard to relatives (*Physics* V.2, 225b11).

This suggests a treatment of the puzzles of the growing boy and the dice. Aristotle can grant (3) above, according to which an object must come to have a given feature if it lacks that feature at one time and has it at a later time. He can also grant (4), according to which an object that has a feature across a span of time cannot have or come to have the contrary feature during that time span. But he can reject (5), according to which an object that has a feature *of any kind whatsoever* cannot cease to have that feature unless something is done to it or happens to it. Although (5) holds, e.g., for non-relative features, and for relatives possessed only by virtue of comparison to a fixed standards, an object can lose a feature without undergoing any genuine change as long as that feature falls under (6) above (see *Physics* V.2, 225b11-13). Therefore, contrary to (5), nothing needs to be done, and nothing needs to happen to a thing to make it lose or gain a relative feature of this sort. And so it is with the features acquired by the dice and by Socrates in the growing-boy example. They are features that fall within the scope of (6), not (5).[38]

XI

Our second and final suggestion has to do with features to which (5) applies. Aristotle's general strategy for regimenting accounts of change requires the scientist to identify the contraries with respect to which the object under investigation changes. For any given change, Aristotle supposes there should be a unique pair of contraries. Its members will be mutually exclusive features such that the change under investigation will consist of (a) the replacement of one contrary by the other, or (b) the replacement of one of the contraries by an intermediate falling somewhere in between it and its contrary, or (c) the replacement of one intermediate by another intermediate, or (d) the replacement of an intermediate by a contrary. For example, Aristotle thinks dark and light are the contraries involved in changes of color; red, blue, and all of the other colors are intermediates ordered by their relations to them. Accordingly, any color change will consist of (a) a completely light object turning completely dark (or vice versa), or (b) a completely light (or dark) object turning one of the intermediate colors, or (c) the replacement of one intermediate color by another, or (d) the replacement of an intermediate by light or dark.[39]

This scheme imposes a *uniqueness requirement* on contraries:

7. If a feature has a contrary at all, it has no more than one. (*Metaphysics* X.5, 1055b30, 1056a11, 19-20)

If all things come to be from and pass away into contraries, there must be contraries in all of the categories with regard to whose properties things can change. Ignoring substantial change, these categories include quantity, quality, and place (e.g., *Physics* V.2, 226a24ff. and *Metaphysics* XIV.1, 1088a31). In what follows, we restrict ourselves to have to do with changes in quantity.[40]

One of Aristotle's problems with quantitative change is that things can change with respect to quantities that don't seem to satisfy the uniqueness requirement. For example, condition (7) is not satisfied by such features as being one or more feet long, weighing one or more pounds, etc. (*Categories* 6, 5b11ff.). That is because each of these magnitudes is opposed not to just one but to an unlimited number of different magnitudes, no one of which has any better qualifications for being called its contrary than any other. Nevertheless, growing a foot and gaining a pound are certainly changes. To accommodate them in his general scheme, Aristotle must find a way to systematically identify such quantities as contraries or intermediates.

A second problem arises with quantities things have by virtue of comparison, e.g., *large relative to a millet seed* or *large relative to a mountain* (*Categories* 6, 5b17). Suppose the size of a particular seed or mountain is fixed. Then things can change with respect to this size: if something is large relative to a mountain at one time and small relative to the same mountain at a later time, it must have undergone a change in the interim. Like contraries, such quantities are mutually exclusive. Furthermore, they admit of intermediates.[41] And— as required for all contraries in *Metaphysics* X.4 and *De Interpretatione* 7-10— an object can lack both magnitudes, either because the object is something like a soul that is incapable of having any sort of spatial magnitude, or because it has an intermediate magnitude rather than one of the contrary ones. But comparatives like these are not definite quantities. Things that are large relative to a millet seed (avocado seeds, watermelons, huts, and mountains, for example) come in an enormous number of different sizes. This means that something whose size changes drastically need not change with respect to such comparative quantities: a sapling and the mighty oak it grows into are both large compared to a millet seed and small compared to a mountain. Such indefiniteness also distinguishes quantities predicated by comparisons between some actual object and the due measures Plato said were required for the successful pursuit of the crafts. For example, a nutritionally adequate amount of iron, an amount that is either small or large enough to cause blood abnormalities, and an amount that must be added to or subtracted from the diet to restore health will all be small relative to some objects of comparison (e.g., the amount of calcium in an oyster shell) and large relative to others

(e.g., the amount of titanium contained in a thin slice of stewed morel). If quantitative contraries are to provide a basis for determining due measures, and if the magnitude of an object that has one of a pair of contrary quantities cannot change unless that magnitude is replaced by an incompatible quantity, contraries must satisfy a *definiteness requirement*:

> **8.** For any pair of contrary quantities, nothing that has either quantity can be larger or smaller than anything else with the same quantity.[42]

Aristotle's second problem is to secure definiteness.

As we understand it, the leading idea of Aristotle's strategy for explaining how contrary quantities can satisfy both (7) and (8) is this: an ideal classification scheme would sort things into kinds such that—where K is one of these kinds—*as large* and *as small as is possible for a K* (or *for a normal*, or *for a fully developed K*, etc.) would be unique, definite magnitudes in relation to which intermediate sizes could be defined. Aristotle knows he must apply this idea in different ways to different sorts of quantities for different sorts of things. But here is one illustration of the general strategy.

Increase is a change in quantity that Aristotle characterizes as change "toward complete magnitude" (εἰς τέλειον μέγεθος). By contrast, decrease is a change away from this complete magnitude (226a23-32). It is not clear just what (if anything) this can mean in every case. But for an animal or plant that grows and shrinks (in size, weight, etc.) during the course of its life, Aristotle's talk of moving toward and away from complete magnitudes makes perfectly good sense if there is a definite maximum size (or perhaps a unique, developmentally ideal size) that normal, healthy, mature organisms of a given kind can attain and a minimum size beyond which no smaller organism of the kind can survive or retain its normal functioning. These sizes will differ from kind to kind; oak trees can grow larger than peonies, and dwarf wombats are smaller than dwarf horses. The magnitudes of maximal and minimal sizes are determined, according to Aristotelian biology, by the natural capacities of nutrition and growth possessed by normal organisms of various kinds. Change in size for an organism will then be increase toward the maximum or decrease toward the minimum for the kind to which the organism belongs.[43]

We believe that when Aristotle characterized contrariety as

> **9 (a)** extreme or complete difference (μεγίστη διαφορά) at *Metaphysics* X.4, 1055a4; διαφορὰ τέλειος at 1055a16) between **(b)** predicates of the same genus (1055a26ff.)[44] **(c)** that can belong to the same recipient (δεκτικόν) or matter (ὕλη). (1055a29 ff.)[45]

he was generalizing from the sort of account we just sketched.[46] For growth or decrease in the size of an organism, the genus (9b) is size, and the extremely or completely different predicates (9a) falling under the genus of size are, e.g., *maximally large* and *maximally small for a stoat*. The recipients (9c) of which these contraries are predicated are organisms of a specific kind. Change in size for a stoat is a process by which the animal's body comes to be closer to one of the extremes and farther from the other than it was at the beginning of the process. Once the contraries are fixed, numbers of convenient units can be assigned to them, and these can be used to characterize intermediates. Suppose that for two numbers, n and m, n ounces is the minimum weight for a stoat and that m ounces is the maximum weight. Then we may think of n and m as measures of contrary sizes. And for any $n' \geq n$ and any $m' \leq m$, such that $m' > n'$, what is n' at one time and m' at another will have changed in size, increasing toward or decreasing away from the complete weight for a stoat. Growing from one of the n' to one of the m' will be a change because the object moves from one position relative to a complete magnitude to another—and similarly for shrinking from one of the m' to one of the n'. Growing larger will be a change because to grow larger will be to grow from one of the n' to one of the m'.

To see how this applies to due measures, imagine that you are an ancient Greek physical trainer who prescribes foods and exercises to maintain the fitness of a runner. You should know the maximal and minimal weights for normal human beings. You should know what intermediate weight range is healthy for humans, and appropriate for athletes like the one you are training. This knowledge will allow you to

decide whether she weighs too much or too little. If you also know how much pasta is required to maintain weight in the proper range, you will be able to find out whether her diet includes too much or too little, and if necessary, how her pasta intake should be changed to remedy an excess or defect in weight.

At *Categories* 6, 5b24ff, Aristotle observes that what counts as many people in a village would not qualify as many people in Athens, and that what counts as many people in a house is less than what counts as many people in a theater. Thus a group of people is not many or few relative to the number of people who were actually in the house, the theater, the village, or the city at any particular time. Instead, *many* and *few* are understood—depending on what is appropriate for the relevant context—*as many for a house* (or *theater*, or *village*, etc.) These magnitudes are determined, not by the populations, but by the capacities of the relevant places. Aristotle's use of Sortal Comparisons to explain quantitative contraries is analogous to this: magnitudes are fixed by appeal to the abilities (e.g., for growth) that are characteristic of kinds of individuals, rather than the magnitudes that have actually been attained by the members of the kinds.

The idea that natural kinds are distinguished from one another to an important extent by the capacities (δυνάμεις) of their normal members is, of course, central to Aristotelian biology. Indeed, if what we have been suggesting in this section is correct, an important part of the work of an Aristotelian biologist (who studies natural differences between members of different kinds of organisms, or seeks to develop an adequate taxonomy of natural kinds) would be relevant to the identification of quantitative contraries.[47] We believe an examination of Aristotle's treatments of other contraries (e.g., contrary colors, tastes, directions, and motions in space) would reveal equally strong connections between the identification of contraries and other departments of Aristotelian natural science. It would be nice to find a text in which Aristotle says that his approach to the natural sciences had been shaped by the approach to the problems of change, contrariety, and due measure that Plato left him. It would be nice to find a text in which Aristotle says that his approach to natural science has the advantage of providing resources for dealing with precisely these problems. We don't suppose there ever were any such texts. But we don't need them to appreciate how important the Platonic problems of contrariety and change were to Aristotle's work in natural science and its philosophy.

NOTE

[*]We presented versions of this paper at California State University at San Bernardino, the University

[1]Although "contraries" is a standard translation of ἐναντία in Aristotle, "opposites" is often used as a translation in Plato. There is something to be said for this diversity of practice: Plato and Aristotle have different ideas about ἐναντίωσις. However, in the belief that it is a single thing they have different ideas about, we use "contraries" for both. Where required, we shall use the terms "Platonic contraries" and "Aristotelian contraries" to distinguish between them.

[2]See also *Metaphysics* X.4, 1055b16-17; *De Caelo* I.3, 270a14-17; *Generation and Corruption* I.7, 323b28-324a9.

[3]But *Phaedrus* 262a seems to anticipate Aristotle's notion of intermediates in speaking of a thing's changing from a feature to its contrary "bit by bit" (κατὰ σμίκρον).

[4]But *Philebus* 12d-13a seems to anticipate Aristotle's definition of contrariety as maximum difference within a genus (*Metaphysics* X.4, 1055a5-6).

[5]And elsewhere: see, e.g., *Phaedo* 78e, 100e-101a, 103e; *Parmenides* 130e-131a; and *Republic* 596a6-7. Aristotle attributes the view to Plato at *Metaphysics* I.6, 987b3-10.

[6]Arguably the forms for unity and duality mentioned at 101c are exceptions to this claim. However, Plato has no clear conception of what features are and what features are not contraries, and he may be treating unity and duality as contraries here. Alternatively, they may simply be bad examples. (*Parmenides* 128e-130b is happy to treat unity and plurality as contraries.)

[7]Thus we disagree with a leading idea of Vlastos's "Reasons and Causes" (Vlastos 1981, 91-110). In particular, the mechanism Vlastos invokes to explain, e.g., how adding snow to something can change its temperature (see *Phaedo* 103b-104a) fails to apply to the cases of change the *Phaedo* concerns itself with. Vlastos thinks that the forms of hot and cold are sufficient to determine, respectively, what it is to be hot and what it is to be cold. Perhaps this is so. But Plato wants to explain changes in which, e.g., one thing that is hot in comparison to (hotter than) another thing becomes cold in comparison to (colder than) that other thing. Even if a share in the form of cold is necessary for being colder than a given knish, and a share in the form of hot is necessary for being hotter than that knish, there is no reason to suppose Plato thought that a full description of those forms would tell us what it is for some borsch to be hotter or colder than a knish. Vlastos also believed that an entailment relation between the forms of snow and cold explains why adding snow to something can give it a share in the form of cold. And he appears to have believed that some sort of exclusion relation between the forms of hot and cold explains why making something share in the cold by adding snow will make it cease to be hot (Vlastos 1981, 102-110). But we think that on Plato's view, a share in the form of cold is not sufficient to make one thing colder than another, and a share in the form of hot is not sufficient to make one thing hotter than another. If we are right, then even if adding snow to the borsch gives it a share in the cold, that will not be enough to explain why the soup becomes colder and ceases to be hotter than the knish. On our view, then, however important the forms may be to Plato's thinking about other topics, they do little work in his thinking about change. (We thank J. E. McGuire for helpful discussion of this point.)

[8]There is also reason to believe that the *Phaedo* does not accept the claim that an object's sharing in a form is necessary for its having the corresponding feature. Consider fire, for example. *Phaedo* 103e clearly implies that fire is hot, and 105bc says that we can adequately explain why, e.g., a stove is hot by citing the presence in it of fire. But the *Phaedo* does not bring the hotness of fire within the scope of the explanatory pattern of 100bc; it does not say that fire is hot because it shares in the hot itself. (In fact the *Phaedo* offers no explanation at all of why fire is hot. *Timaeus* 61d-62a does explain this, in terms of structural features of fire itself and not, or not obviously, in terms of sharing.) According to the *Phaedo*, then, fire is hot, but it does not share in the hot itself. The same is true of the rest of the *Phaedo*'s

are odd while two, four, etc., are even; that snow is cold; that soul is alive; etc.—but it does not explain why these things have the features they do, and, in particular, it does not say that they have them in virtue of sharing in forms.

[9]Σωκράτους ὑπερέχειν ... ὅτι σμικρότητα ἔχει ὁ Σωκράτης πρὸς τὸ ἐκείνου μέγεθος (102c3-4).

[10]Οὕτως ἄρα ὁ Σιμμίας ἐπωνυμίαν ἔχει σμικρός τε καὶ μέγας εἶναι, ἐν μέσῳ ὢν ἀμφοτέρων, τοῦ μὲν τῷ μεγέθει ὑπερέχειν τὴν σμικρότητα ὑπέχων, τῷ δὲ τὸ μέγεθος τῆς σμικρότητος τῆς σμικρότητος παρέχων ὑπερέξον (102c10-d2). (In our discussion below, we ignore the comparison to Phaedo in this explanation.)

[11]The surpassing relation mentioned in the second explanation is a more complicated matter. See n. 14 below.

[12]In this context there may be no significant difference between the two ways of describing the fact. But in general "X is more F than Y" and "X is F relative to Y" will not be stylistic variants of each another.

[13]Similar accounts can be given for Socrates' being smaller than Simmias, Phaedo's being larger than Simmias, and Simmias's being smaller than Phaedo. But as Vanessa DeHarven pointed out to us, if Plato were to give exactly the same explanation, e.g., for Simmias's being larger than Socrates that he gives for Socrates' being smaller than Simmias, he would violate one of his own conditions for adequate explanations. At *Phaedo* 101ab, Socrates rejects such explanations as "Thelonius is larger than Bud, and Bud is smaller than Thelonius, by a head" because they appeal to the same thing in the explanation of contrary features. To avoid explaining being smaller and being larger by appeal to the same thing, Plato should say, e.g., that while the relation between the members of the ordered pair consisting of Socrates' smallness and Simmias's largeness explains why Socrates is smaller than Simmias, what explains why Simmias is larger than Socrates is a relation between members of a different ordered pair–consisting of Simmias's largeness and Socrates' smallness–or a different relation between members of the same ordered pair.

[14]For example, it is far from obvious what the formal properties of the "surpassing" relation mentioned in the second explanation would be, let alone which (if any) relation familiar to us it might correspond to. Moreover, whatever surpassing turns out to be, the following would seem to be an obvious difficulty with the second explanation, at least as stated. Consider the smallness Simmias has in virtue of being smaller than Phaedo and the largeness he has in virtue of being larger than Socrates. We know that Simmias's largeness surpasses Socrates' smallness. Does it surpass his own smallness as well? If it does, then it would seem that he is both larger and smaller than himself. As for the first explanation: it is not clear what it is to say that Socrates' smallness is "something he has relative to the largeness of someone else," let alone whether this involves the surpassing relation mentioned in the second explanation. Finally, it is hard to say whether the two explanations tell two different stories or the same story in two different ways.

[15]Regrettably Socrates does not raise the question whether there are beings relative to whom even the gods are ugly or—to put the issue sharply—whether there are limits to the series (presumably a partial ordering) his examples imply.

[16]A useful discussion of individual and sortal comparison is Wallace 1972.

[17]Note in particular 100e2-3: τῷ καλῷ τὰ καλὰ καλά.

[18]See also *Theaetetus* 154cff.

[19]Indeed, *Republic* 479b6-7 goes on to ask a question about largeness and smallness analogous to 479b3-4's question about double and half.

[20]See *Republic* 479aff., where anything that has a feature will also appear to have the contrary feature, and *Hippias Major* 289c, where participation in beauty makes something appear to be beautiful

Someone may object, e.g., that to be what we are calling beautiful by Perceiving Subject is not to be beautiful at all, but simply to *appear* to be beautiful. This seems to be Plato's view at *Sophist* 235e-236a. There, a sculptor produces a work that is so large that the lower parts will seem larger than they really are and the upper parts smaller than they really are from a normal viewing position. If the sculptor used "the true proportions of beautiful things," the statue would look ugly, and so he uses "proportions that are not but will seem to be beautiful" (οὐ τὰς οὔσας συμμετρίας δοξούσας εἶναι καλάς. But at *Republic* 479b, things that "appear" to be beautiful will also "appear" to be ugly, just as things that "appear" to be doubles will also "appear" to be halves—and similarly for large and small, light and heavy, etc. The verb φαίνομαι, here translated in the language of appearance, is sometimes used to talk about how things appear as opposed to how they really are. But it is also used in connection with what is manifestly the case. The example of doubles and halves indicates that in our passage Plato uses "appears" in the second of these senses: 6 really is double relative to 3, and really is half relative to 12. Plato thinks the sights and sounds that delight the φιλοθεάμονες don't just appear to be beautiful, but *are* beautiful when perceived by some perceivers (or in some settings) and ugly when perceived by others (or in other settings).

[21]These examples all involve qualified predication. Whether compresence is possible for some cases of unqualified predication is a question on which the *Phaedo* is silent. As we shall see, the *Republic* implies a negative answer.

[22]Notice that this does not give us a condition for contrary forms. To get such a condition from Contrariety, we would have to add conditions that appeal to the role of those forms in the qualified and unqualified predication of the features involved.

[23]The claim that each contrary has only a single contrary is used at *Protagoras* 332a-333b as a premise in the argument that wisdom and temperance are a single thing, each being the contrary of folly.

[24]Aristotle's characterization of contrariety as maximum difference within a genus (*Metaphysics* X.4, 1055a5-6) improves on Contrariety in not being subject to either of these criticisms.

[25] Plato presents a similar puzzle for a case involving a group of six dice: that group is more by half relative to a group of four and less by half relative to a group of twelve without undergoing a change in number (154c). This puzzle is introduced by a general assumption—a close relative of (3) above—whose acceptance would generate similar puzzles for heat, color, and other features in addition to size (154b).

[26]He says as much at *Theaetetus* 154c.

[27]See, e.g., *Republic* 349a.

[28]We suppose that with the last phrase Plato has in mind, e.g., presenting a student with more principles of grammar than he can deal with.

[29]In light of Plato's views on the centrality of crafts in human life, an adequate theory of the crafts would articulate what is foundational to the proper conduct of all practical affairs.

[30]For a brief discussion, see DuMond and Cohen 1960, 145.

[31]The units on the scale the surveyors used were themselves fractions of a circle (Klein 1988, 114).

[32]See Klein 1988, 115.

[33]We are indebted to B. Goldstein for pointing this out to us in discussion. For examples, see Heath 1981, ch. 4.

[34]See Heath 1981, 308ff. Although we have no space to discuss it here, it is worth noting that this sort of emphasis on qualified predications of magnitude is by no means peculiar to ancient science. Newton's *Principia* contains many examples in which the determination of proportionalities takes priority over the determination of absolute magnitudes. P. K. Machamer tells us that the assignment of numerical values to physical constants doesn't seem to have been a major theoretical concern until well into the 19th century.

[35]He does not give any general specification of what taxonomic level or levels contain these kinds.

[36]In discussion at the University of Pittsburgh in 1994. Cp. Lennox 1987, 341ff.

[37]Compare Porphyry, *In Aristotelis categorias*, 124.16-125.4.

[38]This anticipates points that would become central to early 20th century discussions of what P. Geach called "Cambridge change" (Geach 1979, 90-91). Russell (1964, 469) defined change as

> the difference, in respect of truth and falsehood, between a proposition concerning an entity and a time T and a proposition concerning the same entity and another time T', provided that the two propositions differ only in the fact that T occurs in the one where T' occurs in the other.

Of course this definition is inadequate; the change in the truth value of a proposition like "Socrates is taller than Theaetetus" requires nothing more than a change in Theaetetus. We have seen that Aristotle is well aware of this. And it is remarkable that when one thing loses or gains a relative feature simply because of facts about what it is compared to, Aristotle says something comes (or ceases) to be true, instead of saying that any genuine (non-incidental) change (μεταβολή) has taken place:

> ἐνδέχεται γὰρ θατέρου μεταβάλλοντος ἀληθεύεσθαι καὶ μὴ ἀληθεύεσθαι θάτερον μηδὲν μεταβάλλον, ὥστε κατὰ συμβεβηκὸς ἡ κίνησις αὐτῶν (*Physics* V.2, 225b11-13).

In this passage Aristotle uses the notion of change in truth-value—by means of which Russell tried and failed to define all change—as part of a characterization that *distinguishes* Cambridge from genuine changes.

[39]For some details, see Bogen 1991 and 1992.

[40]What we have to say about quantitative is of course not a complete account of Aristotle's treatment of quantitative contraries, let alone of the contraries involved in any of the other categories with respect to which things change.

[41]At the very least, the size of a millet seed or a mountain must fall between the sizes of things that are large relative to it and things that are small relative to it. Aristotle needs intermediates to distinguish pairs of relatives that are contraries from pairs of relatives that are not (see *Metaphysics* X.4, 1057a37ff).

[42]A similar condition is required for intermediates, and analogous conditions must be required for contraries and intermediates in other categories. We need not and will not try to formulate any Aristotelian definiteness requirements here. Non-Aristotelian requirements of definiteness can be found in Ellis 1966 or any other standard treatise on measurement.

[43]See Bogen 1992, 17ff.ogen 1992.

[44]This is the way people define contraries according to Aristotle in *Categories* 6, 6a17-18. (Cp. *Generation and Corruption* I .7, 323b29-324a1.)

[45]For further discussion see Bogen 1991 and 1992.

[46]According to *Metaphysics* X.4, 1055a10-22, both uniqueness (7) and definiteness (8) can be secured for any sorts of contraries for which "modes of completeness" can be determined. On our reading, for any pair of contraries (quantitative, qualitative, or spatial) whose members can be possessed by things of some kind or kinds, the "mode of completeness" that secures uniqueness and definiteness for the pair is constituted by the capacities of normal members of the kind or kind in question to have features of the genus (e.g., colors, sizes, weights, etc.) to which the contraries belong. For some discussion of this, see Bogen 1992.

[47]It is not clear, however, that Aristotle's program of identifying quantitative contraries by appeal to the maximal largeness and smallness of natural kinds will succeed. In the first place, it is hard to see how appeal to natural kinds will help at all in dealing with the quantitative changes that would emerge in crafts like carpentry or weaving, say, which do not involve natural kinds in any obvious way. But there are problems even in the sphere in which Aristotle's proposal might be thought to have its best chance of

success—the growth and development of natural organisms. *History of Animals* V.15, for example, notes that the murex attains its full growth within a year (547b23-25); this sort of case fits Aristotle's proposal quite well. But it is not easy to see how the yearly increase in the convolutions of the murex's shell (547b9-11) could be explained in terms of maximal sizes: Aristotle does not suggest, for example, that the murex dies because its shell becomes too large or too heavy. Similar difficulties would be involved in dealing with the growth of so-called moles in human females discussed in *History of Animals* X.7 and *Generation of Animals* IV.7. Finally, it would be a bad joke to suppose that Aristotle could account in terms of maximal and minimal viable sizes for the growth of horns in deer (*History of Animals* IX.5), for the development of breasts in the human female (*History of Animals* VII.1, 581a31-b6), and for the enlargement of the male sexual organ during arousal (*History of Animals* II.1, 500b20-22).

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CONCEPT- MAPPING: AN INSTRUCTIONAL STRATEGY FOR RETENTION OF ORGANIC CHEMISTRY CONCEPTS

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Abstract

The study analyzed students' retention of organic chemistry concepts. The Population for the study was all senior secondary school 3 students in Obio-Akpor, Rivers state. The sample was made up of ninety (90) Senior Secondary 3 (SS 3) Chemistry students split into 2 groups namely experimental and control. The research instruments were validated Organic Chemistry Aptitude Test (OCAT), Organic Chemistry Retention Test (OCRT) consisting of 10 items each and a lesson note on concept mapping. Reliability of the instruments were 0.72 and 0.81 based on a pilot study conducted. Two research questions and two hypotheses guided the study. Data collected were analyzed using the mean, standard deviations, and t-test statistic at $p< 0.05$ level of significance. The results of the study showed that the experimental group performed better than the control group. This shows that concept mapping enhances performance and retention of knowledge. It was recommended that workshops and seminars should be organized by education authorities to sensitize science teachers in order for them to acquire the skills and competences required for effective use of concept mapping strategy.

KEY CONCEPTS: concept mapping, cognitive structure, retention test, learning process, instructional strategy

Introduction

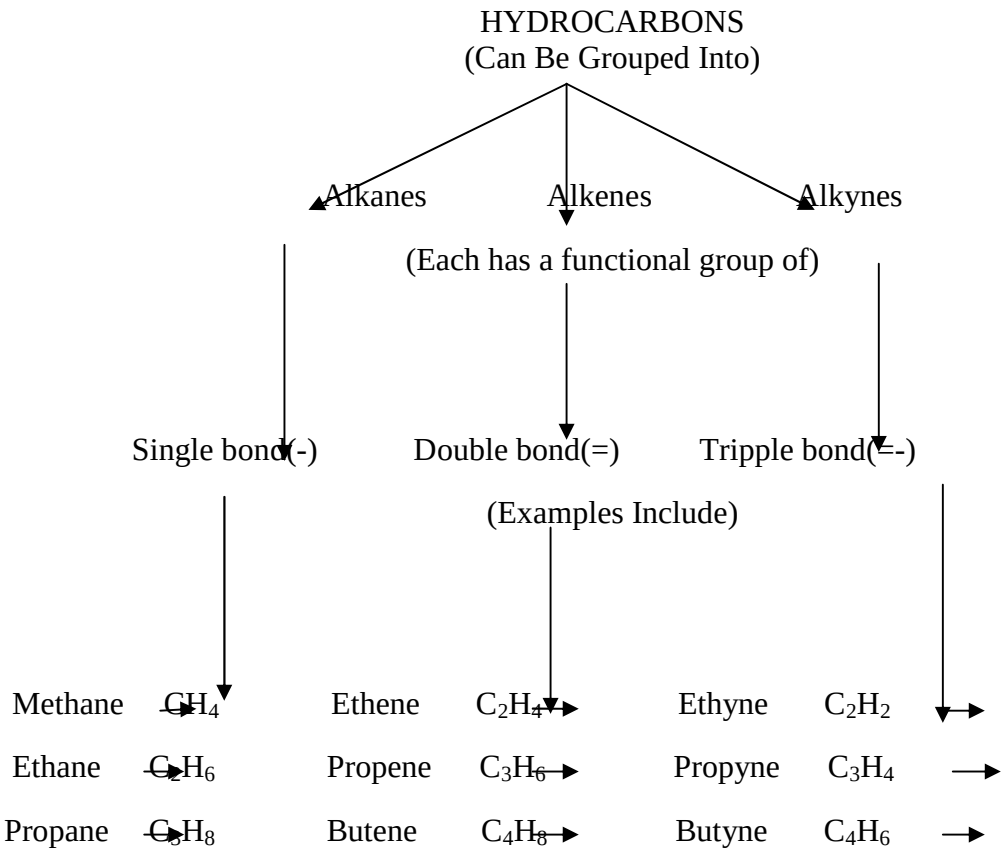
One of the aims of secondary education is to equip students to live practically in this modern age of science and technology, (Federal Republic of Nigeria, 2004). To this end, students at the senior secondary level of education are required to study one or all of the basic science subjects (biology, chemistry, and physics) as core subjects: chemistry is required as a prerequisite to the study of courses such as Medicine, Engineering, pharmacy, Science Education, et cetera. This gives chemistry unique position indeed. Besides, the study of chemistry as a subject helps to develop in the learner such process skills as critical observation, analysis, experimentations, manipulation of variables and equipment which are very important in scientific investigations.

However, the performances of students in chemistry in the senior secondary school certificate Examinations,(WASSC, NECO and GCE) have not been encouraging, probably due to ineffective teaching and learning of the subject. Documented research reports suggest a number of factors to that effect. According to Ayodele (2002), obstacles to effective teaching and learning of chemistry include negative attitudes of teachers and students, lack of requisite mathematical skills and the nature of the curriculum. The presence of too many topics to be taught and the inadequate periods allotted with other factors impart on the teaching-learning strategies. In the bid to cover syllabus, teachers resort to tradition of lecture method which involves mostly the cognitive domain of learning to the detriment of the affective and psychomotor domains. This practice has not yielded effective science learning, (Ukwa, 2003). It is against this backdrop of students' poor performance which could be a resultant effect of poor presentation of strategies (though coupled with other factors), that conscious efforts are being continuously made to determine suitable strategies that will facilitate effective learning and understanding of chemistry concepts.

Katcha (2010) investigated the effects of Vee-mapping (which is a simpler form of concept mapping) instructional strategy on students' achievements in biology. He found out that students exposed to Vee-mapping performed better than those taught with the conventional lecture method; his result shows a mean score of 48.14 for the experimental group and a mean score of 39.48 for the control group. In a related study, (Etiubon (2010) investigated the relationship between availability of laboratory equipment and students' performance in chemistry and revealed that students exposed to studies with adequately equipped laboratories performed better (with mean score of 47.50) than their counterparts who studied with little or no laboratory materials (with mean score of 38.68). The second group of students was taught more theoretical chemistry and less practicals; that is, instruction was more lecture-based than activity-based. Activity-based strategies are known to enhance acquisition of science attitudes (Akporehwe & Onwioduokit, 2010).

Concept mapping is one of such activity-based instructional strategies. It helps students to learn meaningfully, thus assisting them to overcome the problem of misconception, (Novak & Canàs, 2008; Novak & Gowin, 2010). The strategy utilizes concept-mapping which is a graphical representation of the relationship among terms, (Vanides, Tomita & Primo, 2005), and shows the interconnections among networks of related concepts (Jiang, 2004). A concept map exercise should be done by students before a topic is taught and another after the topic has been presented. This way, students themselves can determine what they have learnt and where they need further effort to grasp a concept.

In preparing a concept map, the more general, more inclusive concepts should be at the top of the map, with progressively more specific, less inclusive concepts arranged below. For instance



Source: Researchers' design 2012.

This is because meaningful learning (which concept mapping promotes) proceeds more easily when new concept or meanings of concepts are subsumed under broader, more inclusive concepts (Novak & Gowin, 2010). This agrees with Ausubel's (1960) structuring of learning from more inclusive (complex) materials to less inclusive (simpler) ones, leading to meaningful learning.

In fact, (Novak & Gowin, 2010) see Ausubel's theory as a sound intellectual foundation for concepts mapping, as the strategy enhances students' meta-knowledge and meta-learning. In other words, by promoting meaningful learning, concept mapping is known to enhance assimilation, retention and retrieval of learned knowledge as the learning situation demands. This is because knowledge acquired through meaningful learning is assimilated into the existing cognitive structure and is retained longer, even much longer in many instances, (Novak, 2010). It is against this background that this study is carried out to ascertain if concept-mapping still enhances assimilation, retention and retrieval of knowledge. Will the situation be same with samples in this study?

Objectives of the study are to:

i. Find out if there is any difference in the performance of control and experimental groups in OCAT.
ii. Determine the difference in the performance of control and experimental groups in the OCRT.

Research Questions

i. Is there any difference in the performance of control and experimental groups in the OCAT?

ii. What is the difference in the performance of control and experimental groups in the OCRT?

Hypotheses

Ho_1: There is no significant difference in the performance of students of the control and experimental groups in the OCAT.

Ho_2: There is no significant difference in the performance of students in control and experimental groups in the OCRT.

Methodology/ procedure

The study adopted quasi experimental design.The population for the study comprised all senior secondary school 3 students in the 14 government-owned senior secondary schools in Obio Akpor Local Government Area (OBALGA) of Rivers State (Rivers State Post Primary Schools Board, 2010/11).The sample comprised of Ninety (90) Senior Secondary 3 students randomly selected and assigned into control and experimental groups respectively. Each group is made up of 45 students (samples). Three (3) research instruments were employed for data collection namely Organic Chemistry Aptitude Test (OCAT), Organic Chemistry Retention Test (OCRT) and a validated lesson note on concept mapping. OCAT and OCRT consist of 10-item, four options multiple choice questions based on petroleum as a mixture of hydrocarbons and adapted from standardized West African Senior Secondary School Certificate past questions.

Reliability of the instruments were 0.72 and 0.81 based on a pilot study. The OCAT and OCRT are equivalent (reshuffled) forms of each other. Two research assistants were employed in order to eliminate bias. A pre-test (OCAT) was administered to both groups to establish equivalence in terms of academic ability.

The experimental group was taught using concept mapping (that is the treatment) and the control group taught using the normal lecture method (that is no treatment). A post-test which is an equivalent form of the pre-test was administered. Then, after three weeks OCRT which is a reshuffled form of the post-test OCAT) was administered to both groups. The execution of the entire study lasted for 5 weeks.

Mean scores and standard deviations were computed for each of the groups in order to answer the research questions. The null hypotheses were tested for significance using the t-statistic of the Statistical Package for Social Sciences, (SPSS).

Presentation of Results

The results were analyzed and presented in tables.

Research question 1

Is there any difference in the performance of students in the experimental and control groups in the OCAT?

Table1: OCAT mean and standard deviation scores for the experimental and control groups.

	Experimental group	Control group	Difference in mean
Number of students	45	45	6.67
Mean	60.67	54.00	
Standard deviation	14.83	15.28	

Source: Researchers' field work, 2011

The mean score for experimental group is 60.67 and that for the control group is 54.00, indicating a mean difference of 6.67. Research question one is hereby answered.

Research question 2

What is the difference in the performance of control and experimental groups in the OCRT?

Table 2: OCRT mean percentages for the experimental and control groups.

	Experimental group	Control group	Difference in mean
Number of students	45	45	7.33
Mean	53.33	46.00	
Standard deviation	16.65	17.63	

Source: Researchers' field work, 2011

From table 2, mean retention score for experimental group is 53.33, and 46.00 for the control group, a difference of 7.33 in favor of the experimental group. This shows that the experimental group retained the learned knowledge longer than the control group. Research question two is hereby answered.

Hypotheses: Two null hypotheses were tested.

HO_1

There is no significant difference in the performance of students of the experimental and control groups in the OCAT.

Table 3: Using t-statistic to compare mean scores for both experimental and control groups.

Groups	N	$\bar{x}$	SD	SE	df	t-cal	t-critical	α-level	Remark
Experimental group	45	60.67	14.83	2.21	88	2.10	1.99	0.05	Significant
Control group	45	54.00	15.28	2.28					

Source: Researchers' field work, 2011

From table 3, calculated t-value is 2.10, and table t-value is 199. The calculated value of t is greater than the table value (2.10>1.99), hence there is statistically significant difference, and the null hypothesis is rejected, its alternative is hereby retained.

HO_2

There is no significant difference in the performance of students in experimental and control groups in the OCRT.

Table 4: Comparison of mean retention scores for experimental and control groups.

Groups	N	$\bar{x}$	SD	SE	Df	t-cal	t-critical	α-level	Remark
Experimental group	45	53.33	16.65	2.48	88	2.03	1.99	0.05	Significant
Control group	45	46.00	17.63	2.63					

Source: Researchers' field work, 2011

Table 4 shows calculated t-value (2.03) greater than critical t- value (1.99), consequently there is statistically significant difference between the mean retention scores for both groups. Hence, the null hypothesis is rejected and its reverse is therefore accepted.

Discussion of Results

The difference in mean scores shown on tables 1 and 2 are statistically significant in favor of the experimental group as shown on tables 3 and 4. This means that students taught using concept mapping showed better performance and retention than those taught with lecture method. In other words, learning is imparted more positively through concept mapping than through the traditional lecture method. This is in consonance with previous findings of Keogh & Naylor (1996); Jiang, (2004); Novak & Canás, 2008). According to Jiang, 2004, concept mapping helps to increase students' understanding of organic chemistry concepts, even isomerism. Hence, the reason for the significant difference between mean scores of experimental and control groups could be attributed to the fact that the use of concept map is activity based. Vanides, Yin, Tomita and Ruiz (2005) have shown that activity based learning such as concept mapping helps students to understand and organize what they learn better. According to these authors, concept mapping enables students store and retrieve information more efficiently.

Novak (2010), in support of Ausubel's (1960) meaningful learning theory, affirms that information learnt meaningfully is associated with advanced organizers in the cognitive structure, and can usually be recalled for weeks or even months after acquisition. Such knowledge is retained longer even much longer in many instances. One instructional strategy that enhances such retention is concept mapping. Hence the higher mean retention score for the experimental group. Conversely, the lower mean retention score for control group could have been as a result of rote memorization learning associated with the conventional, traditional (non-activity) lecture method. Information acquired by rote cannot be anchored by elements in the cognitive structure and hence form a minimum linkage with it. Retention of such knowledge is therefore hampered.

Variation in extent of retention and amount of recall depends primarily on the degree of meaningfulness associated with the learning process.

Summary of Findings

i. Students of the experimental group perform better in the Organic Chemistry Aptitude test than those in the control group.
ii. Students of the experimental group retained the Organic Chemistry concepts longer than those in the control group.

Implications of findings for science education

The use of concept-mapping to teach chemistry (science in general) has the potential to increase students' cognition at the same time imparting positively on the affective and psychomotor domains because it enhances retention. The implication of this finding for science teaching and especially chemistry is that the strategy should be adopted in the teaching of science in general and chemistry in particular. This is because concept mapping involves head-on, heart-on and hands-on activities, which foster retention of knowledge. Hence, chemistry teaching and learning should not be business as usual but business unusual in which the 3Hs (Head, Heart and Hands) are at work.

Summary and Conclusion

Consequent upon the findings, the exposure of students to concept mapping strategy enhances their performance in organic chemistry and retention of the knowledge. Retention and recall of assimilated knowledge are functions of the meaningfulness of the learning process. So learning strategies that will make learning meaningful should be adopted, a typical example being concept mapping.

Recommendations

Based on the research findings, the following recommendations are made:

1. The curriculum for training chemistry teachers should include how to develop and use concept maps to teach chemistry and indeed science subjects.
2. Science education authorities should organize workshops and seminars that will sensitize teachers concerning teaching strategies and instructional methods that will enhance knowledge impartation by the teacher, including knowledge assimilation and retention by the students.

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A Thermographic Study of Heat Generation During All Ceramic Preparation

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Absract:

Statement of problem*: Saving pulp vitality is the great priority during all ceramic preparation.All ceramic preparation can cause pulpal lesionsif the temperature isn't controlled.****Purpose****:The study was conducted to highlight two factors that may affect the heat generation during all ceramic preparation: 1- Type of stone according to their abrasivenessgrit size (Fine , medium , Coarse). 2-Pattern of reduction (Continuous , Intermittent).****Materials&Methods:*** *Ninety freshly extracted sound,single rooted teeth was selected for this study and divided into two groups according to pattern of reduction (45 teeth for each group).Each group was subdivided into 3 subdivisions according to the type of stones used in the preparation. Copper-constantan thermocouple wire joined with digital thermometer used to measure the temperature rise in the pulp chamber at different places.* ***Results:*** *1-The intermittent reduction produced lesser increase in tooth temperature and was statistical different than the increase of temperature of continuous reduction.2-The fine grit size stones produce the least temperature rise then the medium grit size stone then the coarse grit size.****Conclusion:*** *All ceramic preparation should be done as intermittent reduction using fine grit size rotary instruments with sufficient water coolant in the high-speed handpiece.*

Keywords:All ceramic preparation, Stones ,Copper-constantan thermocouple,heat generation.

INTRODUCTION

Dental pulp is restricted by inflexible walls with a confined circulation supplied by an arteriole through a narrow apical foramen. Circulation disorders determine the reversibility limit for pulpal lesions and are precipitated by physical, chemical, thermal, or biologic stimuli.[1,2] Several essential procedures may contribute to pulpal necrosis. Heat is a major factor in pulpal injury .Other procedures include desiccation, pressure applied during tooth reduction,chemical injury,ill-fitting provisional restorations, bacterial infection, cementation, and occlusion. [3]. Dental pulps can't survive temperature increases greater than 5.5°C. [3] Crown/bridge abutment preparations produce some of the most damaging effects on the pulp. 16% of pulps became non-vital within a 10-year observation period, and 32% of previously confirmed vital pulps became necrotic following bridge abutment preparations.

Anterior abutment preparations resulted in pulp necrosis in over 50% of teeth examined in the study.Nine previous studies found that pulp necrosis occurred 10-18% of the time following crown preparations on vital teeth.Patients should be forewarned of the possibility of endodontic treatment being required following extensive crown/abutment preparations.[4] Thermal or non-thermal stimuli applied to dental structures can produce pulpal responses.Various alterations can occur by heat generation, such as tissue burning, the development of reparative dentin, postoperative sensitivity, and pulpal necrosis.[5]

Tooth preparations generate heat because the use of rotary cutting instruments on dental tissues creates friction. So Ultrahigh-speed tooth preparation can traumatize the hard dental tissues and the dental pulp.[6] Factors that influence heat generation include size and type of bur, contact intermittence, torque, instrument abrasiveness, load, and the amount of tissue removed. These should be routinely observed and controlled by the dentist to eliminate heat production.[6,7] Other factors that should be observed are the number of coolant apertures on the handpiece and their direction, which should be toward the tip of the bur. [8] Air-water spray cooling is essential in high-speed procedures, regardless of the pressure applied or type of bur associated with the equipment. Water temperature should not exceed 35°C. Adequate cooling prevents excessive drying and promotes drilling efficiency with diamond points or steel or carbide burs. [4,8] Standards to test the cutting efficiency of dental rotary cutting instruments are either nonexistent or inappropriate, and knowledge of the factors that affect their cutting performance is limited. Therefore, rotary cutting instruments for crown preparation are generally marketed with weak or unsupported claims of superior performance. [9]

Thermography was employed to determine the pattern of heat generation, distribution and dissipation during ultra-speed cavity preparation indicating an increase in intrapulpal temperature during cutting procedures. [10]

As clinical efficiency is increased with faster and more aggressive cutting tools. It is clinically imperative that tooth preparation avoid the excessive heat generation that could possibly damage the remaining tooth structure and endanger the health of the pulp.Many factors such as type of stone and pattern of reduction used are questionable controversial on the heat generation during all ceramic preparation, this study is conducted to highlight these factors.

REVIEW OF LITERATURE

Bhaskar SN et al (1965)[11] investigated the intrapulpal temperature during cavity preparation. An instrument consisting of a thermister probe for insertion into the pulp,a telethermometer, and a recorder, was specially designed for this study.Cavities were cut at low speed, at low speed with a coolant, at high speed, and at high speed with a coolant.They found that with low speeds without a coolant, the mean intrapulpal temperature increase was 5.4°C., with low speeds with a coolant the mean intrapulpal temperature dropped by 5.3°C and with high speed and high speed with a coolant, the mean intrapulpal temperature drop was 2.5°C. and 8.1°C., respectively.It can be assumed that under the usual operative procedures there is a drop in the intrapulpal temperature. Consequently, the well-known pulpal changes associated with cavity preparation cannot be due to heat production.It is most likely that these occur as a consequence of severance of the odontoblastic processes, dehydration, and perhaps the "cooling effect" of cavity preparations.

Dahl et al (1977) [12] studied the dentinopulpal reactions to full crown preparation procedures.He used an electron microscopy scanning and histological techniques to study the formation of a dentine smear in ten premolars ground with a water-cooled diamond in an air turbine.He revealed the formation of a dentine smear which was easily removed by light polishing with wet pumice, leaving plugs of debris in the tubule apertures.No bacteria were demonstrated on the prepared surfaces either in the scanning electron micrographs or histologically when stained with Brown & Brenn stain. Severe, acute pulp reactions were observed subjacent to the dentinal tubules cut in full crown preparation.

Pashley DH et al(1983)[13] studied the effect of temperature on dentin conductance (dentin permeability) by measuring the rates of fluid movement across dentin discs, in vitro at 10, 20, 30, 40, and 50°C in unetched and acid-etched dentin. They found that Increasing the temperature 40° (i.e., from 10 to 50°C) resulted in a 1.8-fold increase in fluid flow in unetched dentin, which was of a magnitude similar to the decrease in viscosity that occurred over the same temperature range. In acid-etched dentin, the 40°C temperature change produced more than a four-fold increase in fluid conductance, more than double that which could be accounted for by changes in viscosity. Analysis of the data suggests that this additional increment in hydraulic conductance is due to thermal expansion-induced increases in tubular diameter.

Laforgia PD et al(1991)[14] studied temperature changes in the pulp chamber during tooth preparation for a complete crown. Twelve extracted, morphologically intact human teeth were chosen: four canines, four premolars, and four molars. Six teeth, two of each, were cooled during preparation with an air-water spray; the remaining six were air-cooled. . They found that minimal reduction of dentin using an air-water spray coolant resulted in a lowered temperature in the pulp chamber, mainly with the cross-grooved diamond stones. The application of an air coolant resulted in a temperature rise in the pulp chamber.

Ulusoy N et al(1992)[15] studied the injurious thermal changes occurred in the pulp chamber if a twist drill is used 10 times, and if there is a correlation between temperature rise and distance between a drilled channel and the pulp chamber. Twenty caries-free, human, premolar teeth were randomly distributed to two dentists. With a new 2 mm twist drill, each dentist prepared 10 pinholes (one hole per tooth). Intrapulpal temperature change during the drilling procedure was recorded. The data were statistically analyzed by the Spearman rank order correlation coefficient. The results showed that twist drills should not be used for more than five pinholes. The distance between the pin channel and the pulp chamber does not influence heat generation in the pulp chamber.

Myers et al (1999)[16]carried out an investigaion upon the effect of extreme heat on teeth under laboratory conditions and the subsequent effect of decalcification and histologic processing. Physical and microscopic findings were evaluated in relation to temperature and duration of thermal insult.They found that microscopic examination following decalcification and histologic processing revealed changes including severe tissue fragmentation, vapor bubbles within dentinal tubules, altered histologic staining, charring and tissue shrinkage. Dentin appeared to be the most reliable microscopic identifier of incinerated dental tissues. Temperatures above 600 degrees C strongly predicted tooth disintegration following decalcification. This finding has implications in incineration cases where histologic evidence must be maintained and examined intact.

Lockard MW (2002)[17] studied the clinical and radiographic records for evidence of pulpal necrosis in teeth prepared for complete coverage restorations at ultrahigh speed with air coolant alonewas used. The 1847 teeth in this study (182 fixed partial denture abutment teeth and 1665 single teeth restored with 21 all-ceramic, 1095 metal-ceramic, and 731 all-metal restorations) were prepared with diamond instruments (burs) in a sweeping or painting motion with the use of light pressure at ultrahigh speed with air coolant alone from the handpiece. New burs were used for each patient and then discarded. Each bur was used on no more than 4 teeth. All impressions were made with reversible hydrocolloid. Provisional restorations were fabricated on a stone cast and cemented with zinc oxide and eugenol cement. Provisional restorations were removed at 3 to 4 weeks and definitive restorations placed. All patients were questioned about symptoms of tooth sensitivity, tenderness, or pain at their regular (4 to 6 month) hygiene recall appointments. Success was defined as any definitively restored teeth that remained free of radiographic evidence of periapical radiolucency and clinical signs and symptoms of pulpal sensitivity in the clinical record.They found that tooth reduction procedures can be completed with minimal damage to the pulp when only air coolant from the dental handpiece is used.

Galindo DF et al (2004)[18] studied the different variables involved in tooth cutting to characterize intrapulpal temperaure generation,cutting efficiency and bur durability when using conventional and channeled diamond burs. They found that channeled burs showed no significant advantage over convenional diamond burs when evaluating temperature generation and bur durability.Moreover,the cutting efficiency of conventional burs was greater than that of channeled burs.

Vitalariu A et al (2005) [19] investigated the immediate changes in the pulp-dentin complex that result from crown preparation, and their correlation with the thickness of remaining dentin and the preparation technique (with or without water spray cooling). They proved that there are several differences according with the preparation technique in the pulp morphology. The most severe changes appear after the profound preparation without water-cooling, the odontoblastic layer being extremely affected.Also, vascular reactions and inflammatory infiltrate (in the absence of bacteria) were present. They revealed that the histologic changes in the pulp and dentin following complete crown preparation occur anyway and they are considered difficult to avoid,

even if an adequate technique of preparation is used. The dental pulp shows structural changes, especially in the odontoblastic zone, its reactivity being correlated with the depth and the technique of preparation.

Wilson GJ et al (2005) [20] investigated the temperature changes in the dentalpulp associated with dental procedures using power grinding equipment.They found thatthermal insult to the dental pulp from the use of power instruments have a significant risk to the tooth. This risk can be reduced or eliminated by appropriate selection of treatment time and by the use of water irrigation as a coolant. The increased dentine thickness in older horses appears to mitigate against thermal injury from frictional heat.

Thomas J et al (2005) [21]investigated the effect of bur type (single/multi-use) and grit size on buccal and pulpal wall temperatures simultaneously during high-speed tooth preparation. Forty diamond burs were divided into 4 groups. Lingual tunnel preparations were performed to expose 4 mm of axial wall of pulpal chamber. Buccal walls of 40 extracted third molars were prepared in occluso-gingival direction for 2 minutes under standardized conditions. Reflectance of APC through a first-surface high-reflectance and minimal energy-loss mirror provided simultaneous thermal recordings of APC and buccal walls using a thermocamera. Continuous thermal recording provided 923 images/tooth that were analyzed thermographically using ThermaCAM™ Software. They found thattooth preparation caused overall buccal temperature increase. APC temperature decreased with multiuse burs of various grit sizes. Bur type rather than the grit size plays a major role in heat generation. Caution should be taken using single-use burs.

Materials and Methods:-

Materials

1-Wax blocks (Cavio,Egypt)

2-Copper mold:

A specially designed copper mold used for standerdization of resin blocks .Its is formed of two copper blocks which are assembled together using two screws and two guidind rods . At the middle of the assembled blocks, an oval shaped mold cavity of 35 mm length,20 mm width and 25 mm height.

3-Self cure acrylic resin (Acrostone,Egypt)

4- High speedContra angle (T3 racer sirona handpiece,Germany)

T3 racer with fixed connection(Midwest/ 4-hole) was used.Its head diameter 11.4 mm and the head weight is 14.8 mm. The handpiece weight is 53 g and the recommended bur size is 314/315 and the driving air pressure recommended is 2.3 bar. The speed of T3 racer without tooth contact is approximately 400.000 rpm. It has an anti-retraction valve to ensure no contamination of the ball bearing which made it more durable than other handpiece.

5-Rotary instruments (Diamond burs) (DIAKET, switzerland)

DIAKET multilayer gold diamonds (FG 314) were used

A-Depth marker (834-021-6.8 ML)

The size of the depth marker was 0.5 mm for all ceramic preparation of 1.5 mm thickness.

B- Two types of diamond stones (Taper wih flat end and football stone)

Each type have three types according to their grit size: (Fine grit stones, Medium grit stones, Coarse grit stones).

-Fine grit stones(Red coded) with its grit size 45

Tapered with flat end (847-016-8F)

Football stone (368-020-5F)

-Medium grit size stones (blue coded) with its grit size 105-125

Tapered with flat end (847-016-8ML*)

Football stone (368-020-5ML*)

-Coarse grit size stones (black coded) with its grit size 150

Tapered with flat end (847-016-8MLX*)

Football stone (368-020-5MLX*)

6-Thermocouple (copper-constantan thermocouple) (Philips,Kassel,Germany) with digital thermometer.

Methods:-

Grouping of the samples:-

The teeth were divided into two groups(45 teeth for each group) according to the pattern of reduction

A-Continuous reduction

B-Intermittent reduction . (The interval time of reduction & the total time of reduction were fixed).[6]

Each group was subdivided into three subgroups (15 teeth for each subgroup) according to type of stone according its abrasives grit size used fine, medium and coarse grit.

Temperature was measured at 3 levels (classes): incisal 1/3, middle 1/3, cervical 1/3

Factorial Design:

Pattern of reduction	**Group 1 Continuous reduction**									**Group 2 Intermittent reduction**									
Subgroubs	A 15teeth			B 15teeth			C 15teeth			A* 15teeth			B* 15teeth			C* 15teeth			
Classes	I	M	C	I	M	C	I	M	C	I	M	C	I	M	C	I	M	C	
Total	45 Teeth									45 Teeth									90 Teeth

(I) Incisal 1/3 (M) Middle 1/3 (C) Cervical 1/3

Specimen Preparation:-

Ninety freshly extracted sound,single rooted, crack and caries free teeth With mature apices and normal root morphology extracted for orthodontic or periodontal reasons were selected for this study.All teeth were stored in 10% formalin solution at room temperature. In addition, all teeth in the study were approximately the same shape and size, so that the hard tissue layers surrounding the pulpal chamber were similar. After extraction, the teeth were stored in isotonic saline solution for a maximum of 8 hours before testing to prevent desiccation of the pulpal tissues.

The roots of the teeth were sectioned with serrated double sided diamond disc 6 mm below the cement-enamel junction(CFJ).The root canal of each tooth was enlarged to file #70 to accommodate the thermocouple wire without modifying the dimensions of the pulp chamber. A special silicone material (Optosil P Comfort, Heraeus Kulzer, Hanau, Germany), was injected into the pulp chamber to facilitate the heat transfer from the walls of the pulp chamber.

Every 3 teeth was embeded into wax block by their roots and the wax block was inserted into the closed copper flask and then the cold cured acrylic resin was poured into the flask till the cement-enamel junction (CEJ).The resin blocks was removed from the flask after acrylic resin setting by opening the copper flask from the two screws .

Thermocouples were placed inside the pulp chanmer and their position was confirmed radiographically.The pulp chamber was then filled with heat conductor paste.The openings resulting from root removal were sealed with cement (Cavit,ESPE,Seefield,Germany) and each tooth and thermocouple wire were partially embedded in silicone (Optosil P Comfort Haraeus Kulzer,Hanau,Germany)so that only the buccal surface remained exposed.The purpose of these procedures was to immobilize the thermocouple.

Tooth reduction:-

Cutting was performed with (T3 racer sirona handpiece) with fixed connection (Midwest/ISO 4-hole).The handpiece weight was 53 g and the recommended bur size[ISO] was 314/315 and the deriving air pressure recommended was 2.3 bar.The T3 racer was operated at 400.000 rpm a constant air pressure of 0.23 MPa (33 psi) and a water-coolant supply rate of 15 ml/min.Before each series of cuts,the handpiece was sprayed with lubricant spray for 1 sec and thenrun without load for 60 sec.All of the cutting studieswith the handpiece were performed at maximum outputpower,torque and bur roation speed.The depth marker rotary instrument was used to standardize the depth of preparation for all samples to be 1.5mm.

One stone was used for each sample

Results:

Statistical Analysis

Differences in temperature between the two groups : Group 1 (Continuous reduction)&Group 2 (Intermittent reduction)at different sites (Classes) : I (incisal) ,M (middle) & C (cervical)

	Group1 (N = 45)	Group2 (N = 45)	Mean Difference	T	P-value
	Mean ± SD	Mean ± SD			
I	39.31 ± 0.93	38.66 ± 0.79	0.65	3.59	0.001**
M	39.45 ± 0.92	38.81 ± 0.79	0.64	3.53	0.001**
C	39.67 ± 0.95	38.96 ± 0.80	0.71	3.79	0.000**

Table 1

** The mean difference is significant at the 0.05 level.

There was significant statistical difference at the 0.05 level between group 1 and group 2 in the tooth temperature at the incisal , middle and the cervical 1/3 of the studied teeth .

Group 2 had a lower tooth temperature average.

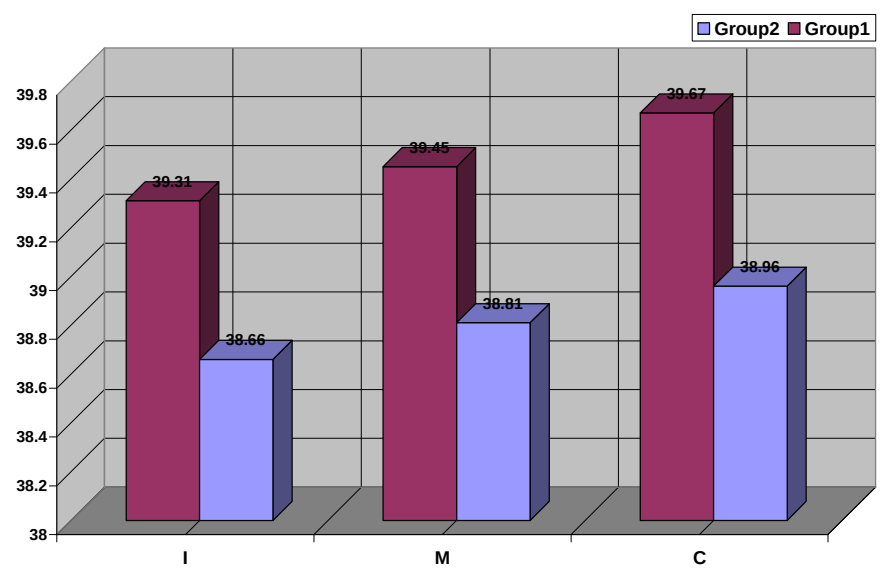


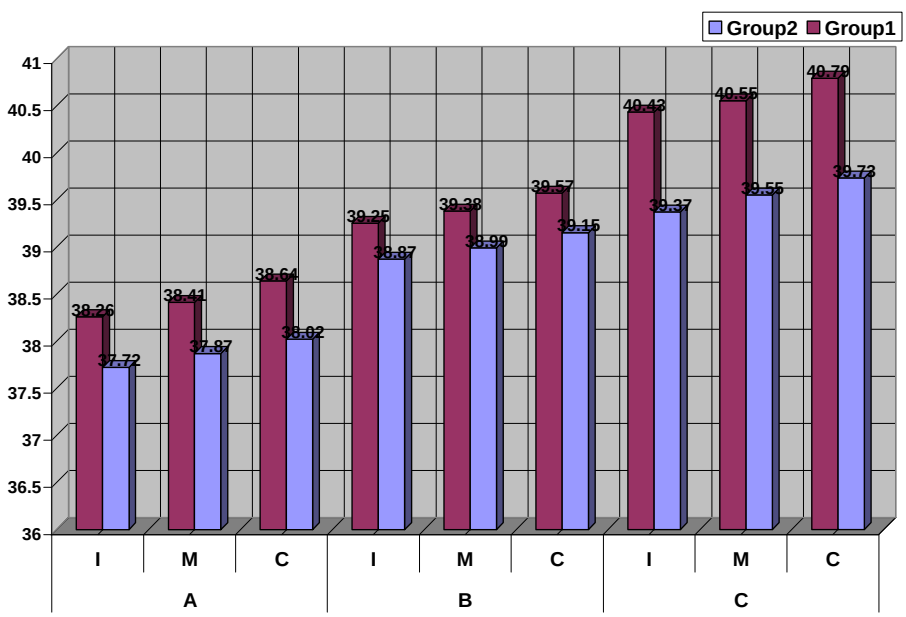
Figure (1)

Differences in temperature between the two groups : Group 1 (Continuous reduction) & Group 2 (Intermittent reduction) when using stones of different grit size (Subgroups)at different sites (Classes) : I (incisal) ,M (middle) & C (cervical).

		Group1(N = 15)	Group2(N = 15)	Mean	T	P-value
		Mean ± SD	Mean ± SD	Difference		
A	I	38.26 ± 0.21	37.72 ± 0.22	0.54	6.76	0.000**
	M	38.41 ± 0.26	37.87 ± 0.22	0.54	6.10	0.000**
	C	38.64 ± 0.36	38.02 ± 0.25	0.62	5.45	0.000**
B	I	39.25 ± 0.36	38.87 ± 0.31	0.38	3.05	0.005**
	M	39.38 ± 0.33	38.99 ± 0.30	0.39	3.34	0.002**
	C	39.57 ± 0.36	39.15 ± 0.31	0.42	3.44	0.002**
C	I	40.43 ± 0.23	39.37 ± 0.52	1.06	7.17	0.000**
	M	40.55 ± 0.21	39.55 ± 0.53	1.00	6.81	0.000**
	C	40.79 ± 0.36	39.73 ± 0.51	1.06	7.29	0.000**

Table 2

There was significant statistical difference at the 0.05 level between the subgroups (A,B,C) of group 1 and group 2 in the tooth temperature.The subgroups of group 2 had a lower tooth temperature average.



In group 1 (Continuous reduction)

Temperature differences between subgroups (A)-Fine grit stones,(B)-Medium grit,(C)-Coarse grit at different sites (Classes) : I (incisal) ,M (middle) & C (cervical).

		Mean ± SD	Maximum	Minimum
I	A	38.26 ± 0.21	38.70	37.90
	B	39.25 ± 0.36	39.80	38.70
	C	40.43 ± 0.23	40.80	40.00
M	A	38.41 ± 0.26	38.90	38.00
	B	39.38 ± 0.33	39.80	38.80
	C	40.55 ± 0.21	40.90	40.20
C	A	38.64 ± 0.36	39.40	38.20
	B	39.57 ± 0.36	40.20	39.00
	C	40.79 ± 0.36	41.20	40.30

Table 3

		um of Squares	df	Mean Square	F	P-value
I	etween Groups(A,B,C)	35.30	2	17.65	235.89	0.000**
	Within Groups(A,B,C)	3.14	42	0.08		
	Total	38.44	44			
M	etween Groups(A,B,C)	34.23	2	17.12	227.60	0.000**
	Within Groups(A,B,C)	3.16	42	0.08		
	Total	37.39	44			
C	etween Groups(A,B,C)	35.00	2	17.50	162.67	0.000**
	Within Groups(A,B,C)	4.52	42	0.11		
	Total	39.52	44			

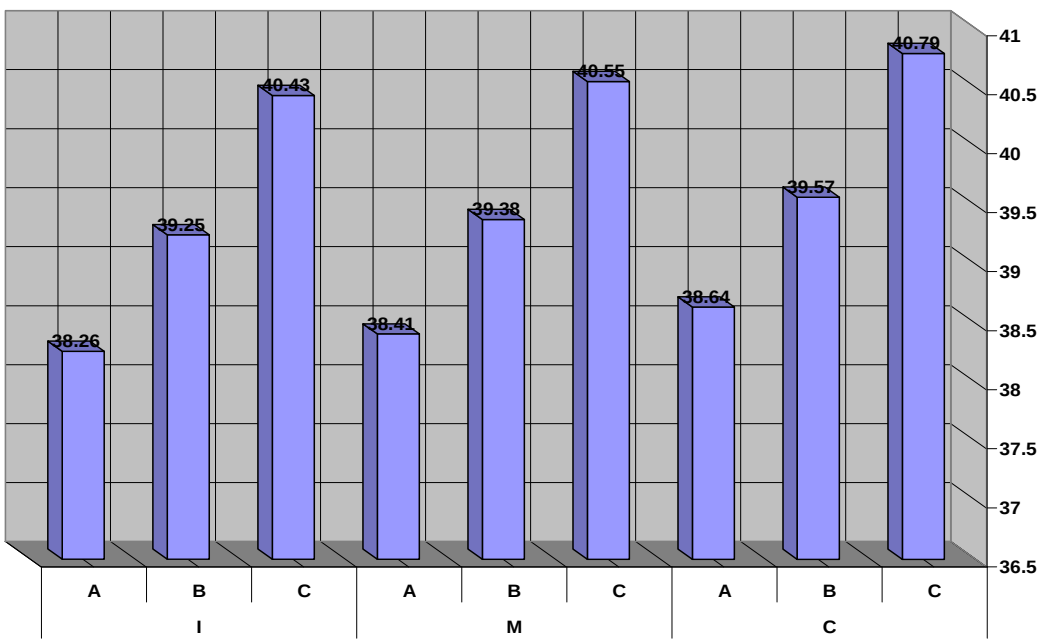
Table 4

There was significant statistical difference at the 0.05 level between the tooth temperature at the incisal , middle and the cervical 1/3 of the studied teeh in subgroups (A,B,C) for group 1 and so we needed to do one of the comparative tests to determine the direction of these comparisons .Scheffe test was used .

C	B	A		
0.000**	0.000**	-	A	I
0.000**	-		B	
-			C	
0.000**	0.000**	-	A	M
0.000**	-		B	
-			C	
0.000**	0.000**	-	A	C
0.000**	-		B	
-			C	

Table 5

There was significant statistical difference at the 0.05 level between subgroups (A,B,C) for group 1 in the tooth temperature at the incisal , middle and the cervical 1/3 of the studied teeh and for the subgroup (A). There was significant statistical difference at the 0.05 level between subgroups (B,C) for the group 1 in the tooth temperature at the incisal , middle and the cervical 1/3 of the studied teeh and for the group (B).



In group 2 (Intermittent reduction)

Temperature differences between subgroups (A)-Fine grit stones,(B)-Medium grit,(C)-Coarse grit at different sites (Classes) : I (incisal) ,M (middle) & C (cervical).

		Mean ± SD	Maximum	Minimum
I	A	37.72 ± 0.22	38.10	37.40
	B	38.87 ± 0.31	39.30	38.40
	C	39.37 ± 0.52	40.30	38.40
M	A	37.87 ± 0.22	38.20	37.50
	B	38.99 ± 0.30	39.40	38.60
	C	39.55 ± 0.53	40.40	38.60
C	A	38.02 ± 0.25	38.30	37.60
	B	39.15 ± 0.31	39.80	38.80
	C	39.73 ± 0.51	40.50	38.80

Table 6

		n of Squar	df	lean Square	F	P-value
I	etween Groups(A,B,C)	21.38	2	10.69	76.78	0.000**
	Within Groups(A,B,C)	5.85	42	0.14		
	Total	27.23	44			
M	etween Groups(A,B,C)	21.95	2	10.98	79.81	0.000**
	Within Groups(A,B,C)	5.78	42	0.14		
	Total	27.73	44			
C	etween Groups(A,B,C)	22.59	2	11.30	81.37	0.000**
	Within Groups(A,B,C)	5.83	42	0.14		
	Total	28.42	44			

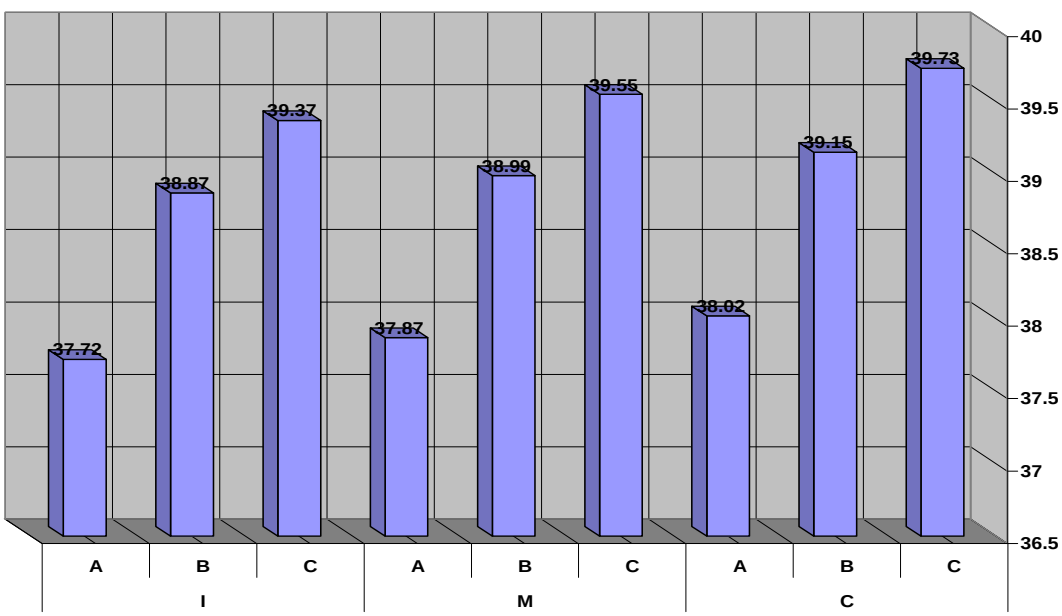
Table 7

There was significant statistical difference at the 0.05 level between the tooth temperature at the incisal , middle and the cervical 1/3 of the studied teeh in subgroups (A,B,C) for group 2 and so we needed to do one of the comparative tests to determine the direction of these comparisons .Scheffe test was used .

C	B	A		
0.000**	0.000**	-	A	I
0.003**	-		B	
-			C	
0.000**	0.000**	-	A	M
0.001**	-		B	
-			C	
0.000**	0.000**	-	A	C
0.001**	-		B	
-			C	

Table 8

There was significant statistical difference at the 0.05 level between subgroups (A,B,C) for group 2 in the tooth temperature at the incisal , middle and the cervical 1/3 of the studied teeh and for the subgroup(A). There was significant statistical difference at the 0.05 level between subgroups(B,C) for the group 1 in the tooth temperature at the incisal , middle and the cervical 1/3 of the studied teeh and for the group(B).



Disscusion

As the demands of patients for improvement of appearance are continuously increasing, the use of all-ceramic materials became increasingly relevant to restorative dentistry. All ceramic restorations are characterized by enhanced esthetic properties, high biocompatibility, diminished plaque accumulation, low thermal conductivity, abrasion resistance and color stability.[24]

For many years, the potentially damaging effect of temperature increases on pulpal tissue during restorative treatment has been a concern. Dental pulps can't survive temperature increases greater than 5.5°C.[3,11,26]

Samples selection and preparation:-

The samples selected in that study as **Galindo DF et al(2004)**.The teeth were single rooted and single canal premolars to facilitate the introduction of the thermocouple from the root to the pulp chamber .They were recently extracted and had intact enamel and dentin without carious lesions or resorations. After extraction teeth were stored in an isotonic saline solution to prevent desiccation of the denal tissue.[18]

However others as **Ottle P(1998)** selected the tooth specimens that were recently extracted , intact human third molars . The teeth were fully erupted, namely, nonimpacted. They had well-developed, not extremely conical roots, undamaged dental pulps,and an intact enamel and dentin structure without any carious lesions or fillings.[6]

The root portions were sectioned as **Wilson GJ (2005)** and **Baysal A (2007)** (with a Carborundum disk (Komet, Gebr Brasseler, Lemgo, Germany) approximately 4 mm below the cemento-enamel junction perpendicular to the long axis of the teeth. The opening into the pulpal chamber was enlarged as needed to insert the thermocouple wire with gatesglidden files. The pulpal chamber was cleaned of remnants of soft tissues with a spoon excavator and sodium hypochlorite application for 1 minute. The pulp chambers of the teeth were rinsed with distilled water, air dried, and filled with silicone transfer compound (Philips ECG Inc, Waltham, Mass) as **Baysal A (2007)** and **Hannig M. (1999)** .[20,25,26]

However others as **Carson J (1979)** sectioned the samples transversely with a diamond disc in the cervical one-third of the anatomical crown then the samples were mounted in dental stone such that the occlusal surface of the tooth and the roof of the pulp chamber were exposed.[10]

Pulp residues was removed from retrograde after root resection as **Hannig M. et al (1999)** to make a space for the thermocouple wire .[26]

Teeth were placed on acrylic blocks of and labeled according to tooth group as **Baysal et al (2007)** to facilitate the differentiation between samples and the fixation of the samples during preparation and temperature measurement.[25]

Tooth preparation for samples:-

The teeth were prepared as **Attia A (2004)** with the following preparation criteria for all-ceramic crowns: 6-degree axial taper, 1.5-mm shoulder finish line placed 0.5 mm occlusal to the cemento-enamel junction, 2-mm occlusal reduction, and occluso-gingival height of 5 mm.**(27)**

However **Chiodera G (2009)** made the tooth preparations using a water-cooled air turbine handpiece and HiDi 501 bur. The design was that for an all-ceramic crown with 1.2 mm reduction on all surfaces determined by comparing the prepared tooth with pre-operative indices.[28]

Tooth temperature measurment:-

A retrograde endodontic approach was done as **Wilson GJ (2005)** and **Hannig M. (1999)** to locate a thermocouple (diameter 0.7 mm, with measurement increments of 0.1oC) within the pulp chamber against the dentine directly opposite the site of grinding. The thermocouple was coupled thermally to the dentine using heat conductive heat sink compound.[20,26]

The tooth temperature was measured as **Ottle P(1998)** by using thermocouples (Philips, Kassel, Germany), 0.25 mm in cross section that was inserted from the apex into each tooth canals until they contacted the roof of the pulpal chamber. Before temperature measurements, the positions of the thermocouples were checked by radiographic films and corrected as needed.[6]

The thermocouple was placed inside the pulp chamber adjacent to the cutting area and their position was confirmed radiographically and the pulp chamber was then filled with heat conductor paste as **Wilson GJ (2005)**.The apertures resulting from root removal were sealed with cement (Cavit; ESPE, Seefield,Germany) and each tooth and thermocouple wire were partially embedded in silicone (Optosil P Comfort, Heraeus Kulzer, Hanau, Germany), The purpose of these procedures was to immobilize the thermocouple and to provide a steady base for the dental crown during cavity cavities and temperature variation measurements.[20]

The temperatures was recorded with Digital Thermometer and a thermocouple as **Mizrahi E. et al(1996)** and **Hannig M. et al(1999)** . Readings were taken directly from the digital display or from the graphic output of a chart recorder.peratures The thermocouple maintained immediate contact with the dentin by means of a thin layer of a silicon oil-based thermal joint compound [26,29]

However **Carson J et al (1979)** used a thermographic imager to detect the emission of infra-red radiation during the experimental procedures.The intensity of the emission is proportional to the temperature. The imager scans the tooth and detects radiation of wavelengths 7-13microns.[10]

Smith E et al (2004) used miniature thermometers to measure the relationship between surface temperature of teeth and internal flow of 37 C water (in vitro) or blood (in vivo). In addition, thermal stimuli were applied to the external surface of the teeth, and the rate of temperature recovery was related to internal flow.[30]

Disscusion of results

Ottle P et al (1998) demonstrated that the coarser the grit of diamond bur, the more pronounced the temperature elevation within a pulpal chamber during tooth preparation. They concluded that coarse diamond burs resulted in more pronounced temperature increases within the pulpal chamber during tooth preparation. In addition, the benefit of short intervals between grinding steps and a cooling water temperature between 30° C and 32° C was confirmed to control the temperature rise. **(6)**

Ozturk B. et al(2004) showed that when high water cooling was utilized, the critical 5.5 degrees C value was not reached with any air pressure or load.[22]

Ercoli C et al (2009) found that tooth preparation with an adequate water flow does not cause harmful temperature changes in the pulp chamber, regardless of rotary cutting instrument type.[9]

Thomas J et al (2005) found that tooth preparation caused overall buccal temperature increase. APC temperature decreased with multiuse burs of various grit sizes. Bur type rather than the grit size plays a major role in heat generation.[21]

Kramer I R et al (1952), Marsland E A et al (1957) , Orban B (1941) , James V E (1955), Mjor I A et al (2001) & Christensen G J (1997) showed that displacement " aspiration"of odontoblastic nuclei into the dentinal tubules following the teeth preparation is a phenomenon taken into account when high-speed dental engines were introduced. (32-37)

Seltzer S. (1958) , James V. E. (1954) & About I. et al (2001) showed that odontoblast numbers and dentine repair activity were found to be influenced more by cavity restoration variables and aspiration of odontoblastic nuclei. (38-40)

Summary and Conclusion

The purpose of this study was to evaluatethe thermographic changes occurred from the heat generated during all ceramic preparation using rotary instruments of different grits.

Data were collected, tabulated and statistically analyzed with the following conclusions:

1-The intermittent reduction produced lesser increase in tooth temperature and was statistical different than the increase of temperature of continuous reduction.
2-There was significant statistical difference between the using of (fine, medium,coarse)grit sizes stones for the continuous reduction in the tooth temperature at the incisal , middle and the cervical 1/3 of the studied teeh.The fine grit size stones produce the least temperature rise then the medium grit size stone then the coarse grit size.

3- There was significant statistical difference between the using of (fine, medium,coarse)grit sizes stones for the intermittent reduction in the tooth temperature at the incisal , middle and the cervical 1/3 of the studied teeh.The fine grit size stones produce the least temperature rise then the medium grit size stone then the coarse grit size.

4- There was no significant statistical difference at the 0.05 level between the tooth temperatures at the incisal , middle , cervical 1/3 of the studied teeth in the continuous or intermittent reduction

Clinical recommendations:

All ceramic preparation should be done as intermittent reduction using fine grit size rotary instruments with sufficient water coolant in the high-speed handpiece.

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Conceptualizing the role of opportunity recognition in entrepreneurial career success

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Abstract

Previous studies conducted on entrepreneurial success and opportunity recognition have been studied as separate phenomenon and examines the entrepreneurial process after opportunities have been discovered. Thus, the aim of the study to conceptualize the role of opportunity recognition on the success of entrepreneurs with several other individual level determinants.Based on the different theoretical approaches and the review of literature, this study suggests a theoretical framework, which includes all individual level determinants of entrepreneurial career success. These drivers are personal capital, psychological capital, human capital, social capital, managerial competencies, and opportunity recognition.

Keywords: Opportunity Recognition, Entrepreneurial Subjective career success, Entrepreneurial Objective career success

1. Background to the Study

1.1. Entrepreneurship and Opportunity Recognition

Due to dramatic unfavorable changes and reduced opportunities for career advancement in the private sector, entrepreneurship has become an increasingly attractive career alternative in many of the countries today. As a result of this, massive number of new ventures are established each year worldwide. However, for many aspiringentrepreneurs it is really difficult to meet their initial expectations and as a result of that the failure ratesamong start-ups and new ventures can amount up to sixty percent within first 5 years (Martin & Ingrid, 2001).

Establishing an entrepreneurial firm is an outcome of one's own decision and his/her self-motivation. Thus, individual level determinants play a dominant role in the success of entrepreneurs. But, despite extensive research on the attributes of both entrepreneurial firms (Mahoney &Pandian, 1992) and individuals (Kehet al., 2002), studies of success outcomes have focused primarily on firms rather than on entrepreneurs themselves (Parasuramanet al., 1996). According to Lau, Shaffer& Kevin Au

(2007), 'entrepreneurial firms are a natural extension of entrepreneurs: thus understanding the career success of these individuals will provide some insights into the success of their firms' (p.126). Conventionally, entrepreneurial career success could be conceptualized in terms of objective and subjective domains(Lau, Shaffer& Kevin Au, 2007).

It is increasingly recognized that entrepreneurial opportunities are at the heart of entrepreneurship (Davidsson, 2004; Shane, 2003; Short et al., 2010). As Shane and Venkataramn (2000) 'without opportunities there is no entrepreneurship' (p.)and (Short et al., 2010) 'apotential entrepreneur can be enormously creative and hardworking, but with the absence of identifying an opportunity to aim these characteristics, entrepreneurial activities cannot be taken place (pp.40).According to Ardichviliet al (2003);Shephered and DeTienne (2005), identification and selection of the right opportunities for new businesses are among the most important abilities of a successful entrepreneur. Further, understanding entrepreneurial opportunities is important because the characteristics of opportunity influence the entrepreneurial process (Shane, 2003). Thus, the study of opportunities is indispensable and central to the entrepreneurship research (Davidsson, 2004; Shane and Venkataraman, 2000). However, many studies on entrepreneurship have focused on entrepreneurs and their behaviours in creating new ventures, but little attention on 'opportunity' (Eckhardt& Shane, 2003).

2. The statement of the Problem

There are great deal of studies on entrepreneurial success and opportunity recognition. However, the phenomenonstudied in relation to entrepreneurial success and opportunity recognition are still inconclusive. Previous studies conducted on entrepreneurial success and opportunity recognition have been studied as separate phenomenon. Shane (2000) emphasize, a great deal of entrepreneurial research examines the entrepreneurial process after opportunities have been discovered. Even if great number of studies has highlighted the importance and role of opportunity recognition in entrepreneurial success a lacuna could be found in examining the interrelationship between these two concepts. Hence, previous studies conducted on opportunity recognition and entrepreneurial success can be considered as polarized studies.

On the other hand, some opportunities are good or right opportunities and some of them are bad or wrong opportunities. Recognizing right opportunities therefore will not lead all entrepreneurs to their success. In contrast, there are entrepreneurs who succeed without identifying opportunities. This unrevealed interrelationship between the two concepts creates a knowledge gap to conceptualize the role of opportunity recognition on entrepreneurial success. Therefore the aim of this study is to conceptualize role of opportunity recognition on the success of entrepreneurs with several other individual level determinants. Particularly this study address the following questions of (i) what are the factors affecting opportunity recognition of entrepreneurs their relative importance (ii) what are the factors affecting entrepreneurial career success and their relative importance and (iii) to what extend does opportunity recognition predict entrepreneurial career?

3. Theoretical Perspective of Entrepreneurship and Opportunity Recognition

Today, entrepreneurship, a field of study, is considered as one of the most dynamic fields, having different views, thoughts and approaches leading to emerge different academic traditions in this field. As a result of is, those different academic traditions or schools of thoughts bring multifaceted and heterogeneous phenomenon with respect to theories, approaches, methodologies in understanding what precisely 'entrepreneurship' is(Audretsch 2012) .

According to Audretsch (2012), there are three main approaches to entrepreneurship as organizational context approach, performance criteria approach and behavioral approach. According to Shane (2003), entrepreneurship research falls into three schools of thought, each with different assumptions about this

process of entrepreneurship, namely as Neoclassical equilibrium theories, Psychological theories and Austrain theories. According to Eckhardt& Shane (2003), the main theories have explained 'entrepreneurship' as a function of the types of people who engaged in entrepreneurial activity and the role of opportunities. Therefore first, entrepreneurship has identified as a person-centric approach. Second, many researchers have assumed that entrepreneurship as an equilibrium phenomenon. In recent, according to Eckhardt& Shane (2003); Shane &Venkataraman (2000) and Venkataraman (1997), entrepreneurship, as a scholarly field, involves the study of opportunities. Samasivan (2009) categorized all these different traditions into six major schools of thoughts as (1). The 'Great Person' school of entrepreneurship, (2). Psychological approach of entrepreneurship, (3). The classical school of entrepreneurship, (4). The management school of entrepreneurship (5). The leadership school of entrepreneurship and (6). The intrapreneurship school of entrepreneurship. More precisely, firstly, entrepreneurship discusses the role of personal traits and skills needed for the venture success and survival. Then it focuses the importance opportunity recognition and exploitation. Next emphasis of entrepreneurship discusses the role of managerial skills & capabilities and their leadership needed for an entrepreneur to manage his business and finally, its focus confers challenges and issues faced by an entrepreneur and the how he/she sets up the business strategies to overcome the barriers. In summary, all these traditions discuss the different aspects of role, characteristics, behavior, skills, practices of both the entrepreneur and his/her venture which lead to their survival and success.

Therefore, the main focus of this study is to reconcile those different approaches into one theoretical framework which includes all the aspects of entrepreneurial success at individual level and to discuss their relative role in entrepreneurial career success.

4. Review of Literature

4.1.Entrepreneurial Career Success

Entrepreneurial success has been defined and measured in different ways. The widely used way is to define and measure the entrepreneurial success is to use tangible elements (Makhbul&Hasun, 2011) or to use objective domains. Therefore, many studies on entrepreneurial success have mainly emphasized on firms rather than individual entrepreneurs (Lau at el., 2007 and Parasuraman et al., 1996). In contrast, some studies have focused on entrepreneurial career success rather than entrepreneurial firm success (Lau at el., 2007, Keh et al., 2002) as they argue that entrepreneurial firm is the natural extension of entrepreneurs and studying those individuals hence provides some insights into the success of their firms.

Conventionally, entrepreneurial career success conceptualized in terms of both objective (extrinsic) and subjective (intrinsic) domains (Lau at el., 2007). Objective career success is observable. Therefore, it is relatively easy to measure. Objective career success is usually measured in terms of income, promotions, job level, status and prestige. The three dimensions to measure objective career success for entrepreneurs are social reputation, social recognition and social status (Lau et al., 2007). On the other hand, subjective career success is unobservable. Hence it is difficult to measure but possible to assess. So, the subjective career success refers to individuals' career appraisal towards their career experiences. Subjective career success dimensions constructed by Lau et al. (2007) in their study are perceived career achievement, career satisfaction and perceived financial attainment.

According to the previous studies, career success can be measured in terms of objective, subjective or both domains. But here the problem arises is that how these objective and subjective careers relate to one another (Hall & Chandler 2005) as whether objective career success influence on subjective career

success or it is the other way round. However, in literature there are studies in supporting both arguments. As Arthur et al (2005) highlighted, the most of studies relating to entrepreneurial success have considered the influence of objective career success on subjective career success. In contrast, some studies have supported the reverse causality (Hall & Chandler, 2005; Aryee et al., 1994). However, studies considering the influence of both ways is scares in literature.

4.2.Opportunity Recognition

In spite of the different definitions provided, some studies claim that opportunity recognition is subjectively perceived and in contrast, others argue it is objectively discovered. Those who argue opportunity recognition as an objective concept suggest that opportunities arise from different external changes such as technological, political, regulatory, and socio demographic changes (Davidsson 2004; Shane 2003). On the other hand, according to Alvarez & Barney (2007); Shephered et al (2010), opportunity recognition is a subjective phenomenon which arises out of the subjective interpretations and creative actions of individuals. However, MaijaRenkoet al. (2012) in their study have established that elements of both these perspectives can be found in every entrepreneurial opportunity.
In addition to the above dichotomy of opportunities, recent entrepreneurship research has focused on another contrast of opportunities: first person opportunities and third person opportunities. ***First person opportunities*** concerns the formation of subjective beliefs that an opportunity exists for those individuals with the relevant knowledge and motivation to exploit it (Gregoireet al., 2010).***The third person*** concerns the evaluation of the opportunity for oneself considering whether the relevant person has the motivation and knowledge to successfully exploit the opportunity. Thus, third person opportunity is a potential opportunity not just for him/her self, but for anyone with the ability to notice and interpret the signal. In contrast, the first person opportunity is purely for oneself. In this instance, the entrepreneur is involved in a decision making process and evaluates the opportunity according to whether it is promising and feasible and what the potential reward for this opportunity is worth etc. (Gregoireet al., 2010; McMullen & Shepherd, 2006).

5. Theoretical Framework

Based on the different theoretical approaches and the review of literature, this study suggests a theoretical framework, which includes all individual level determinants of entrepreneurial career success. Thus the suggested theoretical model of entrepreneurial success in figure 1 includes six drivers of entrepreneurial career success and is more appropriate as it suggests all individual level predictors of entrepreneurial success. They are personal capital, psychological capital, human capital, social capital, managerial competencies, and opportunity recognition.

Personal Capital

Personal capital consists of socio-demographic factors of entrepreneurs such as their age, level of education, gender, experiences, family background. Even if psychological theories of entrepreneurship consider personal capital as a good predictor of entrepreneurial success empirical findings are with greater contradictions. Thus, no consistency could be found on whether personal capital positively relates to objective and subjective success of entrepreneurs. Thus, it proposes the following proposition,

Proposition 1: Personal capital positively related to entrepreneurial success.

Psychological capital

This refers to entrepreneurs' skills and capabilities, needed in business operations. The most widely used psychological factors are risk taking, need for achievement, locus of control, self-efficacy, tolerance of ambiguity, innovativeness, and openness. Since entrepreneurs are owner-managers to their firms they should have these psychological characteristics, lead their success and survival. Many scholars (for example; Cramer et al., 2002; Born &Witteloostuijn, 2009) found positive relationships between the factors of psychological capital and the firm success. But there are controversies about the role of those factors in the higher performance of entrepreneurs. Thus, it proposes the following proposition,

Proposition 2: Psychological capital positively related to entrepreneurial success.

Human Capital

This refers to the knowledge and experiences of entrepreneurs. Human Capital is one of the key components in firms' success and acts as a resource (Rauch & Frese, 2000). Therefore, human capital can be acquired and developed through education, work experiences and job trainings (Markman & Baron, 2003) and need to continuously developed (Born & Witteloostuijn, 2009). Human capital is two types: general human capital and specific human capital. While general human capital acquires through education and work experience, specific human capital develops through industry specific experience, leadership experiences and self-employment experiences (Bruederl, Preisendoerfer, & Ziegler, 1992). Many studies found a strong positive relationship between human capital and firm performance(Bruederl, Preisendoerfer, & Ziegler, 1992; Gimeno, Folta, Coorper, & Woo, 1997; Pennings, Lee, & Van Witteloostuijn, 1998). Thus, this study proposes the following proposition,

Proposition 3: Human capital positively related to entrepreneurial success

Social Capital

Social capital is another important components of entrepreneurial success. Social capital includes entrepreneurs' social networks, contacts and relationships with third parties and can be in the form of formal and informal ties. Formal ties are partnerships and industrial contacts which comes in the forms of financial, technology and strategic and informal ties are social and community-based networks (Makhbul & Hasun, 2011). Thus entrepreneurs use four main types of network ties as (1). Entrepreneurs' inner circle – includes the people with whom entrepreneurs have stable and long-term relationships. But they are not venture partners. (2). Action sets – those who recruited by entrepreneur to provide necessary resources (3). Partnerships (4). Weak network ties – uses to gather general information. Regardless of the type, entrepreneurs use social capital to gather more knowledge, information and better access towards resources. Studies have found positive impact of social networks on entrepreneurial success (Makhbul& Hasun, 2011; (Bruderl & Preisendorfer, 1998). Thus, the following proposition is sugessested in this regard.

Proposition 4: Social capital positively related to entrepreneurial success

Managerial Competencies and Business Strategies

Even if the entrepreneurial traits and characteristics are the most significant drivers of entrepreneurial success, managerial competencies and business strategies too have significant influence in firm performance. Entrepreneurs themseleves have to take all resposibilities, engage in many of the firm activities, combine & utilize resources effectively and efficiently, expolit/innovate new opportunites,

products, markets etc., identifying customer needs & wants and meeting their satisfaction (Tanveer, Akbar, Gill, & Ahmed, 2013). Therefore, in this regard, managerial competencies and business strategies are of particular importance for them in firm success (Rauch & Frese, 2000). Thus, it propeses the following proposition.

Proposition 5: Managerial competencies and business strategies positively related to entrepreneurial success.

Opportunity Recognition

It is increasingly recognized that entrepreneurial opportunities are at the heart of entrepreneurship (Davidsson, 2004; Shane, 2003; Short et al., 2010).Eckhardt& Shane (2003) defines entrepreneurial opportunities as "the introduction of new goods, markets, raw materials and organized methods in order to create something new" (p.339). Identification and selection of the right opportunities for new businesses are among the most important abilities of a successful entrepreneur(Ardichviliet al., 2003;Shephered&DeTienne, 2005). Further, understanding entrepreneurial opportunities is important because the characteristics of opportunity influence the entrepreneurial process (Shane 2003). Therefore, identifying correct opportunities lead entrepreneurs to start new ventures and do significant improvements in existing businesses (Sambasivan, Abdul, & Yusop, 2009). Thus, this study proposes the following proposition.

Proposition 5: Opportunity Recognition positively related to entrepreneurial success

As per literature, there are many factors influencing the process of opportunity recognition. Among them entrepreneurial alertness, prior knowledge, social networks, personality traits and psychological factors are significant. Many studies (Ardichvili et al., 2003; Shane, 1999; Shephered&DeTienne, 2005; Venketaraman, 1997) found that the said factors are significant predictors in opportunity recognition. Therefore, this study proposes the following propositions in this regard.

Proposition 5: Personal capital positively related to entrepreneurial opportunity recognition.

Proposition 5: Psychological capital positively related to entrepreneurial opportunity recognition.

Proposition 5: Human capital positively related to entrepreneurial opportunity recognition.

Proposition 5: Social capital positively related to entrepreneurial opportunity recognition.

Proposition 5: Personal capital positively related to entrepreneurial opportunity recognition.

6. Research Methods and Methodology

6.1.Research Design and Research Model

Most of the research studies on entrepreneurship have been performed as quantitative studies. Thus, to provide an empirical support for the conceptual frame work proposed above, a quantitative research method will be most appropriate in order to conduct a cross-industry field survey for primary data collection. The unit of analysis of the study will be the individual entrepreneurs as the focus of the study is on entrepreneurs and their characteristics towards entrepreneurial career success. Suggested propositions were developed based on the study framework.

Figure 1 explains the conceptual framework of the research design.The conceptualization has been originated based on the existing theoretical and empirical studies in the area of entrepreneurial opportunity identification and development.

Figure 1: Conceptual Framework – Please refer Annexure 1

For this purpose, the study will be used two main research instruments as structured questionnaire and interviews where it necessary. The self-structured questionnaire will be developed to collect data. Informal interviews will also be used as a research instrument. The study intends to employ both descriptive statistics and statistical inferences for the data analysis purpose in order to achieve its objectives. Therefore frequencies, means and standard deviations will be used as main descriptive statistics. Multivariate analysis will beappliedto test the model of the study. Structural Equation Modeling (SEM) will be the main statistical tool in this regard. However, when using regression or ANOVA, the researcher can only conducts his/her analysis on variables that are directly measured, and this can therefore limit the testing of the underlying theoretical constructs (Martens, 2005). But SME measures the relative importance of each independent variable included in the model. Another important attribute of SEM is that it can address the measurement error that other linear techniques cannot model.

7. Discussion and Conclusion

Although studies on entrepreneurship have acknowledged the potential constraints on business growth and success arising from conflicts between work and family demands, the role of opportunity recognition by entrepreneurs and entrepreneurial career success are extremely few and with full of significant research gaps, unaddressed phenomenon and contradictory findings. Shane &Venkataraman (2000) assert that to have entrepreneurship there must first be opportunities. Shane (2003) is of the view that both individuals and opportunities are important in the entrepreneurial process because opportunities themselves lack human agency.

Knowledge relating to the opportunity recognition and entrepreneurial success has been limited due to various conceptual gaps, methodological challenges and inconclusive empirical findings in the field Shane &Venkataraman's (2000). This study, therefore, addresses some conceptual gaps and methodological challenges associated with opportunity recognition and entrepreneurial career success. Further, it investigates the relative importance of opportunity recognition with several other individual level of determinants of personal capital, psychological capital, human capital, social capital, and managerial competencies in entrepreneurial career success.

This study yields some limitations too. The proposed model of entrepreneurial career success only focuses on individual level determinants of entrepreneurs and their relative importance in entrepreneurial career success. But, it does not investigate the impact of the factors of external environment and firm level determinants within which those entrepreneurial firms operate. Therefore, future research could be conducted in this direction in order to improve this model, incorporating individual level determinants with firm level determinants and external environment factors.

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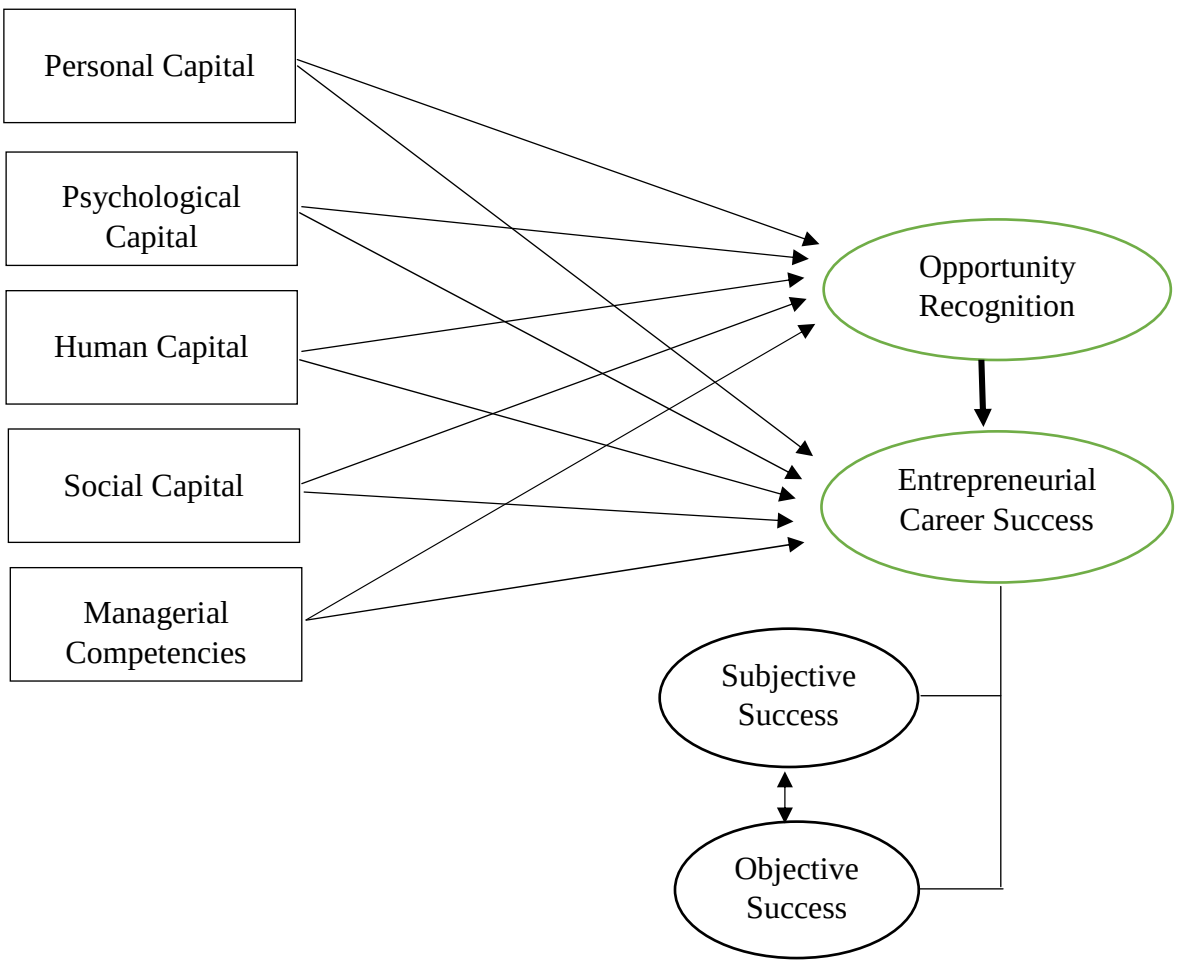
Annexure 1:*Figure 1: Conceptual Framework*



Strain Analysis of Zirconium Fpds with Pier Abutments Using Different Designs

Mohammed M. Alsamhari (1); Abdelaziz M. A.(2); Jihan F. Younis (3) *and* Tarek S. Morsi(4)

Abstract

Statement of problem: *in some patients, the pattern of missing teeth may require theuse of a fixed partial denture (FPD) with an intermediate (pier) abutment, information is needed regarding the biomechanical behavior and best (FPD) design as treatment option.*

Purpose: *This study was aimed to examine the effect of three different bridge designs with pier abutment on strain analysis of Zirconia Bridges after aging process (cyclic loading and acid storage). The three different designs were: fixed-fixed bridge with rigid connector,fixed-fixed bridge with non- rigid connector and fixed-free Bridge.*

Material and methods: *A total of 30 all-ceramic zirconia bridges were constructed and divided according to bridge design in to three groups (10 bridges each);fixed-fixed design(10 samples), non-rigid design (10 samples),and cantilever design (10 samples).Each groupwas made to measure;1 strain gauge analysis at 300 N, 2 strain gauge analysis at fractureload.*

Results: *One way Analysis of Variance (ANOVA) was used to compare between*
three types of designs. Tukey's post-hoc test was used for pair-wise comparison betweenthe means when ANOVA test is significant. The test reveal that fixed-fixed design groupshowed equal distribution of strain while the non rigid design decrease the strain in the distalof the pier abutment but it concentrate it in the mesial of the posterior abutment.

Conclusion: *the fixed-fixed design showed the equal strain distribution when it is used to restore maxillary 5-unit FPD with pier abutment.*

Keywords: Strain, Zirconia, Pier Abutment, Bridge Design

Introduction

If an edentulous space occurs on both sides of a tooth, it will create a lone, free standing isolated tooth which is known as a Pier Abutment. So, the Pier
Abutment can be defined as it is a lone, free standing isolated tooth or, it is the intermediate or middle abutment[A]

Statement of the Problems of the Pier Abutment:

The problems which might arise with the pier abutment teeth are: Stress Distribution and Movement of Abutment Teeth, Bone and Periodontal Investing
Structures, Lack of Parallelism between Abutment Teeth, Size, Shape and Location of Abutment Teeth, Size and Shape of the Pulp of Abutment Teeth and
Vitality of Abutment Teeth.[B]

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Landry et al., 1987,[C]simulated a mandibular 5-unit FPD retained by a canine, second premolar, and second molar. Three types of FPDS made of type III gold alloy were fabricated: (1) Non-rigid connector at the distal aspect of the second premolar, (2) non-rigid connector at the distal aspect of the canine, and (3) all-rigid connectors. Each unit of the FPD was loaded separately with a force of 30 psi, perpendicular to the alveolar crest. The amount and pattern of stress fringes were recorded at 15 zones around the roots of the abutment teeth. The results showed that when the rigid framework was loaded, the stresses were more evenly distributed among the abutment teeth.

Moreover, when a terminal abutment was loaded, low-grade stress fringes were seen around the apex of the opposite terminal abutment. The authors stated that the low shear stresses observed at the terminal abutments question the high tensile stresses that were suggested in the presence of an intermediate abutment and as a cause of retainer failure. When the anterior segment of an FPD containing a nonrigid connector was loaded, the abutments located anterior to the attachment experienced high compressive stress, while only minimal stress was noted at the apices of the posterior abutments.

When the compressive force was applied to a tooth containing a non-rigid connector, the highest stresses were noted at the apex of that tooth. These were higher in magnitude than the stress that developed when the tooth was loaded while incorporated in arigid framework.

Standlee and Caputo., 1988 ,[D]simulated the same clinical situation of a mandibular 5-unit FPD with a pier. Simulated tissues were made of different plastic materials. Three types of FPD frameworks were constructed from a non-precious alloy (Biocast Rx, Jeneric Gold): (1) all-rigid connectors, (2) precision Attachment at the mesial of the premolar abutment, and (3) precision attachment at the distal of the premolar abutment.

Vertical loads of 30 lb. were applied separately to each retainer and pontic. The stress induced fringe patterns were recorded by a camera and the vertical displacement of each tooth was measured with a dial gauge.

It was found that no matter where the rigid framework was loaded, some degree of apical stress was noted around all abutment teeth and all showed some apical displacement.

The authors conclude: “There was no evidence that the premolar abutment acted as a fulcrum.”The experiment also showed that when a non-rigid connector was incorporated into the framework, the stress to the abutments at the loaded side increased while the stress to the abutments on the unloadedside decreased.

Moulding et al., 1992,[E] examined a similar setup of a mandibular 5-unit FPD with a pier through a photoelastic model, using different materials. Six FPD designs made of palladium-silver alloy were fabricated: (1) all-rigid connectors, (2) non-rigidconnector at the distal aspect of the canine, (3) non-rigid connector at the mesial aspect of the pier retainer, (4) non-rigid connector at the distal of thepier retainer (keyway within the retainer), (5) nonrigidconnector at the distal of the pier retainer (keyattached to the pier and keyway within the pontic ofthe first molar), and (6) non-rigid connector at themesial aspect of the second molar.

Each unit of the FPD was subjected individuallyto a loading force of 198 N and the stress fringes in13 areas around the roots of the abutment teeth wererecorded by a camera. When the rigid frameworkwas loaded at the canine, stress was noticed at theapex of the canine, second premolar, and to a smallerextent at the apices of the second molar. Loadingthe second premolar caused stress fringes to appearat the apices of all abutment teeth. Loading of the second molar produced high stresses at its apices,less stress at the apex of the second premolar, and no stress at all around the whole surface area of the canine. The

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authors concluded that the rigid FPD distributed stresses vertically and evenly. When a non-rigid connector was placed at the pier and thepier was loaded, the highest stress concentrationdeveloped around its root, due to the inability of thenon-rigid framework to effectively transfer the loadto the terminal abutments. The authors concluded that the results supported Markley, who proposed that stress should be broken at either terminal abutment so that loads centered on the pier are partially distributed to theterminal abutments.

Ziada et al., 1998,[F] investigated the stress patterns that develop in an anterior 5-unit resin bonded fixed partial denture (RBFPD) with a pier.
The model consisted of a simulated maxillary canine, central incisor, and the contralateral lateral incisor. The simulated teeth were constructed at a size 2.5_ larger than their anatomic size to assist in the visual resolution of the stress patterns. Loading was performed simultaneously over the 2 pontics and the stress fringes were recorded from the adhesive layer of the RBFPD (no data are provided on the magnitude of force used). The results show that stresses were concentrated over the entire surface of the cement layer of the pier retainer. The authors therefore conclude that the design of an RBFPD with a pier should be avoided due to increased risk for debonding of the pier retainer.
The complex behavior and stress distribution patterns of enamel, dentin, pulp, and cementum that comprise a tooth cannot be duplicated by a simplistic model. The nonlinear behavior of the periodontal ligament (PDL) also cannot be simulated. Nonetheless, it should be considered that no study on a posterior 5-unit FPD with a pier has demonstrated a fulcrum effect of the pier abutment, while all of them have demonstrated increased stresses on the pier when loaded while bearing a non-rigid connector.
Selcuk et al., 2008,[G]evaluated stress distribution, by means of finite element method (FEM), the effects of rigid and non-rigid design types on for
5-unit FPDs with pier abutments. A 3-dimensional cross-section FEM model (SAP 2000) simulating a 5-unit metal ceramic FPD with a pier abutment with rigid or non-rigid designs (connector location at the mesial region of the second molar, at the distal region of the second premolar, at the mesial region of the second premolar, and at the distal region of the canine) was developed. In the model, the canine, second premolar, and second molar served as abutments. A supporting periodontal ligament and alveolar bone (cortical and trabecular) were modeled. A 50-N static vertical occlusal load wasapplied on the cusp of each abutment to calculatethe stress distributions. Three different types of loadwere evaluated: loading of all cusps to simulatemaximum centric occlusion contacts, loading ofthe canine to simulate a single anterior contact,and loading of the second molar to simulate aposterior contact. They found that the analysis ofthe von Mises stress values revealed that maximumstress concentrations were located at the load areasfor all models. Also, for all models, the highststress values were located at connectors andcervical regions of abutment teeth, especially atthe pier abutment, they concluded that The area ofmaximum stress concentration at the pier abutmentwas decreased by the use of a non-rigid connectorat the distal region of the second premolar, Becausethe pier abutment used in rigid FPDs can act as afulcrum, the restoration of a terminal abutment maybecome loose. When fabricating a 5-unit FPD fromthe maxillary canine to second molar with a pierabutment, the use of a non-rigid connector at thedistal of the second premolar may reduce potentiallyexcessive stress concentration on the pier abutment.
In some patients, the pattern of missing teethmay require the use of an FPD with a pier abutment.Restoration of 2 missing teeth and an intermediatepier abutment with a rigid FPD is not an

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ideal treatment. When an occlusal load is applied tothe retainer on the abutment tooth at one end of anFPD with a pier abutment, the pier abutment mayact as a fulcrum. Thus, tensile forces may then begenerated between the retainer and abutment at theother end of the restoration. Anterior or posteriorabutments may experience extrusive forces duringfulcrum action, and resultant tensile force atthe retainer to-abutment interface5 may result inpotential loss of retention for these restorations.

It has been reported that rigid FPDs with pierabutments are associated with higher debondingrates than short-span prostheses.

Adams3[H]advised placing one non-rigidconnector at the distal side of the pier, and ifdesired, adding one more at the distal of the anteriorretainer. The authors did not provide reasoning fortheir recommendations. the use of a non-rigid connector in aposterior 5-unit FPD with a pier is contraindicatedin some situations: (1) if the abutment teeth presentsignificant mobility; (2) if the span between theabutments is longer than 1 tooth, because the stressestransferred to the abutment tooth under the solderedretainer would be destructive; and (3) if the distalretainer and pontic are opposed by a removablepartial denture or an edentulous ridge while the 2anterior retainers are opposed by natural dentition,possibly allowing the distal terminal abutment tosupraerupt.

Accepting the principle of evidence baseddentistry, it seems warranted to critically review thedocumentation behind a concept that is addressed inseveral textbooks.

Material and Methods

A right maxillary first premolar and first molarwere removed from the upper arch of an acrylictypodent. The socket of the upper lateral was closedwith pink modeling wax to simulate an edentulousarea of a missing first premolar and first molarbounded by maxillary right canine, second premolar(pier), and second molar acrylic teeth. Each toothwas prepared to receive a full coverage all-ceramicretainer.

A total of 30 all-ceramic zirconia bridges were constructed using (MAD/MAM manualy aiadeddesign/manualy aided milling zirconzhan; Bruneck,Italy) and divided according to bridge design in tothree groups(10 bridges each);fixed-fixed design(10samples) figure 2,non-rigid design (10 samples)figure 1,and cantilever design (10 samples).analysis at 300 N, and strain gauge analysis at fracture load.

The fitting surface of the retainers were sandblasted with 50 ìm AL2O3 at maximum pressure of 2.5 bar for 30 seconds at an approximate distance 2 cm.

Thirty epoxy resin (Chemapoxy 150 Transparent) casts were fabricated by introducing the polymerizing resin into a polyvinylsiloxane mold (KERR Extrude Medium) of the master dies. The adhesive resin Metacem was used for cementation of the restorations. The restorations were seated slowly with gentle finger pressure then seated in the lower compartment of cement loading device under (1.5 Kg) load for one minute. Excess luting material was removed with sponge pellets immediately, and each cement surface/margin was light cured for 40 seconds.

The samples were subjected to aging process as they were stored in acidic medium (citric acid) with pH. 6 and cyclic loading (wet type) for 500,000 cycles with forces ranges from 5-50 N.

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The samples were subjected to vertical loading using a universal-testing machine (LIoyd Instrument LR 5K). The cross-head speed was 0.5 mm/min. the very first discontinuity resulting from an early crack, debonding or catastrophic failure of bridge and/or die was detected. 4 KYOWA strain gauges were bonded at four points; point A, at lingual –mesial surface of the distal retainer, point B, at lingual –distal surface of the pier retainer, point C, at lingual –mesial surface of the pier retainer, point D, at lingual – mesial surface of the anterior retainer using strain gauge cement. The strain induced in the samples during 300 N and till fracture load was measured by a KYOWA strain meter.

Results

Data of this study were presented as mean as mean and standard deviation (SD) values. Data were explored for normality using test of normality. A low significance value (less than 0.05) of test indicates that the distribution of the data differs significantly from a normal distribution. Strain data showed a normal distribution so parametric tests were used for the comparisons. One way Analysis of Variance (ANOVA) was used to compare between three types of designs. Tukey's post-hoc test was used for pairwise comparison between the means when ANOVA test is significant.

At A Site: the Non-rigid design at 300N showed mean strain value (193.8) statistically significant highest mean. While the Cantilevered design showed mean strain value (135.6) statistically notsignificant lowest mean strain with the mean strain of the Fixed-Fixed design (150.8).

Fig. (1) Photograph showing zirconia FPD with non-rigid Connector

Fig. (2) Photograph showing zirconia FPD with rigid connector

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At B Site: the Non-rigid design at 300N showed mean strain value (81.6) statistically significant lowest mean. While the Fixed-Fixed design showed mean strain value (101.4) statistically not significant lowest mean strain with the mean strain of the Cantilevered design (106.8).

At C Site: the Cantilevered design at 300N showed mean strain value (213.8) statistically significant highest mean. This is followed by the Non-rigid design with mean strain value (103.8).The Fixed-Fixed design showed the lowest mean strain value (65.6)

At D Site: the Non-rigid design at 300N showed mean strain value (149.2) statistically significant highest mean. While the Fixed-Fixed design showed lowest mean strain value (47.0) statistically significant higher mean strain.

At A Site: the Non-rigid design at fracture showed mean strain value (608.6) statistically significant highest mean. This is followed by the Cantilevered design with mean strain value (495.4).the Fixed-Fixed design showed the lowest mean strain value (467.6).

Table 1: Results of ANOVA and Tukey□s test for strain comparison between different designs at the same site (at 300 N) (in µm □m)

Design Site 300N	Fixed-Fixed		Cantilevered		Non-Rigid		P-value
	Mean	SD	Mean	SD	Mean	SD	
A	150.80 [a]	9.039	135.60[a]	8.264	193.80[b]	11.432	<0.001*
B	101.40[a]	8.444	106.80[a]	7.463	81.60[b]	8.142	0.001*
C	65.60[a]	8.562	213.80[b]	10.663	103.80[c]	8.408	<0.001*
D	47.00[a]	5.831	NP	NP	149.20[b]	5.263	<0.001*

*Significant at P≤ 0.05, Means with different latters in the same raw are statistically significant different according to Tukey□s Test.

Table 2: Results of ANOVA and Tukey s test for strain comparison between different designs at the same site (at fracture) (in µm m)

Design Site Fracture	Fixed-Fixed		Cantilevered		Non-Rigid		P-value
	Mean	SD	Mean	SD	Mean	SD	
A	467.60[a]	14.153	495.40[b]	38.598	608.60[c]	26.054	<0.001*
B	450.20[a]	20.765	478.20[a]	64.267	195.60[b]	17.813	<0.001*
C	431.80[a]	19.486	713.80[b]	11.756	256.00[c]	29.351	<0.001*
D	429.60[a]	14.792	NP	NP	347.80[b]	20.620	<0.001*

*: Significant at P≤ 0.05, Means with different latters in the same row are statistically significant different according to Tukey s Test.

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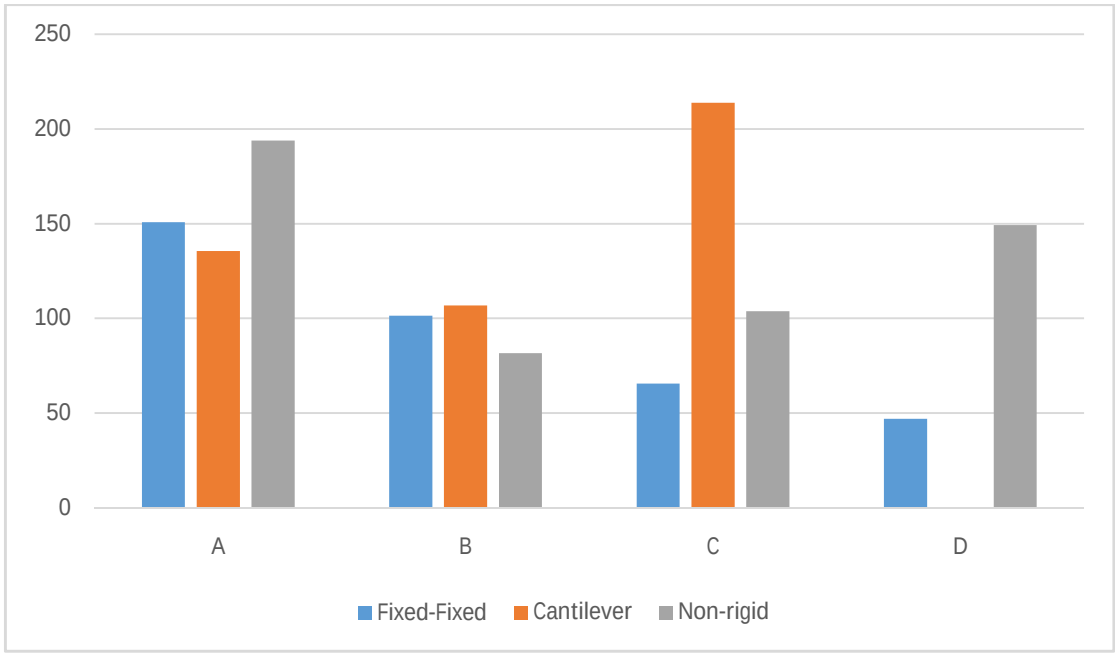

Fig (3) Bar chart showing mean strain comparison between different designs at the same site at 300 N.

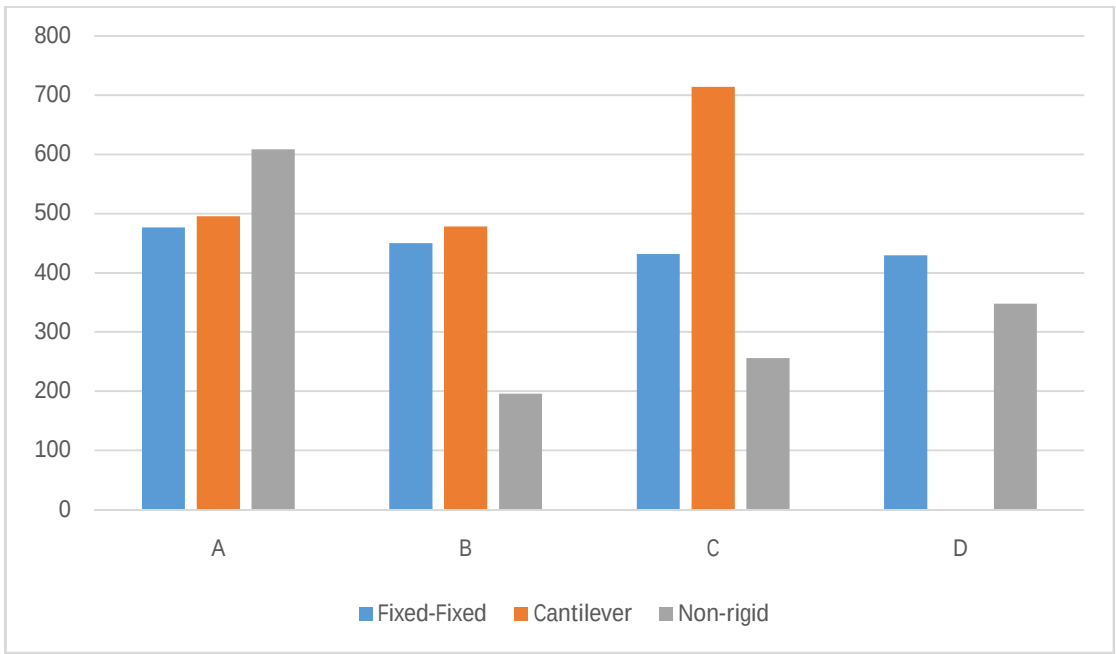

Fig. (4) Bar chart showing mean strain comparison betweendifferent designs at the same site (At fracture).

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At B Site: the Non-rigid design at fracture showed mean strain value (195.6) statistically significant lowest mean. While the Cantilevered design showed the highest mean strain value (478.2) statistically not significant with the mean strain of the Fixed-Fixed design (450.2
At C Site: the Cantilevered design at fracture showed mean strain value (713.8) statistically significant highest mean. This is followed by the Fixed-Fixed design with mean strain value (431.8). the Non-rigid design showed the lowest mean strain value (256.0).
At D Site: the Fixed-Fixed design at 300N showed mean strain value (429.6) statistically significant highest mean. While the Non-rigid design showed lowest mean strain value (347.8) statistically significant higher mean strain.
For Fixed-Fixed design: the A site showed the statistically significant highest mean strain (150.8). this is followed by the B site (101.4), C site (65.6). the D site showed the statistically significant lowest mean strain (47.0).
For Cantilever design: the C site showed the statistically significant highest mean strain (213.8). this is followed by the A site (135.6).the B site showed the statistically significant lowest mean strain (106.8).
For Non-rigid design: the A site showed the statistically significant highest mean strain (193.8). this is followed by the D site (149.2), C site (103.8). the B site showed the statistically significant lowest mean strain (81.6).
For Fixed-Fixed design: the A site showed thestatistically significant highest mean strain (467.6). this is followed by the B site (450.2), C site (431.8). the D site showed the statistically significant lowest mean strain (429.6).there was no statistically significant different between C site and D site.
For Cantilever design: the C site showed the statistically significant highest mean strain (713.8). this is followed by the A site (495.4).the B site showed the statistically significant lowest mean strain (478.2). There was no statistically significant different between A site and B site.
For Non-rigid design: the A site showed the statistically significant highest mean strain (608.6). this is followed by the D site (347.8), C site (256.0).
the B site showed the statistically significant lowest mean strain (195.6).

Table 3: Results of ANOVA and Tukey□s test for strain comparison between different sites within the same design at 300 N (in µm □m)

Design Site 300N	Fixed-Fixed		cantilevered		Non-Rigid	
	Mean	SD	Mean	SD	Mean	SD
A	150.80 [a]	9.039	135.60[a]	8.264	193.80[a]	11.432
B	101.40[b]	8.444	106.80[b]	7.463	81.60[b]	8.142
C	65.60[c]	8.562	213.80[c]	10.663	103.80[c]	8.408
D	47.00[d]	5.831	NP	NP	149.20[d]	5.263
P-value	0.011*		<0.001*		<0.001*	

*Significant at P≤ 0.05, Means with different latters in the same column are statistically significant different according to Tukey□s Test.

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Table 4: Results of ANOVA and Tukey□s test for strain comparison between different sites within the same design at fracture (in µm □m)

Design Site Fracture	Fixed-Fixed		cantilevered		Non-Rigid	
	Mean	SD	Mean	SD	Mean	SD
A	467.60[a]	14.153	495.40[a]	38.598	608.60[a]	26.054
B	450.20[ab]	20.765	478.20[a]	64.267	195.60[b]	17.813
C	431.80[b]	19.486	713.80[b]	11.756	256.00[c]	29.351
D	429.60[b]	14.792	NP	NP	347.80[d]	20.620
P-value	<0.001*		<0.001*		<0.001*	

*Significant at P≤ 0.05, Means with different latters in the same column are statistically significant different according to Tukey□s Test.

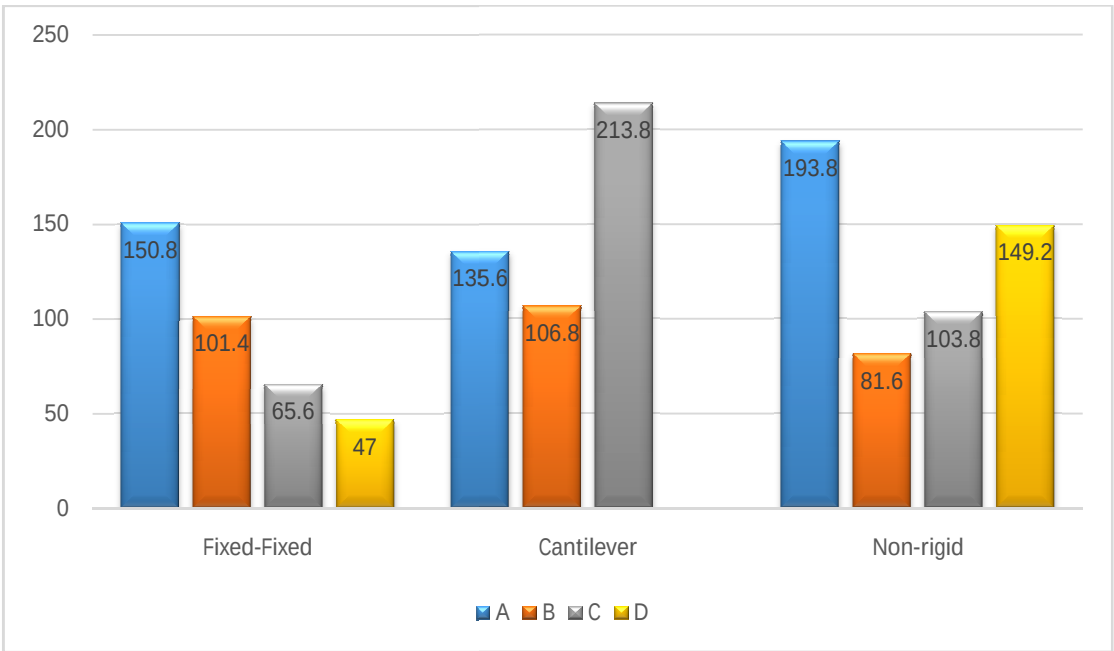

Fig. (5) Bar chart showing strain comparison between different sites within the same design at 300 N (in µm □m).

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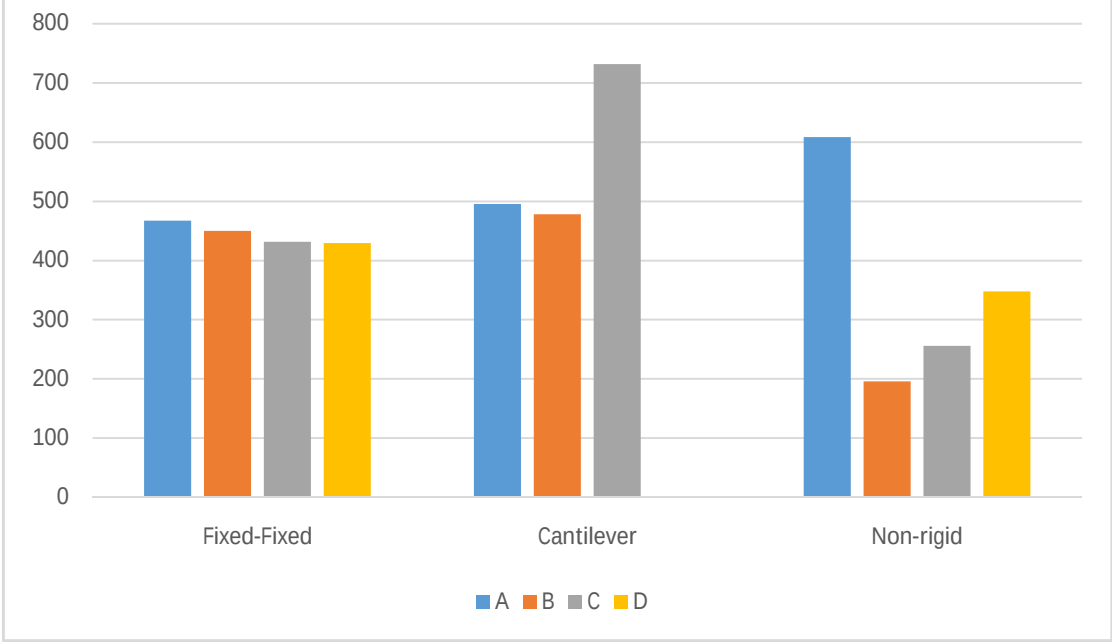

Fig. (6) Bar chart showing strain comparison between different sites within the same design at fracture (in μm/m).

Discussion

In some patients, the pattern of missing teeth may require the use of a fixed partial denture (FPD) with an intermediate pier abutment. Information is needed regarding the biomechanical behavior, different FPD designs and the use of a non-rigid connector for this treatment option.

According to the Glossary of Prosthodontic terms, a connector is the portion of a fixed partial denture that unites the retainer(s) and pontic(s) or it is the component of a fixed partial denture prosthesis that joins the individual retainers and pontics together. The durability and performance of a fixed partial denture largely depends on the occlusal relationship, area of missing teeth, distribution of stress, alveolar bone loss and condition of the periodontium. furthermore, the excessive flexing of a long span FPD varies with the cube of the length of the edentuluos span, which can lead to material failure of the prosthesis or an unfavorable response. Therefore, depending on the clinical condition and the patient demand, the clinician must be cautious in selecting the type of connector for fixed Prosthodontic treatment. Although, the rigid connectors are mostly used, there are certain special circumstances where a non-rigid connector is required such as long standing abutment (pier abutment) with edentulous spaces on either side that allow physiological tooth movement and relieve stress.[I]

In the current study three different designs of FPDs were used to restore 5-unit maxillary FPD with pier abutment, fixed-fixed, non-rigid and cantilevered design.

The use of fixed-fixed design is supported to restore 5-unit FPD with pier abutment by many researchers[J](11),also the non- rigid design.[K]

A common clinical situation, either in the maxillary or mandibular arch, is of a missing first premolar and first molar, resulting in FPD design in which the canine and the second molar are theterminal abutments and the second premolar servesas a pier abutment.

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It has been postulated that the tendency of the terminal abutments to intrude during function results in a teetering movement, where the pier acts as a fulcrum. This movement will eventually result in debonding of the less retentive terminal retainer, namely the canine, and inevitably the failure of the prosthesis.[L] In order to overcome this potential risk, the use of non-rigid connectors has been advised.[M,N]

In the current study anon-rigid connector is placed in the distal aspect of the pier retainer this is supported by many researchers as Shillingburg et al determined that the patrix of a non-rigid connector (either a precision or semi-precision attachment) should be placed at the distal aspect of the pier retainer and the matrix in the distal pontic[AM]. He assumed that this would nullify the fulcrum effect, and that the matrix portion of the attachment would be seated firmly in place when pressure was applied distally to the pier, due to the mesial movement of the distal abutment.

However, Moulding [B] suggested that the nonrigid connector should be placed on one of the terminal retainers, and emphasized that it should not be placed at the pier abutment because this would subject the relatively weak premolar abutment to extreme loads. Gill[M] recommended placing nonrigid connectors at one side or both sides of the pier abutment.

Adams[D] advised placing one non-rigid connector at the distal side of the pier, and if desired, adding one more at the distal of the anterior retainer. The authors did not provide reasoning for their recommendations.

In the current study strain analysis showed that the fixed-fixed design was succeed to evendistribution of the strain rather than the non-rigid design which succeed to decrease strain in the distal aspect of the pier retainer but the strain was increased in the mesial surface of the distal retainerthese results is agreed by Standlee and Caputo[D]simulated the same clinical situation of a mandibular 5-unit FPD with a pier. Simulated tissues were made of different plastic materials. Three types of FPD frameworks were constructed from a nonprecious alloy (Biocast Rx,Jeneric Gold): (1) allrigid connectors, (2) precision attachment at the mesial of the premolar abutment, and (3) precision attachment at the distal of the premolar abutment.

Vertical loads of 30 lb were applied separately to each retainer and pontic. The stress induced fringe patterns were recorded by a camera and the vertical displacement of each tooth was measured with a dial gauge.

It was found that no matter where the rigid framework was loaded, some degree of apical stress was noted around all abutment teeth and all showed some apical displacement.

The authors conclude: “There was no evidence that the premolar abutment acted as a fulcrum.”

The experiment also showed that when a non-rigid connector was incorporated into the framework, the stress to the abutments at the loaded side increased while the stress to the abutments on the unloaded side decreased.

The result of the current study not substantiated the theory that the pier abutment is acting like fulcrum as the strain values were evenly distributed in the four measured points of the fixed-fixed design while the non-rigid design showed more strain values in the mesial surface of the posterior retainer these result is in agreement with those of Savion et al [K] as they concluded that The assumption of increased risk for debonding of the canine retainer in a 5-unit FPD with a pier due to the pier abutment acting as a fulcrum is not substantiated by any in vitro experiments, clinical observations, or mathematical analysis.

They also concluded that the potential hazardfor debonding is related to the development of extrusive reactive forces at the canine retainer as the first molar pontic is loaded, due to the flexural forces that

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develop within the FPD. However, the magnitude of the force and its clinical significance should be further determined by well-designed in vitro and in vivo trials.

The result of the current study is not coincide that Oruc et al[G]as they concluded that the area of minimum stress occurs in pier abutments when anon-rigid connector is located at the distal region of the pier abutment for a 5-unit FPD (mandibular canine, second premolar, and second molar as abutments) with a pier abutment, the results of thecurrent study showed strain analysis that the fixed-fixed design was succeed to even distribution of the strain rather than the non-rigid design which succeed to decrease strain in the distal aspect of the pier retainer but the strain was increased in the mesial surface of the distal retainer this difference can be explained by many reasons as the current study studied the 5-unit FPD with pier abutment in maxillary arch which mean more angulation in the arch and more complicity of stresses and used a strain gauges method to measure strain and the aging process for all samples as they subjected to acid storage and cyclic loading also the direction of force application as all teeth loading using occlusal index at 300 N and two layers of foil when stain measured till fracture.

The quest for biocompatible and esthetic restorative materials has stimulated the introduction of new all ceramic systems for fixed dental restorations.in response to the reported dissatisfying clinical results of all ceramic fixed restorations, new ceramic materials or sophisticated design were investigated. However, the demand forceramic materials of better physical and mechanical properties still continues.

Recently, new materials and techniques have been introduced to enhance the strength and facilitatefabrication of all ceramic restorations. Severalrestoration designs have been recommended, but there are few studies that evaluate the effect of restoration design on the fracture resistance of 5-unit FPD with pier abutment or demonstrate the amount and location of strain induced within these restorations.

Conclusions

Within the limitations of this study, the following conclusions could be obtained

1- It is possible to fabricate a non-rigid connector from zirconia to restore 5-unit FPD with pier abutment.

2- The aging process with acid storage and cyclic loading simulating 3 years function did not result in fracture of any sample of the tested groups.

3- The strain values of an FPD with a pier abutment are affected by the presence of a non-rigid connector, the presence of non-rigid connector succeed to reduce strain in the distal surface of the pier abutment but there is increase in the strain values in the mesial surface of the posterior abutment.

4- The area of minimum strain concentration occurs in pier abutments when a fixed-fixed design were used for a 5-unit FPD (maxillary canine, second premolar, and second molar as abutments) with a pier abutment.

5- The cantilevered (fixed-free) design showed the maximum values of strain when used for a 5-unit FPD (maxillary canine, second premolar, and second molar as abutments) with a pier abutment.

Clinical implications

1- For a 5-unit FPD (maxillary canine, second premolar, and second molar as abutments) with a pier abutment affixed-fixed design are recommended in case of normal occlusion and good parallels of abutments.

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2- For a 5-unit FPD (maxillary canine, second premolar, and second molar as abutments) with a pier abutment with lack parallels of the abutment, zirconium non-rigid connector could be promising solution.
3- The development of zirconia non-rigidconnector provide an esthetic alternative when used in the treatment of the edentuluos cases with pier abutment.

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Vehicle operating cost in Sri Lanka with a special reference on short haul Prime Mover Transportation

Anuja Fernando & Thilanka Wijesiri

ABSTRACT

This study was designed to develop a scientific methodology to calculate truck operating cost in Sri Lanka. Currently the market price is decided by the bargaining power of the service provider or the service consumer. It signifies the importance of having a scientific formula to calculate truck operating cost. This study is focused on a quantitative research approach. It is selected a sample size of 50 truck operators who are working for third party service providing companies, individual service providers and company owned truck operators by using random sampling method. Data was gathered by using primary data gathering sources of interviews and questionnaires. Secondary data sources used to get previous statistics of third party logistics companies. By analyzing data cost distribution was identified. Finally the cost calculation formula has generated to find out the vehicle operating cost for each prime mover for short haul operation.

Keywords: Third Party Logistics Provider, Freight

1. Introduction

1.1 Background of the study

Transport costs can be identified as a monetary measure which transport provider has incurred to generate the transportation service. This cost has a significant effect on final product pricing in organizational aspects and there is a significant impact on the structure of economic activities in the country plus international trade transactions.

Stakeholders of an organization are thoroughly considered about the sea transportation cost and air freight cost in calculation of total supply chain transportation cost. Traditionally each and every interested party of the business is doing this almost in same way but no one is critically evaluates the costs of land transportation. So there is a lapse in accepted scientific system to determine the land transport cost gradually leading to increasing total cost of goods unnecessarily.

Since there is no any established mechanism to calculate the truck operating cost, third party transport service providers and organizations controversially get the ability of decide the price according to the bargaining power that they possess. As the end result of all these circumstances final consumer has to bear the additional profit margin of those third party transport providers. Main cause of this issue can be lack of conventional method to calculate vehicle operating cost. After analyzing all of these states of affairs, researcher seeks to answer to the question of how to calculate vehicle operating cost in Sri Lanka with a special reference on short haul truck transportation.

1.2 Problem Statement

The intention of this research is to develop a scientific methodology to calculate truck operating cost in Sri Lanka. Currently market price is decided by the bargaining power of the service provider or the service consumer which signifies the importance of having a scientific formula to calculate truck operating cost in Sri Lanka.

1.3 Objectives of the Research

- Identify the components which are considered to formulate truck operating cost in current market
- Identify main cost components of truck operation, their contribution for the final operating cost and how those are varying according to the external factors
- Formulate a scientific formula to calculate truck operating cost
- Introduce cost determinant factors for industry benchmarking
- Identifying the nature of truck operating cost including day to day costs and periodic costs

1.4 Research Questions

- Is there any relationship between operating variables such as route of operation, age of the vehicle, nature of the good transported and the operating cost?
- What are the main cost components of truck operation?
- How to calculate truck operating cost scientifically according to the cost components?
- What are the differences of truck operating costs with related to frequency of it occurs?
- What is the current practice for conversion process of costs in to tariff?

1.5 Significance of the study

In Sri Lankan job market truck operation is not considered as a professional job while some of the developed countries value it with high professionalism by providing good social status and as well as standard operation procedures. In order to increase the quality of the industry, there must be industry standards. Perhaps this research will help to set the standards with related to truck operating cost.

As per general understanding, transportation cost carries up a considerable portion of any supply chain cost that is gradually increasing due to current practices like just in time (JIT). So knowing the exact amount of transport cost can be helpful to take decisions to the top managers because some industries are not fully fitting to JIT operation method where as some are identically fitted to the JIT operation system. After formulating truck operating cost calculation method, Sri Lankan companies also can compare inventory caring cost with transportation cost that may lead to have JIT operations in local supply chains.

According to current market practices, there are some instances that the cost is decided by the bargaining power of service consumer or service provider and sometimes there is no the win-win deal for both parties. As a result of that there is a tendency of affecting this situation to truck operating industry. After formulating scientific methodology to calculate the operating cost we can eliminate the bargaining power from cost deciding factor which disobediently helpful for industry wellbeing.

2. Literature Review

2.1 Significance of Truck and Prime mover operation cost in transportation

Transportation cost is account for 2.88% of sales. They are the largest component of logistics cost and represent 40% of that cost (Davis & Drumm, 1996). *Kasilingam (1999)* has stated that transportation costing is one of the importance areas which should give the concentration in product costing as well as in supply chain perspective since it includes a higher proportion of total cost. As Forkenbrock (1994) has stated in his study, in many of developed countries truck

transportation and rail transportation have somewhat equal contribution to the amount of total freight operations.

Commercial trucking firms have costs that depend upon a number of factors including the types of commodities hauled, the length of hauls, the types of equipment used, the proportion of truckload (TL) or less than truckload (LTL) traffic, and the regions they serve (McMullen, 1987). McMullen (1987) estimated a log-linear truck costing model for truckload firms (TL) using ton-miles, average length of haul, average load, average shipment size, insurance payments (per ton-mile) and the utilization of brokerage firms (rented ton-miles divided by total ton miles) as dependent variables.

In the external costs of intercity truck freight transportation, Forkenbrock (1994) further stated that comparatively low-cost freight transportation has been an important element in the growth of the US economy. Goods can be transported between most points in the country quite cheaply and efficiently. To varying degrees, however, the freight transportation services we consume generate costs that are borne by others. Such costs are commonly referred to as external costs. From a societal perspective, it is desirable for all transportation services to pay their full social (private and external) costs. If the full social cost were rejected in the prices shippers pay, transportation users could choose the amount of each form of service to consume on the basis of the true cost of this service to society. By internalizing external costs, policy makers would effectively create a market through which transportation users could weigh the benefits of consuming a particular transportation service against the true costs.

The question of truck operating costs has been of long interest. In general, firms seek to minimize their cost including truck operating cost. Truck operating cost for each firm can be divided into fixed and variable costs. Fixed costs are insensitive to the volume of output, but variable costs change with the level of output. Watanatada (1987) divided the variables that affect truck operating cost into truck characteristics (weight, engine power, maintenance), local factors (speed limit, fuel price, labour cost, drivers attitude), and road characteristics (pavement roughness, road width). Operating cost is considered to be a function of road characteristics and thus is policy sensitive.

It is important to have a formula to calculate operating cost when work is done on highways, or when new highways are built, one of the possible impacts is that the people who make trips on those highways might spend more or less money to operate their vehicles (Barnes & Langworthy, 2003). Perhaps Sri Lanka being a third world country is experiencing rather different situation than developed country. “At its inception, railway was carrying more freight than passenger. But today, it is passenger oriented. Sri Lankan Railway’s market share for passenger transport is about 6.0 % and about 0.7 % for goods transport.” (http://www.railway.gov.lk). As indicating in the above, the rest 99.3 % of freight transportation market share is currently possess by road transportation while a larger proportionate of it probably handling through trucks.

2.2 Contextual researches

The calculation of truck and prime mover operating cost is a subject matter that has been attracting researchers’ interest from mid of 19th century due to its enhancing importance with the rapid development of transportation. Barnes (2003) estimated operating cost for commercial trucks based on fuel, repair, maintenance, tyres and depreciation costs. He also considered adjustment factors for cost, based on pavement roughness, driving conditions and fuel price changes. He estimated an average truck operating cost per kilometre of $0.27, excluding labour cost. If it is assumed that labour cost is around $0.22 per kilometre, total operating cost using Barnes model is $0.49 per kilometre. This

number can be used as a check for operating cost per kilometre obtained from the survey.
Later work by McMullen and Tanaka (1995) used a translog cost function to examine the differences between large (less-than-truckload or LTL) and small (truckload or TL) motor carriers. Their results revealed significant differences in cost structures between large and small carriers. For large firms, there were significant economies associated with increasing average load, average length of haul, and average shipment size. Smaller firms, they claimed, showed no increase in costs due to increases in average shipment sizes, lengths of hauls and loads, indicating they have already taken advantage of these economies.

2.3 Fixed and variable costs in prime mover operations

According to Berwick and Farooq (2003), "In general, firms seek to minimize their cost including truck operating cost. Truck operating cost for each firm can be divided into fixed and variable costs. Fixed costs are insensitive to the volume of output, but variable costs change with the level of output". Berwick and Farooq (2003) categorized cost components in to variable cost and fixed cost.
Differentiation of cost type is depending on their possibility of changing with the mileage. Fixed costs are unaffected by mileage, and variable costs, which increase with mileage. This indicates the savings from transportation improvements that allow consumers to reduce their vehicle ownership and use (Victoria Transport Policy Institute, 2013).
Fixed costs expenses are costs that entail just having the truck and these costs have to bear even though the truck is not running. The biggest items in this category are mortgage on the truck, license fees, insurance, sales, tax etc.
Variable costs are expenses that are directly related to operating the truck. Generally, the more usage of truck, the higher these expenses will increase. But due to the economies of scale, some of these expenses will become less per mile as increasing the number of miles. Some of the main variable costs can be identified as tyre cost, fuel cost, repair & maintenance cost, labour cost and trailer cost etc.
Daniels (1974), divided vehicle operational cost in to two categories "running costs (includes fuel consumption, engine oil consumption, tyre costs and maintenance cost) and standing costs (license, insurance and interest charges)." Also "Daniels identified speed as the most important factor in fuel consumption and found maintenance costs rise with increasing speed. If fuel consumption and maintenance cost change, operating cost will change as well." (Corbett & Hashami). Vehicle size is another factor that affects fuel consumption and thus influences operating cost. By using average axle numbers for each firm, vehicle size can be included in the model.
For an owner/operator company, "Fixed costs are costs that do not change with output and cannot be changed quickly or in the short run. The short run is a period in which a firm cannot change its factors of production. Variable costs change with output and may be easily changed" (Ferguson & Kreps , 1965). Dooley, Bertram and Wilson (1988), defined "Variable costs are costs that can be attributed to mileage, or running time and fixed costs are incurred whether or not a truck is logging miles" .
Watanatada and Dhareshwar (1987), categorised factors effect to operational cost into three.

- Truck characteristics (weight, engine power, maintenance)
- Local factors (speed limit, fuel price, labor cost, drivers' attitude
- Road characteristics (pavement roughness, road width)

Barnes and Langworthy (2003) carried out cost estimation for commercial trucks based on fuel, repair, maintenance, tyres and depreciation costs. Coyle, Bardi, and Novak (1994), identified difference between small type owner/operator trucking firms and large scale owner/operator trucking firms. "Operational trade-offs exist between large and small carriers. Small firms may be free from many costs associated with larger firms such as terminal operations, administrative and management

specialists, and information systems; but larger firms may enjoy an advantage in purchasing sophisticated technology, equipment, and other inputs where large volume discounts may exist" (Coyle, Bardi & Novack ,1994).

"Even though it appears economic gains from size are minimal, there are many small companies owning more than a single power unit or trailer. It would be intuitive to assume that some economies could be gained in the form of volume discounts for some inputs used in the trucking industry for those operating more than one power unit. However, in the truckload sector of the trucking industry, there does not seem to be any major economies due to the size of a company" (Coyle, Bardi & Novack ,1994).

According to Griffin, Rodriguez and Lantz (1992), "Owner/operators may not incur some fixed costs associated with larger firms. While economies of size are minimal for the owner/operator, economies of utilization are possible. Cost minimization for the owner/operator encourages high usage of equipment".

According to Berwick and Farooq (2003) "Opportunity exists for the entrepreneur who employs a strategy of increased equipment use. Increased equipment usage may be accomplished by adding a driver and using a team concept. Additional revenue from increased equipment use may more than offset higher labor and other increased costs by decreasing fixed costs and total costs per unit of output".

2.4 Significance of the Trucking Industry in Sri Lanka

Trucking and prime mover in Sri Lanka currently plays vital role in line with the government's vision of creating a naval hub in the country. Meanwhile Sri Lankan industrialists are facing to some challenges like increasing fuel prices and other costs such as vehicle servicing, tyres, tubes, spare parts etc.

The heavy traffic situation around the Port of Colombo is directly effecting the increasing costs and idling time of the vehicles are unmanageable. It has been calculated that averagely the cost of a running kilometer is around LKR 120.00- LKR150.00 depending on the vehicle. Therefore the owners are compelled to increase the rates to sustain this business (Daily News, 2011). Unavailability of a proper mechanism of calculating the operating cost put the industrialists in difficulties in determining the price factor of their operation.

However, previous researches could not be found in this research with respect to Sri Lankan context. As observed above results generated in those literature may vary based on geographical, economical and legal environment. In Sri Lanka, high tax on fuel, high cost for repair and maintenance etc. which may change operational cost in high margin.

Therefore it is necessary to manage operational cost in a small owner/operator trucking company to increase its financial and operational performance. In order to do that a detailed cost analysis for individual company is necessary to support effective decision making.

3. Methodology

3.1 Research methodology

Data was gathered by using primary data gathering sources of Interviews and questionnaires and secondary data sources like previous statistics of selected TPL companies. This study is mainly focused on a quantitative research approach. Research methodology is consisting with three main steps as determination of required data types and identification of data collection methods, data collection and data analysis.

3.2 Sample population

The sample size is 50 truck operators who are working for third party service providing companies, individual service providers and company owned truck operators. The sample population has selected by using random sampling method.

3.3 Data Collection

Mainly the data collection was based on collecting financial data from different operators regarding their operational cost. Data was collected the period of April, 2012 to December, 2012. Data collection was primarily grounded under, mileage covered, fuel pumped, repair and maintenance (R & M), tyre replacement, trailer cost, insurance and leasing costs, licensing and permit costs, depreciation driver/helper incentives and driver/helper wages. These collected data was fed in to a MS Excel 2010 spread sheet manually. Data checking was done to data entry errors.

3.4 Database setup and data entry

By using MS Access 2010 database management software, it was developed a database to link all the separate data files in to one relational database. Spread sheets are created during the data collection method and they were directly exported to the Access database to eliminate errors in data entry. Purpose of this Relational Database Model was to increase efficiency of data extraction by linking separate data collected during data collection method using vehicle registration number and month. By using SQL queries researcher could extract all the data relevant to one particular vehicle.

3.5 Data Extraction

Using query support provided by MS Access 2010, queries are used to extract, mileage covered and fuel pumped per each vehicle in each month, R&M cost and tyre cost per each vehicle in each month , Mileage covered and driver incentives for each driver and Mileage covered and cost for each trailer data. These queries are extracted as spread sheets and these extracted data were then entered in to Minitab Statistics 17 software which was used to carry out the analysis. It was developed four databases in Mini Tab, for each data set. The purpose was to identify relationships between each cost component and mileage covered.

3.6 Measurements and Calculations

As described in earlier chapters, it is necessary to identify the relationships between variable cost components and output. Following definitions were used to set measurements and calculations throughout the research.

Variable Costs : Costs which change with the output are defined as variable costs. For an owner/operator trucking firm, Tyre cost, Fuel cost, Repairs & Maintenance cost, Labour cost (Driver/helper incentives) and Trailer cost (R&M and Tyre cost for trailers) were included in variable cost. In this definition, non-revenue trucks or other types of vehicles (employee's vehicles etc.) of the firm were eliminated.

Fixed Costs: Costs which are insensitive to output are defined as fixed costs. For an owner/operator trucking firm, following costs were taken as fixed costs. Depreciations (Depreciations of trucks and trailers straight line method is used to calculate depreciations), License Fees and Insurance (Licensing, permits ,Revenue license, port entrance permit, emission test permit) and insurance cost for both trucks and trailers) , Management and Overhead Costs (Administrative and general overheads of the company) and Wage were taken as fixed costs.

Output: There are several attributes to measure the output. Since both volume and mileage have an effect on output so the best attribute would be number of ton mileage covered. However due to unavailability of data on volume, it is decided to depend only on mileage. Therefore mileage covered in number of kilometres was defined as the output throughout this research.

Performance Measurements: measurements are taken to measure performance of the company. These measurements can be used to set benchmarks and also support decision making process.

- Fuel Economy (FE) = Number of kilometers covered / Number of liters fuelled
- Cost per kilometer (CPK) = Variable cost + Fixed Cost / Total kilometers
- Variable cost per kilometer (VCPK) = A+ B x kilometer
- Fixed cost per kilometer (FCPK) = Fixed Cost / Total kilometer

4 . Data Analysis and Presentation

4.1 Data Analysis

After collection of all the necessary data for the study, a systematic data analysis was carried out to come up with the results to achieve the intended objectives of this study. To analyze the data researcher used MS Excel for basic analysis and the statistical data package SPSS for advanced analysis. Data Analysis tools have been Pearson correlation, Regression analysis and Scatter Diagrams in SPSS software.

Since the researcher wanted to find out how the operating cost is vary according to the route of operation, age of the vehicle, etc. all the routes are divided in to four areas as urban area, up country routes, low country routes and very long distance routes. All of above selected data will be separated according to their route of operation. As subsequent activity preparing a sheet which is indicating the cost of operations according to the route and age of the vehicle because some of the fleets may have operated in different routes within the selected month. This sheet can clearly elaborate the variation of cost according to the route of operation. There will be another sheet which is comparing the cost variation according to the age of the vehicle. If operating cost is different according to above two parameters analysis has done separately for each segment if not analysis has done for country level.

As the first step researcher found the contribution from daily cost components for one kilometre distance travel. This will be calculated by using cumulative daily expenses divided by cumulative distance travel. As a subsequent activity the contribution from the monthly fixed charges for one kilometre travel will be found out. Then considered about the travelling variables like services and maintenance cost, tyre replacement costs, are taking in to consideration to calculate the operating cost. As final task researcher converted all cost elements to per kilometre travel distance to generate the cost calculation formula.

4.2 Fuel cost with respect to mileage

As described in earlier chapter, a linear regression analysis was carried out to explain the relationship between fuel cost and mileage. Fuel cost was calculated in LKR and mileage in kilometres as defined in Chapter 3. Following are the results I obtained from the linear regression analysis. Mileage (output) in kilometres was taken as the independent variable and fuel cost in LKR was taken as the dependent variable.

4.2.1 Regression Analysis: refuelling versus kilometres

The regression equation is REFUELLING = 4018 + 55.6 Kilometres

Regression analysis (Figure 4.1) shows the relationship between refuelling cost and total mileage. This regression line is fitted 95.2% and it can be considered this as best fitted line. Constant number (4018) is the reserve fuel which should be in tank even though the prime mover is not operating. LKR 55.6 is the fuel price for one kilometer. That means the marginal cost per kilometer travel is LKR 55.6. This constant number can be vary according to the fleets and in here is is considered in X brand prime mover with three different horse power machines with mean age of 9.6 years old.

4.3 Tyre cost

Tyre cost for a truck can be considered as semi-variable cost. It can be varied with the operating parameters like road conditions. The contribution from tyre cost is comparatively low percentage per kilometre travel. Hence it is included it as a repair and maintenance cost.

4.4 Repair and maintenance cost

Repair & maintenance cost for a truck can be considered as semi periodic costs. To identify a possible relationship between the output and R&M expenses, it was conducted a linear regression analysis. It does not reveal any kind of a significant relationship between these two variables. The linear regression is done by selecting repair & maintenance as dependent variable and mileage as the independent variable. R & M cost does not show any rational relationship with respect to total fleet mileage. But, there is a relationship with an individual fleet. Table 4.3, Figure 4.2, Figure 4.3 and Figure 4.4 elaborate the scenario.

The regression analysis further elaborates that there is no significant relationship between because the regression line fitted only 29.7% but the constant number of 25,414 shows that if the fleet is not moves there is a high repair and maintenance cost because when repair and maintenance going on the fleet can not engage in operation. That will be further elaborating the analysis with respect to one fleet.

To further analysis, it is selected a fleet which has been engaged in operation all months randomly. It shows the relationship between mileage and repair and maintenance cost. There is a possibility when the fleet is running less kilometers, it may have more number of repairs in that period. Apart from this scenario age of the vehicle, operating condition, cargo type, driver skills and route of operation are can be a factors to increase R&M.

Figure 4.5 is elaborating that how the maintenance expenditure varying with age of the vehicle. It has clearly proven that new fleets are economical than old fleets when it comes to repair and maintenance as well as operating cost. That happens because of new fleets give better mileage per liter than old fleets. Apart from that fewer repairs will provide better utilization to owner that will help them to increase their ROI. This analysis shows that within first five years of the fleets maintenance expenditures are bellow than LKR 600,000 Most of the big companies are trying to cover their investment within this five year period after that they sell prime mover in second hand market at a reasonable cost.

4.5 Trailer cost

Trailer cost includes R&M cost and tyre replacement cost for trailers. The company allocate trailers to prime movers one to one basis. Therefore the mileage covered by each vehicle equals to mileage covered by its trailer. However other than the trailer down time, its vehicle down time is also effects to reduce mileage, since one trailer is permanently allocated for a vehicle. Two lines were plotted to identify relationship between output and trailer cost.

Regression analysis (Figure 4.6) shows two clear lines bellow line is normal trailer cost with respect tomileage. The above line which consists of small number of data show the costs incur when the trailer is down or under repair. That is the reason for regression line is fitting to 7.3% to actual scenario but equation is representing for normal operating condition so that the marginal cost of trailer per kilometre travel is LKR 2.655. The company has allocated trailers one to one basis that leads them to less utilization of the fleet as well as the prime mover.

4.6 Labour cost

Labour cost is the general term used for cost of drivers and helpers. There are several ways in the industry to calculate labour cost. Fixed monthly wage for drivers and helpers, pre-determined percentage from the income generated by each trip, fixed monthly wage with an incentive based on the number of kilometres covered in each trip and fixed monthly wage with overtime payments (OT hours are determined according to the labour law) are some of those.

The method used by each firm may differ due to various characteristics. Most of the large scale trucking companies may use the last option, a wage with overtime payments since these firms are well established in the market. On the other way newly establish small scale owner/operator trucking firm may probably use pre-determined percentage from the income generated (Invoice value to the customer) by each trip. In this research, it is considered the company pays fixed monthly wage with an incentive based on the number of kilometres covered in each trip. This incentive is a variable cost which changes with the output and monthly wages may considered as fixed during the time period.

The regression analysis of wages (Figure 4.7) with respect to kilometres clearly shows two lines. Bellow line shows that long distance trips with less/fast loading and unloading. The line which has rapid change with respect to mileage is short distance trip with more loading/unloading time. Due to these two different scenarios regression line is not much fitted to the actual situation. That happens because of inefficiencies and operating parameters of the industry. Incentives and overtime payments have got different behaviour than the wages it will elaborate in bellow regression analysis.

Incentives and overtime has got positive relationship between mileages because if fleets travel more driver and helper has to work more and more due to that mileage and incentive and overtime has positive relationship with respect mileage. But the regression line (Figure 4.8) is only fitted 53.4% to the actual data that happen due to the operating conditions. As an example if it is a long trip unloading/loading time also come under this but at that moment the fleet is not moving so that the time taken to load or unload in the long trips create the deviation with mileage. According to the regression analysis marginal incentive and overtime cost per kilometre travel is LKR 6.802.

4.7 Total operating variable costs and semi variable costs with mileage

The result of this analysis shows that the operation cost (variable cost and semi variable cost) the equation consists of constant number of LKR 25,193.70 (Figure 4.9). it meant if person is going to own a prime mover has to bear cost of LKR 25,193.70 before it begins the operation. The marginal operating cost of prime over is LKR 79.381/= That means the operator has to spend LKR 79.381/= as operating cost but this is not include capital costs such as depreciation and other utilities.

4.8 Fixed cost

Depreciations for the prime movers and trailers are based on straight line method. For a prime mover annual depreciation is 20% of its purchased cost and for a trailer annual rate is 10%. License and permit fees include, revenue license amount, fee for emission test. Calculation of depreciation cost for prime mover had done according to manufacturer suggestion and table 4.6 shows depreciation cost for each month to 60 trailers.

License & insurance and emission test fee also not changed with running kilometres as well as its not change year by year because those are decided by government cabinet papers. So that in this research those cost also considered as fixed cost due to above mentioned two reasons. Table 4.7 elaborates about how the license, insurance, and emission test fee has occurred. Total fixed cost for this prime mover operation is shown in table 4.8 and it consists of both of the fixed cost parameters which have defined on beginning of this section.

4.9 Performance measurements & sensitivity analysis

All the collected data were summarized monthly basis in to the table 4.9. Purpose of this summary was to carry out an analysis for the whole company rather than considering a single vehicle.

Figure 4.10 explains the operational cost, variable cost and fixed cost during April to December the year 2012. Based on these summarized data, frequency distributions are generated (Figure 4.10 & Figure 4.11). Descriptive statistics for variable cost and operational cost were also developed.

Ratio between the variable cost (69%) and fixed cost (39%) is in figure 4.12. Further classification of variable costs, it clearly defined, fuel cost is the major cost component which is about 64% from variable cost (Figure 4.13). As a respective costs wages, incentive and OT are contribute for

variable cost. Contribution to the operational cost by each cost component, also highlight its importance to be focused. Effective controlling over top cost components in the list will increase overall performance of the company.

As defined in the third chapter, following performance measurements were determined using relevant data.

- Fuel Economy (FE) = Number of kilometers covered / Number of liters fuelled = 2.57km per litre
- Cost per kilometer (CPK) = Variable cost + Fixed Cost / Total kilometers = LKR(71.99 +79.38) = LKR 151.37
- Variable cost per kilometer (VCPK) = Variable cost / Total kilometers = LKR 79.381
- Fixed cost per kilometer (FCPK) = Fixed Cost / Total kilometers = LKR 71.99

5. Conclusion

5.1 Introduction

Purpose of this study to generate a formula to calculate prime mover operating cost and it is differentiated cost elements in to three segments as variable cost, semi variable cost and fixed cost. In those three segments some cost competes such as refuelling, tyre wastage, trailer cost, driver/helper incentive and OT, lubricant costs are have direct variation with respect to mileage. Costs like repair and maintenance, wages are falling in to as semi variable cost because those are not daily basis costs but between 1 to 3 months times those are occured. Depreciation cost and utilities are fallen as fixed cost in prime mover operation.Relevant data for the year 2012 were collected and then analysed in order to find the relationships between variables and to identify distribution of each vehicle. Each cost component was analysed and following results and interpretations were found out.

5.2 Summary of Findings

- There is a significant relationship between the output (mileage) and the fuel cost. During this research a linear regression model was developed between these two variables as follows.
  REFUELLING = 4018 + 55.6 Kilometres
- As a truck operator, it is necessary to have an effective control over fuel consumption since, according to the research; fuel cost is about 64% from total operational variable cost for the year 2012.
- R&M and tyre replacement cost can be considered as irregular or periodic expenses. It was difficult to find a linear relationship between these two and the output. However it was found that high R&M expenses may reflect not only the monetary value spent but also the opportunity cost of vehicle being held up and may result reduce in total income especially for prime mover owner/operator.
- Tyre wastage also have positive relationship with mileage, the regression line clearly fitted to the actual scenario the equation of tyre wastage with related to mileage as follows.
  TYRE WASTE = 0.39 + 0.9137 Kilometres
- There are several ways of paying drivers/helpers. From these methods, small scale operators often go for a trip based incentive with a wage large scale companies go with wage and overtime while some firms go with wage and invoice commission. So that the driver/helper wages become a fixed cost and the incentive becomes a variable cost.
- Performance measurements which were defined in third chapter are calculated to measure

performance and also according to the total cost in year 2012, fuel cost was found out to become the most sensitive which is about 64% with a fuel economy of 2.57 km/litre. Wages, incentive and overtime costs were the next top factors which could influence the total operational variable cost. Tyre replacement and repair and maintenance costs are also contributing 10% of total operational variable cost.

- Lubricant and regular service cost also behave like fuel cost but it is more fitting to the actual scenario than refuel cost. But it has lower contribution to final operating cost because burden with respect to kilometres is less in this cost component. However following equating provides relationship between kilometre and lubricant and regular service cost.

  LUBRICANT AND REGULAR SERVICES = 0.7258 + 0.9401 Kilometres

- Since this research has focused on higher number of fleets the fixed cost is considerably large propionate of total cost. Since monthly average running is 18,012.94 km per month that lead to have high number of fixed cost with respect to kilometre but that is vary with the type of fleet you use and the way of depreciation calculation. If the company is depreciating in rapid strait line basis fixed cost component is considerable higher than others. In this research utility payments like insurance premium, license fee and emission test fee also considered as fixed costs but the contribution from those are very minimum than depreciation
- As the final outcome of conducting this study, researcher has successfully derived the following formula. This has the ability to generate the cost of operating prime movers in an organization subjected to the conditions which have considered in this study. OPERATING COST = Fixed Cost + Semi-variable Cost + Variable Cost

  = fixed cost contribution + 79.381 x kilometre

TABLES AND FIGURE

Figure 4.1: Refueling vs. Mileage

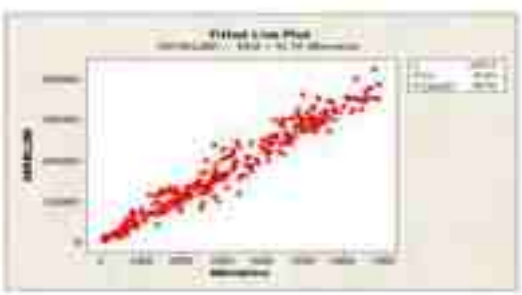


Figure 4.2: R&M cost variation with Mileage

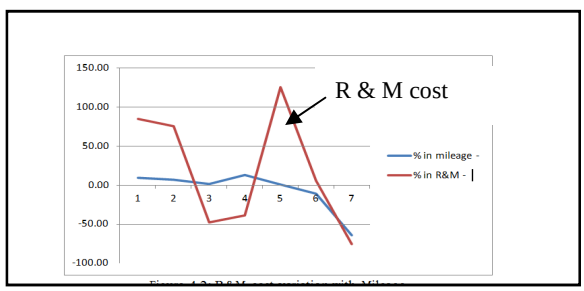


Figure 4.3: R&M cost regression Analysis

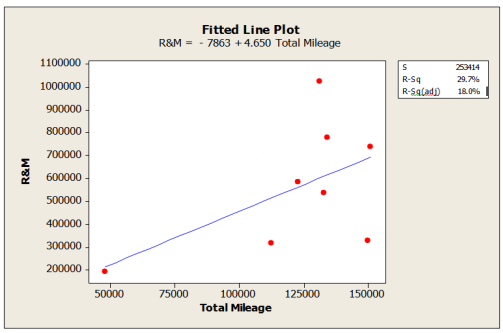


Figure 4.4**:** R&M cost variation with Mileage

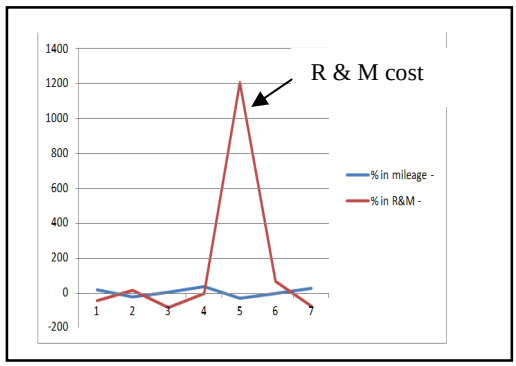


Figure 4.5: R&M cost variation with age of the vehicle

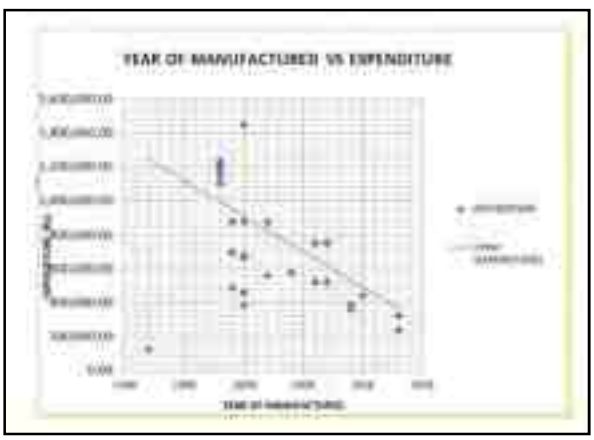


Figure 4.6: Trailer cost regression Analysis

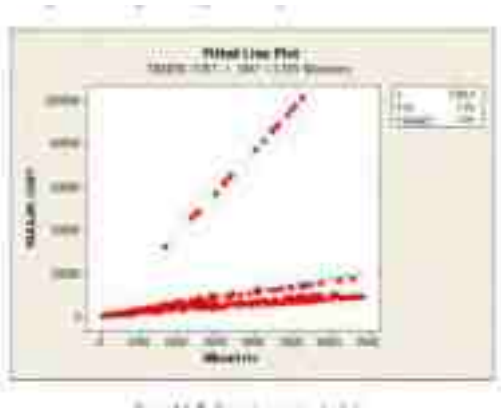


Figure 4.7 : Regression Analysis of Driver Helper Wages

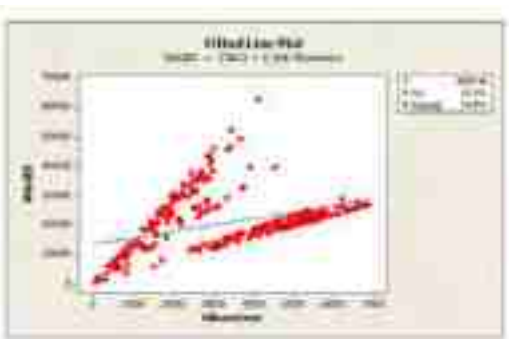


Figure 4.8 : Regression Analysis of Driver Helper overtime payment

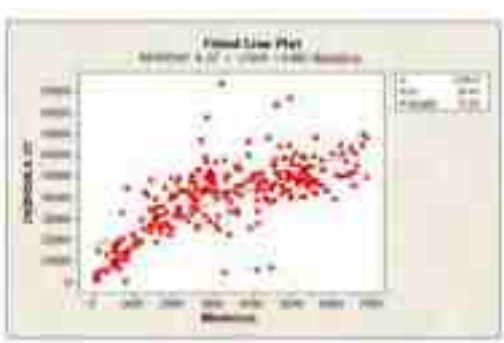


Figure 4.9: Total mileage vs. operational cost

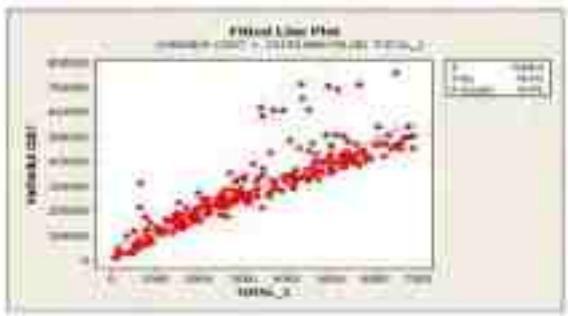


Figure 4.10: Monthly total operational cost

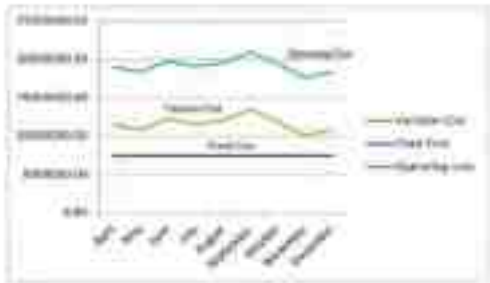


Figure 4.11: Histogram of operating cost
cost and fixed cost

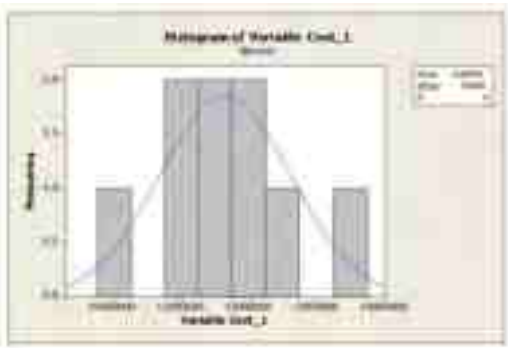
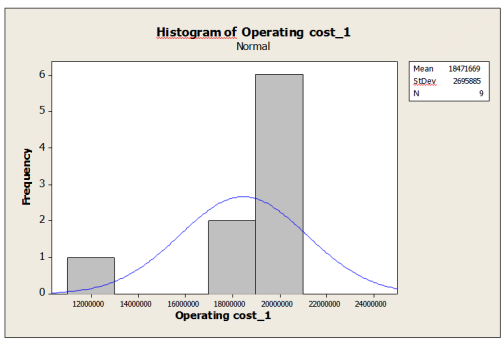
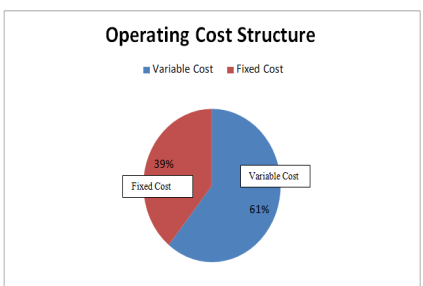
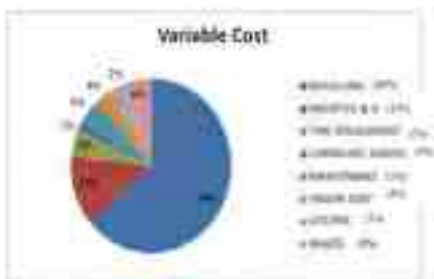


Figure 4.12: Ratio between the variable



4.13: Variable cost analysis





Tables:

Table 4.1 – Regression analysis for refuelling vs. kilometres

Predictor	Coef SE	Coef T	P	
Constant	4018	2795	1.44	0.152
Kilometres	55.5941	0.7504	74.08	0.000

S = 22707.2 R-Sq = 95.2% R-Sq(adj) = 95.2%

Table 4.2 – Variance analysis of refuelling vs. kilometres

Source	DF	SS	MS	F	P
Regression	1	2.82993E+12	2.82993E+12	5488.41	0.000
Residual Error	275	1.41795E+11	515619179		
Total	276	2.97172E+12			

Table 4.3 – Descriptive statistics for total cost vs. variable cost

Residuals:				
Min	1Q	Median	3Q	Max
-1,80,185	-23,676	-17,279	10,665	351,163

Coefficients:				
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	25,193.7	4,604.9	5.471	7.73E-08
mileage	79.381	1.508	52.636	< 2e-16

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EFFECT OF DIFFERENT DOUGH IMPROVERS ON THE PROXIMATE COMPOSITION, MINERALS, VITAMINS AND SENSORY PROPERTIES OF WHEAT BREAD

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Abstract

Comparative evaluation of bread made from wheat flour using five different dough improvers was evaluated. The improvers were ascorbic acid, EDC-2000, (etheylene dough conditioner), *egg, STK (screw thread kneading), and azodicarbonamide. The samples were coded A, B, C, D, E and F where sample A with no improver served as the control. The proximate composition of the bread samples analyzed showed that the percentage crude protein content of the samples ranged between 7.06+0.06 to 8.37+0.11 and were significantly different at P<0.05 for all the dough improvers used. The highest value for the crude protein was recorded for bread baked with egg as the dough improver with a value of 8.37+0.11%. The % moisture, % ash and %crude fibre contents were not significantly different at P<0.05 while the fat and carbohydrate contents were significantly different for all the improvers used. The mineral composition of the bread samples analyzed were potassium, calcium, zinc, iron and phosphorus and all were significantly different with all the dough improvers used and the control sample A at P<0.05. The vitamin content analyzed comprised of water soluble and fat soluble vitamins. Vitamin A content of the bread samples ranged between 3.28+0.00mg/100g to 3.45+0.00mg/100g. The water soluble vitamins which comprised of Vitamins C, B_1, B_2, and B_3 were not significantly different with the control sample A at P<0.05 for all the dough improvers used. Bread samples were evaluated for sensory attributes of appearance, texture, crumb color, crust color, taste and general acceptability. Samples B, D, and E were rated significantly higher (P<0.05) for all the attributes except for taste. In terms of general acceptability, sample B (ascorbic acid improver) was rated highest with a mean value of 8.08+0.67 followed by sample D (egg improver) with a mean value of 8.0±0.43 while the least was recorded for bread without improver (control) with a mean value of 6.42±1.08.The bread volume was rated highest for sample B (ascorbic acid) with a value of 3906.25cm^3 while the least volume was recorded for the bread without dough improver (control) with a value of 2310cm^3. This work showed that acceptable bread could be produced from wheat flour using all the five bread improvers with ascorbic acid and egg giving better results in terms of sensory and physical characteristics of the bread.*

Key Words: wheat flour, dough improvers, bread.

INTRODUCTION

Bread is a food prepared by baking dough of flour, water and yeast and often additional ingredients, such as butter or salt to improve the taste (Osuji, 2006). Bread is one of the important staple foods in the world today. It has become an essential part of Nigerian diet, constituting the breakfast menu of many families, especially the medium and high income class. The consumption of which is steady and increasing in Nigeria as well as several countries of the world. Bread has come to symbolize existence. Hardly does a day pass without the commodity making appearance on the menu of many families (Okoroanyanwu *et al.*, 2007). Bread also comes in various sizes; small, medium and large loaves, thus making it affordable by everyone. Several ingredients are involved in bread making. Some are mandatory (flour, water, yeast) and others are optional (sugar, fat, emulsifiers, milk, malt flavour etc). Today in Nigeria many bread manufacturers add optional ingredients without regard to safety. For example potassium bromate added by Nigerian bakers is now prohibited in view of its health hazard (carcinogenic). Flour for bread making should be of good quality that is, flour with enough protein particularly gluten, must be capable of forming dough of satisfactory elasticity, strength and stability. In addition the flour should have good amylase activity, below 14% moisture and satisfactory colour. Flour treatment agents (also called improving agents, bread improvers, dough conditioners and dough improvers) are food addictives which are usually combined with flour to improve baking functionality. They are used to increase the speed of dough rising and to improve the strength and workability of the dough. In fact bakers in recent times cannot do without these improvers and they are the important component of modern plant baking, reducing the time needed to produce a loaf of bread to 2h from the 12 to 24h early bread making required. During preparation of the dough for bread making, a network of protein molecules is formed, linked together by disulphide bonds. The strength and elasticity of the network gives the dough its characteristics properties and is best when the network comprises of long chain proteins such as gluten. Unfortunately, short chain proteins are present such as glutathione, which reacts with gluten molecules breaking down the dough mixture. This can be prevented by adding oxidizing agents (Kent, 1984). Potassium bromate, ascorbic acid, azodicarbonamide are some of the examples of oxidizing agents. The reaction of these oxidizing agents increases the elasticity and reduces the extensibility of the dough. These oxidizing agents are also use to improve the handling characteristics of the dough, specific volume and texture of the finished product. Due to the disadvantage associated with the use of potassium bromate (carcinogenic), it has been banned by the National Agency for Food, Drug administration and control (NAFDAC) in Nigeria bakery industries. Since then research have been on going to get an alternative dough improver. Thus the objective of this study is to ascertain the effect of different dough improvers on proximate, mineral, vitamin and sensory attributes of the bread with the view of improving the prospect of bakery industries.

MATERIALS AND METHODS

Sample collection

The bread wheat flour of the golden penny brand and other ingredients like fat, sugar, salt, instant dried yeast, milk, dough improvers: EDC 2000, ascorbic acid, STK, azodicarbonamide and eggs used in this work were purchased at Owerri Main Market, Imo State, Nigeria.

Sample preparation

The method described by Oti and Aniedu (2006a,b) was used in the bread production. The ingredients – salt, water, sugar, fat, yeast, wheat flour and the dough improver were thoroughly mixed, fermented, kneaded, proved, baked, cooled, packed and stored prior to analysis. The bread production was repeated with the other four dough improvers.

PROXIMATE ANALYSIS

The percentage moisture, crude protein, fat, fibre, ash and carbohydrate were determined by the standard methods of AOAC (1990).

Determination of mineral content of bread samples

The mineral element (phosphorus, zinc, iron, potassium, and calcium) were determined by atomic absorption spectrometer method described by AOAC (1990).

Determination of vitamin content of the bread samples

The vitamins A, C, B_1, B_2, and B_3 were determined by the method described by AOAC (2000)

Determination of loaf volume

This was done by measuring the volume of the loaf from the dimensions. This was done by multiplying the dimension of length, width and height of the rectangular shaped loaf in cm^3.

SENSORY EVALUATION

Sensory evaluation of the five bread samples produced each with different dough improvers with the control sample (zero dough improver) was conducted using 12 member panelists. Bread samples quality was judged in terms of appearance/colour, crust texture, crumb texture, flavour/aroma, taste and overall acceptability. The 9-point hedonic scale (9 -like extremely, 5 – neither like nor dislike, 1 – dislike extremely) as described by Iwe (2002) was used

STATISTICAL ANALYSIS

All data were subjected to analysis of variance (ANOVA) and means were separated by Fisher's Test at 5% level of significance to establish where there were significant differences between the means (O'Mahony, 1986).

Results and Discussion

Proximate Composition of bread Samples

The result in Table 1.0 shows the proximate composition of the bread samples made with five different dough improvers.

The percentage crude protein content

The crude protein content for bread samples A, B, C, D, E and F were 8.22±0.03, 8.21±0.06, 7.06±0.06, 8.37±0.11, 8.17±0.11 and 7.53±0.39 respectively (Table 1.0). The bread sample produced with egg as bread improver had the highest value of protein with value of 8.37± 0.11 (Sample D). The reason for sample D having the highest protein content could be that the egg used which is a good source of protein contributed to the protein content. These values were within the range reported by Okezie (2006) that crude protein of baked samples using eggs are found to range from 8.36% to 9.26%. This implies that bread produced with egg as bread improver will help alleviate problem of protein malnutrition. The protein content of sample C was lowest with a value of 7.06±0.06 which could be attributed to the ability of EDC (etheylene dough conditioner) to denature protein molecules in baked products (Corrine, 1994).

Percentage ash Content

The ash content which is an indication of the mineral content of the bread samples ranged from 1.06±0.03 to 1.14±0.03. The ash content for all the samples were not significantly different from the control sample A at $P < 0.05$. This implies that the different bread improvers did not alter so much the mineral content of the bread. The sample E produced with STK improver had the highest ash content. The increase in the mineral content of baked products using STK as an improver was also reported by Corrine (1994) with an increase of 1.02%.

Percentage crude fibre

The crude fibre content of the bread samples produced from different dough improvers ranged from 0.92±0.04 to 1.05±0.00. Sample A (zero improver) had the least crude fibre content of 0.92±0.04 % while sample D (egg improver) had the highest crude fibre content of 1.05±0.05%. It was highest when compared with the recommended standard of crude fibre (0.80-0.98%) in some cereal flour. The highest crude fibre in sample D (egg improver) showed that egg could have inhibited the digestibility of polysaccharides in wheat flour. The high crude fibre obtained could add bulk to faeces thereby making defecation easier. When enough crude fibre is consumed they are passed into large intestine where they absorb water and swell thereby increasing the mass of the stool and also makes it soft (Olusanya,2008).

Percentage moisture content

The moisture content of the bread samples made from different dough improvers and the control sample (zero improver) were 34.71±0.13, 33.85±0.01, 32.80±0.05, 32.46±0.06, 32.53±0.11 and 32.78±0.11 for samples A, B , C ,D, E, and F respectively. They moisture contents were not significantly different for all the samples at $P<0.05$. The values obtained did not exceed the recommended moisture content of baked products of 35% by Standard Organization of Nigeria (SON). The values also did not differ much with what was reported by Lawrence and Adewumi (2012). The samples moisture content indicates that the product will likely have good shelf stability which will extend the usefulness of the products.

Percentage fat content

The fat content of the of the bread samples made from different improvers ranged from 11.92±0.03 to 12.84±0.00. Sample D (egg improver) had the least fat content of 11.92±0.03 Table 1.0. This could be as a result of the emulsifying property off the eggs which could have broken down the fat molecules enabling it to mix with water leading to reduction in its value. The fat content of the samples were higher when compared to the value reported by Lawrence and Adewumi (2012). This could be as a result of the recipe used in the production of the bread samples.

Carbohydrate content

The carbohydrate content of the bread samples made from different bread improvers ranged from 42.21±0.21%to 45.17±0.05%. The least carbohydrate content was recorded for the control sample A with zero improver with a value of 42.21±0.21%. The higher values of carbohydrate obtained for bread samples with improvers could be as a result of the presents of simple sugars in the bread improvers (Osuji, 2006).

Table 1.0: Proximate composition of wheat bread produced with different dough improvers

Parameters \ Samples	A (Control)	B	C	D	E	F	LSD
% Crude Protein	8.22±0.03[a]	8.21±0.06[a]	7.06±0.06[c]	8.37±0.11[a]	8.17±0.11[a]	7.53±0.39[b]	0.42
% Ash	1.11±0.02[a]	1.06±0.01[a]	1.12±0.01[a]	1.10±0.03[a]	1.14±0.03[a]	1.08±0.01[a]	------
% Crude fibre	0.92±0.04[a]	0.94±0.00[a]	1.02±0.00[a]	1.05±0.00[a]	0.94±0.03[a]	0.95±0.01[a]	------
% Moisture	34.71±0.13[a]	33.85±0.01[a]	32.80±0.05[a]	32.46±0.06	32.53±0.11[a]	32.78±0.11[a]	------
% Fat	12.84±0.00[a]	12.77±0.02[a]	12.82±0.03[a]	11.92±0.03[b]	12.63±0.04[a]	12.59±0.57[a]	0.35
% Carbohydrate	42.21±0.21[c]	43.18±0.08[b]	45.17±0.05[a]	45.10±0.00[a]	44.61±0.19[a]	45.08±0.57[a]	0.65

Means in the same row with the same superscript are not significantly different at ($P<0.05$).

The means were separated using least significant difference (LSD) fisher's test

Sample A= wheat bread + zero improver (Control)

Sample B= wheat bread + ascorbic acid improver

Sample C= wheat bread + EDC 2000

Sample D= wheat bread+ egg improver

Sample E=wheat bread +STK improver

Sample F= wheat bread +azodicarbonamide

Mineral composition of wheat bread samples produced with different dough improvers.

Phosphorus

The phosphorus content of the bread samples is as shown in Table 2.0. The values ranged from 240.80±0.00mg/100g to 244.82±0.03mg/100g. The highest value was recorded with bread improver named azodicarbonamide (sample F). This could be as a result of the chemical composition of the improver. According to Gordon and Margaret (2002) about 20 to 30% of dietary phosphorus comes from food additives, especially in baked goods, cheeses, processed meat, and many soft drinks.

Zinc

The zinc content of the bread samples were 13.71±0.13mg/100g, 14.64±0.02, 12.66±0.2, 12.72±0.09, 14.49±0.09 and 14.65±0.07mg/100g for samples A (control), B, C, D, E and sample F respectively. The highest value was obtained in the bread sample with azodicarbonamide as dough improver with a value of 14.65±0.07mg/100g. According to Gordon and Margaret (2002) zinc is not part of the enrichment process of flour so refined flours are not a good source of zinc. This result corresponded with the range of value (12.28mg/100g to 15.28mg/100g) obtained by Fayemi (1999).

Iron

The iron content of the bread samples made from different dough improvers ranged between 25.77±0.44 and 32.54±0.37. The highest was sample B made with ascorbic acid as dough improver. According to Gordon and Margaret (2002) bakery products including white breads, rolls, and crackers are among major sources of iron. Most of the iron in these products is elemental forms of iron added to refined flour as part of the enrichment process. This result obtained is within the recommended dietary allowance according to Olusanya (2008) which stated that an adult man needs 30mg/100g to 500mg/100g iron. Iron helps to prevent anemia when included in the human diet.

Potassium

The potassium content of the bread samples were 206.78±0.00mg/100g, 209.53±0.11mg/100g, 208.18±0.03, 207.54±0.08, 209.62±0.00, 209.68±0.11mg/100g for samples A, B, C, D, E, and F respectively. Samples B (ascorbic acid improver), sample E (STK improver) and sample F (azodicarbonamide improver) had the highest potassium content (above 209mg/100g) while the least was the control sample A (zero improver) with a value of 206.78±0.00mg/100g. The values for the samples corresponded with the range recommended by world health organizations (200mg/100g to 240mg/100g). Potassium helps to maintain osmotic pressure and the acid base balance of the body. It also helps to activate several enzyme reactions (Olusanya, 2008).

Calcium

The calcium content of the bread samples ranged from 160.77±0.00mg/100g to 164.63±0.18mg/100g. The least was sample A (zero improver) with a value of 160.77±0.00mg/100g. The calcium contents for all the samples were below the recommended intake for calcium for adults which ranged from 1000 to 1200mg/day (Gordon and Margaret, 2002). This intake is required to build higher bone mass.

Ta ble 2.0. Mineral contents of wheat bread produced with different dough improvers

Samples / Parameters	A (Control) mg/100g	B mg/100g	C mg/100g	D mg/100g	E mg/100g	F mg/100g	LSD
Phosphorus (P)	240.80±0.00^{f}	243.88±0.04^{b}	242.77±0.10^{d}	242.56±0.08^{de}	243.68±0.11^{bc}	244.82±0.03^{a}	0.25
Zinc (Zn)	13.71±0.13^{b}	14.64±0.02^{a}	12.66±0.20^{cd}	12.72±0.09^{c}	14.49±0.09^{a}	14.65±0.07^{a}	0.42
Iron (Fe)	25.77±0.44^{f}	32.54±0.37^{a}	29.67±0.10^{d}	28.77±0.04^{e}	31.62±0.02^{b}	31.34±0.08b^{c}	0.42
Potassium (K)	206.78±0.00^{d}	209.53±0.11^{a}	208.18±0.03^{b}	207.54±0.08^{c}	209.62±0.00^{a}	209.68±0.00^{a}	0.25
Calcium (Ca)	160.77±0.00^{c}	164.63±0.18^{a}	163.83±0.04^{a}	162.79±0.01^{b}	164.62±0.11^{a}	164.19±0.01^{a}	0.25

Means in the same row with the same superscript are not significantly different at ($P<0.05$).

The means were separated using least significant difference (LSD) fisher's test

Sample A= wheat bread + zero improver (Control)

Sample B= wheat bread + ascorbic acid improver

Sample C= wheat bread + EDC 2000

Sample D= wheat bread+ egg improver

Sample E=wheat bread +STK improver

Sample F= wheat bread +azodicarbonamid

Vitamin contents of wheat bread samples produced with different dough improvers.

The vitamin content of the bread samples made with different improvers is as shown in Table 3.0

Vitamin A

The vitamin A for the bread samples made with different dough improvers ranged from 3.28±0.00 to 3.45±0.00mg/100g. The bread sample A with zero improver (control) had the highest value of 3.45±0.00mg/100g. This could be as a result of non addition of dough improver that resulted in the non oxidation of vitamin A. The value obtained were within the range (3.26 to 3.60mg/100g) reported in baked products comprising of cake and bread (Uzor, 2008). Vitamin A is required for better vision.

Vitamin C

The vitamin C content of the bread samples ranged from 0.68±0.05 to 8.76±0.05mg/100g. Sample B (ascorbic acid dough improver) had the highest value of 8.76±0.05. The higher content of vitamin C could be as a result its composition of ascorbic acid (vitamin C). The value of the vitamin C contents of the different samples corresponded with value of (0.68 to 9.23mg/100g) reported by Hussan (2006). According to Hussan (2006) heat during baking decreases the level of Vitamin C in baked products. Vitamin C helps in prevention of scurvy.

Vitamin B_1, B_2 and B_3

Vitamin B_1 (thiamin) content of the bread samples ranged from 0.034mg/100g to 0.044mg/100g, Vitamin B_2 (riboflavin) ranged from 0.027mg/100g to 0.037mg/100g, while vitamin B_3 (niacin) ranged from 0.038mg/100g to 0.053mg/100g. According to Gordon and Margaret (2002) the low values obtained in all the B vitamins is as a result of heat destruction or alkalinity and all are subject to leaching into cooking water. The B vitamins and vitamin C is greatest in foods that are prepared by steaming, stir-frying, microwaving, or simmering in minimal moisture. Vitamin B_1, B_2 and B_3 help to prevent or cure these disease conditions of beriberi, ariboflavinosis and pellagra respectively (Gordon and Margaret, 2002).

Table 3.0. Vitamin contents of wheat bread produced with different dough improvers

Samples / Parameters	A (Control) mg/100g	B mg/100g	C mg/100g	D mg/100g	E mg/100g	F mg/100g	LSD
Vitamin A	3.45±0.00[a]	3.43±0.00[a]	3.28±0.00[a]	3.42±0.00[a]	3.38±0.03[a]	3.29±0.01[a]	……
Vitamin C	5.25±0.05[a]	8.76±0.05[a]	0.68±0.05[a]	1.45±0.05[a]	6.40±0.05[a]	0.87±0.05[a]	…….
Vitamin B_1	0.034±0.00[a]	0.044±0.00[a]	0.035±0.00[a]	0.038±0.00[a]	0.039±0.00[a]	0.037±0.00[a]	…….
Vitamin B_2	0.027±0.00[a]	0.031±0.00[a]	0.029±0.00[a]	0.031±0.00[a]	0.030±0.00[a]	0.037±0.00[a]	……..
Vitamin B_3	0.038±0.00[a]	0.053±0.00[a]	0.039±0.00[a]	0.040±0.00[a]	0.038±0.00[a]	0.038±0.00[a]	……....

Means in the same row with the same superscript are not significantly different at ($P<0.05$).

The means were separated using least significant difference (LSD) fisher's test

Sample A= wheat bread + zero improver (Control)

Sample B= wheat bread + ascorbic acid improver

Sample C= wheat bread + EDC 2000

Sample D= wheat bread+ egg improver

Sample E=wheat bread +STK improver (**Screw type kneading) machine improvers**

Sample F= wheat bread +azodicarbonamide

Sensory evaluation of bread samples made with different dough improvers

The mean sensory scores of the bread made with different dough improvers were as shown in Table 4.0.

Colour

The scores of the colour were 6.41±1.56, 7.33±0.65 and 6.80±0.83, 8.10±0.29, 7.00±0.60 and 6.3±0.89 for samples A, B, C, D, E and F respectively. There is significant difference in the colour of all the samples at $P < 0.05$. Sample D (egg improver) was rated highest in terms of colour with a mean value of 8.10±0.2. It could be as a result of egg used as an improver which might have induced mailliard reaction. This is a reaction involving proteins and carbohydrate resulting in browning or darkening of colour of food products. According to Ihekoronye and Ngoddy (1985) drying of eggs results in the darkening of the colour by the process of maillard reaction.

Crust texture

The mean scores for the crust texture of the bread samples made with different dough improvers ranged from 5.75±0.86 to 8.1±0.39. The bread sample with egg improver was most preferred by the panelist while the least preferred was sample A with zero improver Table 4.0. The high mean value for the bread sample with egg improver could be attributed to maillard reaction which is involved in the crust formation as well as caramelization of the sugars (Ihekoronye and Ngoddy, 1985).

Crumb Texture

The mean score for the crumb texture of the bread samples made with different improvers ranged from 5.91±1.2 to 7.5±0.80. Sample D (egg improver) was rated highest while the least was sample F (azodicarbonamide improver) Table 4.0. The reason for the bread sample with egg improver being rated highest in terms of crumb texture could be that the protein content from the egg may have aided in the smooth consistency of the dough during kneading and formation of tiny smooth pores in the crumb after baking. According to Ihekoronye and Ngoddy (1985) eggs help in structure formation in food products and the egg white proteins ovalbumin and globulins are important in foam formation. When these proteins partially coagulate at the interface, they facilitate retention of air which provides leavening and volume and gives the dough light porous structure which is retained to form open honey comb texture of the finished bread. This also takes place during fermentation of sugar in the dough.

Flavour/Aroma

The flavour/aroma of the bread sample with egg improver was rated highest with a mean score of 7.8±0.58 by the panelist. Table 4.0. Maillard reaction of the egg protein with the sugar in the flours could be responsible for the high rating of the flavour of the bread sample with egg improver. According to Ihekoronye and Ngoddy (1985) maillard reaction is responsible for many of the specific taste, aromas, and colours of foods. This is in addition to alcohol and other products of yeast fermentation which the products formed in the crust by heat of the oven.

Taste

In terms of the taste, the bread sample D made with egg as the dough improver was scored highest with mean value of 8.25±0.62 Table 4.0 while the least scored was sample F, bread made with azodicarbonamide as dough improver with a mean value of 5.50±1.0. The highest score of the taste for sample D with egg as dough improver according to Ihekoronye and Ngoddy (1985) could be attributed mostly to the maillard reaction just as it is with the colour and aroma.

General Acceptance

In general acceptability the sample B (ascorbic acid improver) was rated highest with a mean score of 8.08±0.67 .This was followed by sample D (egg improver) with a mean score of B (8.00±0.43) while sample A (zero improver) was rated the least with mean score of 6.42±1.08. The least rating of the bread sample with zero improver (sample A) in terms of general acceptability emphasis the need for addition of dough improver in the production of bread by bakery industries. It also implied that ascorbic acid and egg dough improvers which were most preferred should be the best choice of bakers inorder to improve the sensory and physical properties of their bread products.

Volume of bread samples made with different dough improvers

The volumes of the bread samples made with different dough improvers were included in Table 4.0. The volumes were 2310.00cm^3, 3906.25 cm^3, 2783.00 cm^3, 2662.00 cm^3, 3456.00 cm^3, and 3272.14 cm^3 for samples A, B, C, D, E and F respectively. The highest bread volume was recorded with bread sample baked with ascorbic acid as dough improver (Sample B) while the least was the control sample A (zero improver). The bread volume of all the dough improvers used was higher than the control sample A, with zero improver. This implied that addition of dough improvers in bread increases the volume of the bread and hence its acceptability.

Table 4.0. Sensory evaluation and volumes of bread produced with different dough improvers

Parameters \ Samples	A (Control) mg/100g	B mg/100g	C mg/100g	D mg/100g	E mg/100g	F mg/100g	LSD
Colour	6.41±1.56^{cd}	7.33±0.65^{ab}	6.8±0.83^{cd}	8.1±0.29^{a}	7.00±0.60^{bc}	6.30±0.89^{d}	0.89
Crust texture	5.75±0.86^{d}	7.33±0.89^{ab}	6.83±0.72^{bc}	8.10±0.39^{a}	6.83±0.71^{bc}	5.75±0.87^{d}	0.75
Crumb texture	6.40±1.31^{bc}	7.00±0.43^{ab}	6.67±0.65^{abc}	7.50±0.80^{a}	7.10±0.51^{ab}	5.91±1.20^{c}	0.86
Flavour/Aroma	6.3±1.23^{b}	7.50±0.80b	6.33±0.49b	7.80±0.58a	6.60±0.51b	6.10±1.16b	0.73
Taste 0.81	6.25±0.87^{cd}	7.83±0.94^{a}	6.58±0.79^{bc}	8.25±0.62^{a}	5.83±0.83^{cd}	5.50±1.0^{d}	
Overall acceptance	6.62±1.08^{d}	8.08±0.67^{a}	7.17±0.58^{c}	8.00±0.43^{a}	7.58±0.51^{ab}	6.58±0.67^{cd}	0.69
Bread volume	2310.00cm^3	3906.25cm^3	2783.00cm^3	2662.00cm^3	3456.00cm^3	3272.14cm^3	

Means in the same row with the same superscript are not significantly different at ($P<0.05$).

The means were separated using least significant difference (LSD) fisher's test

Sample A= wheat bread + zero improver (Control)

Sample B= wheat bread + ascorbic acid improver

Sample C= wheat bread + EDC 2000, Sample D= wheat bread+ egg improver

Sample E=wheat bread +STK improver (**Screw type kneading) machine improvers,** Sample F= wheat bread +azodicarbonamide

Conclusion

This work showed that acceptable bread could be produced from wheat flour using all the five bread improvers with ascorbic acid and egg giving better results in terms of sensory and physical characteristics of the bread. Bread produced without dough improver will likely have poor physical and sensory attributes like poor volume, taste, flavour, crust colour, crumb texture and crust texture.

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Two Track diplomacy and early warning: an overview of Governance styles in West Africa

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ABSTRACT

The recognition accorded Track Two diplomacy, otherwise known as Non-governmental Organizations, is due to the waning impact of Track One diplomacy in satisfying the inevitable needs of salient diplomatic interaction. The resultant weakness of Track One diplomacy, which is restricted to the interaction between governments and predicated on rigid foreign policies of each nation-state, has created major problems concerning issuance of Early Warning to prevent conflict emergence. This is in spite of an avalanche of privileged information channels available to any government, such as the state or military intelligence services, diplomatic missions, the mass media and many others. This is a far-cry from the operations of Track Two, which are non-partisan and apolitical, an attribute that encourages freedom and non-adversarial interaction between feuding nations and communities. Besides, NGOs are a reservoir of privileged information concerning issues that often serve as catalyst to violence. The endemic catastrophe in the West Africa sub-region generally is due to the disdain and to ambivalence in decision taking which point to the need for embracing early warning signals by various non-governmental organizations in order to reduce the overall costs of intra-state conflicts. As it is cheaper and cost-effective to tackle any conflict before graduating into an armed conflict which is lacking in West Africa, this paper will examine the governance styles of some conflict prone West African States, taking into account the role of non-governmental organizations in areas of early warnings, with a view to recommending strategies for sustainable peace-building in West Africa.

Key words: Track Two Diplomacy, Early Warning, Governance, State Actors, West Africa.

INTRODUCTION

The manifest dysfunctions of contemporary West African States and their inability to effectively respond to the peace and security needs of the sub-region led to the rising popularity of Track II Diplomacy in the process of peace building in West Africa (Olarinde 2010:218). Besides, recent catastrophes, not only in the West African sub-region but elsewhere in the global community, as well as the realization that it may be easier to deal with conflicts at the earliest stage, led to the growing consensus of the importance of conflict prevention in the United Nations and among many (trans)governmental and non-governmental organizations. (Miall, Rainsbothan and Woodhouse, 1999).

Paradoxically, despite indices of impending conflict such as occasional bouts of violence, political and religious fundamentalism as well as many other peace threatening signals, governments are still lackadaisical in giving timely warnings to both Local and International Communities, to avoid the label of either alarmists or the backlash of repelling would-be- investors. Where governments lack the courage of prompt alertness for political reasons, Track 2 Diplomacy, a collection of various Non-governmental Organizations which have no political affiliation and are pursing peace-building agenda, often come up with tangible early warnings, to the discomfiture of governments. This is found cost-effective because, as advanced by Tongeren (1996:18), the overall costs of intra-state conflicts are much higher than the eye-catching material damage and human casualties. These are evidenced in issues having to do with the demolition of the democratic system, disintegration of states, social disequilibrium occasioned by separation of families and communities, while spiritual costs, in terms of the undermining of values and meaning of life, do occur. Above all, the inevitable impact of psychological effect of conflicts have been serving overtime as catalyst to yet, the eruption of new violence.

It is the strong belief of this paper that most of the conflicts in the West African sub-region, which have been generating refugee-flow or showing traits of intractability, are due to the government's insensitivity to giving early warnings and where such have been alerted by the practitioners of Track 2 Diplomacy, they are regarded as crying wolf where there is none, or at best, treated with disdain. Without any gainsay, the West African and International Communities will be the beneficiary of early conflict prevention because a stitch in time saves nine.

Conceptual And Theoretical Framework

In order to situate this paper pertinently, its theoretical takeoff point advocates that conflict prevention or mitigation through the application of early warning and early response by the Government is desirable as the current power politics approach by various states have not helped matters. The conceptual clarification of early warning as well as Track Two Diplomacy which are central to this paper must be attempted. In the opinion of Schmid, (1998), early warning is "the systematic collection and analysis of information coming from areas of crises for the purpose of anticipating the escalation of violent conflict, the development of strategic responses to these crises, and the presentation of options to key decision makers". Buttressing the significance of formulating strategic responses and policy options are other scholars like McCarthy (1997), Archarya and Dewill, (1997), among many others. McCarthy (1997:15) opines that Early Warning is a process of communicating judgments about threats early enough for decision makers to take action to deter whatever outcome is threatened; or failing that, to manage events in such a way that the worst consequences are mitigated". In the collective views of Archarya and Dewill, (1997:131-132), early warning involves monitoring of developments in political, military, ecological, refuge flows, threats of famine, and the spread of disease that may, unless, mitigated, lead to outbreak of violence or major humanitarian disasters". If we contextualize the submissions of Archarya and Dewill (1997), it will be discovered that close monitoring of developments such as political, military, ecological and

strategic responses. It is on this ground that the view of Jentleson (1996), becomes helpful. Accordingly, he asserts that early warming is the provision of relevant institutions, groups and organizations with essential information about escalatory developments, far enough in advances, in order for them to react timely and effectively with preventive measures.

In his view, the institutions required for peace building may be groups and organizations such as:

- The prospective victims and groups at risk;
- The perpetrators (in order to deter them);
- Trans-governmental organizations, such as the Organization for Security and Co-operation in Europe and NATO, as well as United Nations Agencies;
- Governments of nearby or neighboring countries willing and able to provide their good offices;
- The Secretary-General and Security Council of the United Nations;
- Non-Governmental Organizations Concerned with relief;
- The Mass Media and public;

And lastly – Eminent persons who can lend credence to the early warning. (Jentleson, 1996).

Mimicking African proverbs which specify that thunder is the usual concomitant of a storm, and that there is no smoke without fire, the submissions of the aforementioned scholars are pointers to the level of preparedness which must be envisaged against any anticipated conflict. However, due to political mediocrity, engineered by a complacent posture among those communities or states where, despite an abundance of signals about an impending humanitarian disaster, the leaders there still sit petrified, with fears about taking decisive action to stem the tide. In the West African Sub-region, the indices of backwardness are quite prevalent several years after independence, as the sub-region keeps graduating from one conflict to another, in the mist of unheeded early warnings. Conflict generation has reduced the region to the celebrants of mediocrity where, in the 21st century, construction of a kilometer road or repairing a damaged bridge is celebrated with funfair, attracting the presence of recruited political hangers-on, in the name of stakeholders, traditional rulers, and diplomat etc to signal the arrival of the new political savior. Such could be tolerated in the days of 16th C Renaissance in Rome, Germany or Genera. What an irony! The presence of such teeming thousands of mere clappers in a mundane ceremony and during planting or harvesting seasons, by itself, is a potent signal of an impending malcontent and conflict explosion.

At this juncture, an attempt will be made to explain the concept of Track 2 Diplomacy which is a bridge builder between those parties in conflict. Track Two is unofficial, informal, and introspective in its examination of a conflict or other issues. On the basis of this, it generates freedom of interaction not possible in Track One Diplomacy, otherwise known as traditional diplomacy. It is through Track Two that activities such as "citizenship building, microfinance of small business in developing nations, disease prevention, education and a host of other beneficial support activities are realized. www.imtd.org/publications - retrieved (26th April, 2013). What makes Track Two as a concept quite amenable to conflict solving is the deep suspicion with which governments, both local and foreign, view each other on account of histories of oppressive behaviors and corruption, whereas, Track 2 hasn't got such stigma. Track Two lends credence to skilled professionalism, versed in societal cohesiveness and win-win negotiation in any situation. In the words of Diamond and McDonald, (1996:37).

> Track Two is transformational, positing a world view in which power politics is superseded by mutual empowerment; identity groups at least join, if not replace, nation-states as the loci of power; basic human needs and not strategic interests set the agenda; collaboration and exclusivity replace competition and exclusitivity; international relations are seen as ongoing relationships between all the people, not as crisis or situational relationships between governments; and the international community is called to address human environmental

Essentially, the theoretical thrust of this paper is predicated on conflict prevention or mitigation from the perspective of the multi-track diplomacy and that the Non-governmental organizations otherwise called Track Two Diplomacy, can contribute towards societal homogeneity like any other collaborative tracks such as Government, (Tack One), Business Organizations (Track 3), Private Citizens (Track Four), Research, Training and Education (Track 5), Activism, (Track 6), Religious Diplomacy (Track 7), Funding Agencies Diplomacy otherwise known as (Track 8), and the Track 9 diplomacy otherwise called Communications and the Media. From this stand point and echoing a renowned Peace and Conflicts Scholar, (Albert, I.O 2011), Multi Track Diplomacy refers to a synergetic approach to development, particularly peace intervention across levels, actors and interests. Multi –Track Diplomacy approaches the task of Peace-building as systemic and a process, contained and elaborated within conceptual compass of nine (Albert, I.O, 2011), as above enumerated. We will now establish how Non-Governmental Organizations have featured in the West African Sub-region, and Governments' response to their views, as well as difficulties faced by Track Two Diplomacy.

Early Warning & Track Two Diplomacy in the West Africa

There are many precursor events on signs of unrest that could be used in forecasting situations that have the potential to escalate into acrimonious situations. As advanced by Carnegie Commission (1997), important indicators of imminent violence include widespread human rights abuses, increasingly brutal political oppression, and inflammatory use of the media, the accumulation of arms, and an increase in organized killings.

The manifestations of early warnings, which were largely unheeded in West Africa are not wanting generally, but attempts will only be made to feature those states with great spill-over conflict manifestation. In Nigeria, the feebleness of the political structure on which Nigeria anchored her democratization project was pointed out in 1952, from the platform of Multi-Track Diplomacy when Adelabu (2005), painfully asked thus: Have we any genuine political party in Nigeria? Adelabu, (2005:120). His answer was emphatically no. His warning then was drawn from what he perceived as the lack of ideological base of the political parties then, coupled with carpet crossing of the political actors, which was a novelty at that time, not on account of principle or ideological incompatibility, but for what the gladiators stood to gain from where they were crossing to, in Adelabu's view. When again he saw that Nigeria was on the descent because of an ardent appeal to sectionalism and religion for political ascendancy, he warned thus:

> Any sentimental appeal to my Oduduwa ancestry or subtle attempts to exploit my religious susceptibilities is doomed to failure. Christians, heathens and atheists will always have my political confidence, respect and support. No sectional loyalty or group interest will ever deter me for a moment, from my sacred duty to my mother land. I will live, work, strive, think, write, fight and die for Nigeria… my ideal is a West African States Union, stretching form the banks of the Gambia to the shores of the Congo in panoramic beauty and unparallel grandeur. (Adelabu, 2005:120-121).

The problems of unheeded warnings are manifesting in the organization and management of political parties in Nigeria today. The rewards of neglected warnings are being seen in the unrest and terrorism ravaging the land and being controlled at a high cost. Similarly in the series of publications of the Friedrich Ebert Stiftung; a focused Track-Two Diplomacy advocates, timely warnings have been advanced to avert violence, be it political, economic, or social, while making necessary suggestions through a collection of professionals, intellectuals, as well as eminent persons who, in the words of Jentleson (1996), could lend credence to the early warnings. One of those publications, edited by Olurode and Akinboye (2005), is titled Democracy, Good Governance and Corruption in Nigeria.

Getting worried about the negative effect of corruption on Nigerian economy and image, and having collected workable data on the enigma, Friedrich Ebert Stiftung Foundation sponsored a workshop organized by the Faculty of Social sciences of the University of Lagos. In one of the workshop papers, it was rhetorically submitted thus:

> To most of our compatriots, corruption has taken on the complexion of an industry such that whoever thinks that he could erase the scourge must be engaged in a quixotic adventure and needed to have his head examined… but must we embrace this seeming reality that no nation is free of corruption as an alibi to refrain from taking action against a scourge that daily assaults our collective psyche as a nation? (Ribadu, 2005:viii preface, cited in Olurode and Akinboye, 2005).

If "total war" against the scourge has been unleashed as warned, could there not have been a marked difference? Every sector of Nigerian economy as well as political sphere is corruption ridden. It is discovered that corruption has percolated deep into the fabrics of our society like a permanent feature, and the political or social platform cannot be an exception. It is therefore out of this abiding concern that African Scholars and civil society organizations devote considerable amount of time and resources to addressing the question of good governance which no doubt has been identified as a factor responsible for the proliferation of conflict in the continent (Yaqub and Abubakar, 2005:15). Having sounded the warnings of the coming storm, how receptive have the Governments been? Are the by-products of prevarication by the ruling elites in Africa, particularly in the West African sub-region not responsible for many protracted conflicts, manifesting in poverty, unemployment, under-employment and other vices?

Relief activities often take precedence over pro-active peace-building, measures. One begins to wonder then when various governments beat their chest for having provided enabling environments for gainful employment, educational advancement, agriculture etc when the impoverished citizenry, on account of unending conflicts which could have been averted, could not muster enough economic means to satisfy their felt needs. It is the effect of bad governance, occasioned by lack of respect for pre-conflict warnings that resulted in poverty and crime commission. What is the use of having facilities that could transform one's living standard when the means to acquire such is unavailable? This type of situation influenced Mclelland to declare that "it is no use having the right of access to the Grill Room of the Ritz if you cannot afford the bill. (Mchelland, 1983:145). This is the type of issues accentuating psychological violence, serving as catalyst to yet, another violence.

The ceaseless demand for good governance by the World Bank and many other local and international organizations since the early seventies till date is anchored on the profligacy of political leaders in the developing economies and the leaders in the West African sub-region have a large share of the dose. Among the indices of bad governance contained in the warnings of many financial institutions and other concerned organizations of the Track Two Diplomacy are corruptions, electoral fraud, etc which throw up political leaders whose mission in government is predatory accumulation and looting of the state's treasury which encourage gross maladministration. As aptly captured by Odukoya (2011:323),

> State weakness, maladministration, ill-digested and externally-imposed policies, irresponsible leadership, corruption and unproductive capitalism are some of the major factors behind the Africa's crisis. Regrettably, the crisis which started in the late 1980s is far from receding.

With these unaddressed ills staring us in the face, the inevitable repercussions are poverty, unrest, destitution, unemployment, diseases, illiteracy, crime and violence. Yet, in spite of the persistent warnings against blocking the path of institutionalizing square pegs in square wholes, to redress this

conspicuous distress calls, holds sway. The issue is not which party or person is in power but which party or person is able to supply the citizen the basic needs of life. The perpetuation of the state of mediocrity attracts the attention of Abrokwaa (1999:663), who submits that:

> The African State has increasingly become irrelevant to the people due to its inability to supply them their needs, hence, thousands are joining in the silent revolution of dropping out of the formal economy for their own survival.

A point that is generally agreed to by all analysts is that heaping the blame of lack of development, or perpetuation of conflict in Africa and particularly the West African Sub-region on erstwhile colonial masters' amounts to a defeatist and dastardly policy. Poor governance is self inflicted as due timely warnings were not lacking by parishioners of Track Two Diplomacy, be it on economic, social, or political sphere. For instance, on agricultural terrain, policy making is that of Track One Diplomacy but the significance of Track Two Diplomacy is sensitization through collaboration with other Eight Tracks, and the in-depth fraternization of the practitioners with the grass root, which assists the Track to assess the feelings and raise timely warnings for the overall good of the community, in practical and empirical terms. The policy maker in the West African sub-region had signs of economic diversification through series of sensitization seminars by Academics Institutions, particularly humanitarian bodies, faith inspired groups etc. but they often assumed that they were crying wolf when there was none. The alert on the danger posed by abandonment of agriculture in Nigeria, which kept, and is still able to keep over 80% of the citizens gainfully employed was loud enough but not heeded. In the West was Cocoa, in the East, Palm Oil and Kernel and in the North, Groundnut, exhibiting pyramids and seeking spaces at Apapa port, awaiting evacuation to Liverpool. Their growth was jettisoned after independence without any provision of alternative avenues for gainful employment for the teeming million who are farmers. In Ghana and Ivory Coast, Cocoa and agricultural products were no longer regarded relevant but transient mining. The Wheat Farmers of Niger and Chad Republics as well as Malian authorities saw the advent of political independence as life more abundant. The effect of these neglects that keep people busy and which Track Two Diplomacy had warned against, is conflict and violence. Whatever the apparent cause of any riot, the real one is always (about) want of happiness" (Paine, cited by Abiodun Afolabi 2012:391). Afolabi is recalling the frightful farmers' conflict and violence in the old Western Region of Nigeria in the late 1960s after several unheeded warnings, and submits that personal ambition, fears, rivalry etc are usually not the motives impelling peasants to any severe anti-authority struggles, but that such wars are always fought for economic interests when the authorities ignore their pleas. Signals of chronic deprivation, rioting, brain drain or refugee-flow are some indices which Non-Governmental Organizations use in sounding timely warnings to Governments but such are often thrown into the dustbin. From the above,

> What appears fundamental is that popular agitation for the amelioration of the human condition had been an enduring phenomenon throughout the history of human kind… The material base and the economy portend instances of distortions or disarticulation that adversely affect the human condition. The instances of distortion include the increasing deterioration of the public health sector, rising unemployment, and the attendant rising social problems of insecurity and crime, increasing aberrations and dilapidation across the spectrum of publicly-owned formal education sector, capacity under-utilization in the manufacturing sector, and associated rising costs of living… Inter alia. (Ninalowo, cited in Olurode and Akinboye 2005:27).

Without much stress, Ninalowo is alluding to the danger inherent in complacency with which pre-conflict warnings are being handled by various governments which often lead to horrendous conflicts with dire consequences. One may then ask; if catastrophes in many political communities and the realization that it is best to deal with conflicts at the earliest stage compelled (the practitioners of Track Two Diplomacy to embark on early warnings, why are they often ignored? We may need to

peruse the strains and stresses confronting the practitioners of Track Two Diplomacy to unravel this pertinent question.

Strains And Stresses Of Track Two Diplomacy

Isaac Newton, (http://chemistry.about.com/od/mathsciencefundamentals/a/newtons-laws-of-motion.htm retrieved 26th April, 2013), while pontificating about the laws of motion, alluding to the vicissitudes of life, submitted that "for every action, there is an equal and opposite reaction". Though a Scientist, whose experiments are empirical, yet his views could be gleaned through those constraints inherent in human activities. This is because however strenuous an individual or a group of individuals could strive to assuage an impending catastrophe, characters benefiting from the impasse will serve as impediments to order to render innocuous the efforts of the peace builders for their own ascendancy. It is within this purview that we are discussing the strains and stresses of Track Two Diplomacy. Among the earliest constraints Track Two Diplomacy encounters relate to their sources of information. Irrespective of whatever expertise or experience at the disposal of the practitioners, authenticating their source, as well as the required level of signals to blow the lid for acceptability by the State Actors, is always a problem. Another issue constituting an impediment revolves around how whatever early warning eared will not be misconstrued. Besides that, despite the apolitical stance of the practitioners of Track Two Diplomacy, and irrespective of their intention for societal good, the fear of blowing the lid over an issue of vital public interest must be such that does not result in conflict escalation in view of those perceived vested interests.

For instance, in Nigeria, before and after independence, there were series of events that served as early warnings such as ethnic based riots, Cow Fulani/Hausa uprising in the Old Benue/Plateau State, religious based fundamentalism, especially in the Northern part of Nigeria and many other clashes in Southern Nigeria. The creation of a segregated settlement in Kano and Ibadan by the Colonial masters were early strong warning about the need for a clear policy on either homogeneity or heterogeneity. Before the Nigerian Civil War, Nigerians were warned by well placed individuals as well as organizations to avert electoral violence which could occur if subsequent elections were manipulated. Among these was Sir Francis Ibiam, who called a World Press Conference (Daily Times, (Nigeria), 1965, 21st Dec. p1, 8, 9) warning of the calamity awaiting Nigerians if his early warnings were ignored. He was called names and derisively named a false soothsayer. The result was the endless stress and strain manifesting in Nigeria's political, social, economic and cultural scenario.

Hear him: *"we are a divided people and therefore, may fall, and fall woefully, if we do not quickly see that we are drifting and put our house in order"*. What else do we, as a nation, require as a timely warning? He and several others sounded the warnings of the coming storm, but they were disdainfully derided. Events in Ghana, during the days of Kwame Nkrumah could not escape mention as they rattled the entire West African Sub-region because of the unique position the country occupies. Carnegie Communication (1997) alerts us that indicators of imminent violence include wide-spread human rights abuses, increasing brutal political oppression, inflammatory use of the media, amongst other indicators. These were firmly rooted in Nkrumah's Ghana but because of the constitutional cog – non-interference in the internal affairs of member states – inserted into the constitution of all member states, none could muster the courage to appeal to Nkrumah to soft pedal. He amended the constitution of Ghana through his proxies in Parliament to suit his whims and caprices. He abandoned the 2/3 majority for a simple majority when he began his repression. He abolished the Regional Assemblies and the Judicial Service Commission. He usurped the powers of the House of Chiefs as well as that of the Attorney General. He eliminated the guarantees for fundamental human rights, initially entrenched in Ghana's 1957 Constitution.

His regime introduced Preventive Detention Act which empowered him to detain suspects without

party state and was made President for life. The Press could not utter a word. *"The flow of news to the public was curbed, the press was censored, and some overseas press representatives were expelled. The Accra Anglican Bishop, Reseveare, was declared a prohibited immigrant in August 1962, although, he was allowed to return after three months"*. (Adekunle Ojelabi; 1970:293), Nkrumah went ahead to dismiss the Chief Justice of Ghana, (having been granted such powers at his prompting in 1964) for failing to condemn to death as charged by him some members of the opposition. University lecturers for raising voices of dissent were out rightly dismissed. The end result of these dastardly acts, which left many of his political opponents dead in detention, was the overthrow of his regime in 1966. Ghana, since then has been struggling to find its feet. The political climate of Guinea in the era of Sekou Toure had semblance with Ghana. Oppositions to his regime were brutally met with stern repression. For criticizing his government "the Roman Catholic Archbishop of Conakry, Gerard de Mille Vile was expelled in 1961 by Sekou Toure" (Adekunle Ojelabi 1970:302). The trials and condemnation of his political opponents especially, the erstwhile Secretary General of the Organization of African Unity, Diallo Telli, remains evergreen. The press could not speak, neither any warning sigh heeded by him, hence, his eventual overthrow, leaving behind him political and economic casualties.

In Cote de Ivoire, there were very conflicting accelerating indicators such as tribalism, political concept of Ivoirite as an instrument of persecution, and religious cleaverage which were largely not taken into account until the emergence of Laurent Gbagbo and Alassane Quattara acrimonious political contests. What ought to have been nipped in the bud during the long stay in office of Felix Houphouet-Boigny was allowed to germinate, leading to loss of human and material resources, besides its impact on the democratic institution. There is hardly any West African state that did not have symptoms of what are confronting them these days but the fear of various governments dealing with them either tactically or strategically, drove them to silence. It is the fear of the unknown, whereby a liberator becomes a villain that compels scholars to submit that

> one has to overcome the analytical problem of avoiding misperception or other faulty analysis of: the likelihood of diffusion and/or escalation of the conflict; the impact on interests; and the potential risk and the social, economic, military and political costs of both action and in action. (Jentleson, 1996;219). We are admonished to always give a second thought to any pre-conflict information received with a view to separating the grains form the chaff.

Be that as it may, another constraint that elicits strain and stress is in a situation where adequate data is made available but owing to either the absence of political will among governments, or a raging situation which overshadows the issue over which early warning is raised, action could not be taken to forestall the envisaged repercussions. Further, another issue is located in the vested interest that government may have, especially political considerate before acting. In Nigeria, enough pre-conflict religious uprisings were given which government could have used to stem the tide until it resulted into terrorism, such as napping any suspected individual but the absence of political will had the upper hand. Yet, elsewhere in Africa, particularly in Rwanda, often described as the worst humanitarian tragedy, the Democratic Republic of Congo as well as Somalia, early warnings were never lacked but yet, the countries were ravaged with violence, indicating the effect of procrastination. The international bodies cried out early enough but yet, the incapacity for quick response by those governments to early warnings was another disservice to the activities of Track Two experts.

Without any pinch of salt, Track Two practitioners are typically humanitarian as they are renowned for bringing humanistic instincts to diplomacy in their activities, besides daring exploits in the nooks and crannies of any State or Community. However, we need to examine those areas where they are quite successful in the performance of their duties and where they are vulnerable as there are always *two sides to a coin*.

Success And Challenges Of Track Two

Conflict situations are quite dynamic as changes happen, often quite rapidly. Many Non-Governmental Organizations, in view of their deep knowledge of issues in a state or community, provide quick and essential alert on situations considered inimical to any society as well as pushing out any signal that a situation, hitherto considered a non-issue, seems to be getting out of hand. They interact with ease among contending parties without raising suspicion, through which they attract confidence to themselves. Track Two practitioners have been providing humanitarian assistance and protection in conflict or war zones, despite the high risk involved. They have served as main sources of information from which the international communities receive their view in many conflict zones where the international institutions are either procrastinating or are having no link at all. During the Nigerian Civil War of 1967-1970, the International Red Cross and the Caritas Organization were very active Track Two Practitioners, providing relief in form of food, medicine, and succor for war victims, especially, on the Biafran side. In Liberia and Sierra – Leone, the horrendous situation within the war zones were made known to the international community by the irrepressible Track Two Practitioners.

The Liberian War Lord, Charles Tailor, whose propensity for generating and enhancing conflict knew no bound, was shaken to his marrow when he realized that the Track Two practitioners in his country were in possession of vital information with which he intended perpetuating his holocaust. Realizing that the cat was out of the bag, not only did Charles Taylor disorganize the Non Government Organizations in his country, he simply condemned to death by firing squad two Nigerian Journalists on that account. Indeed the disruption of normal NGO operations is itself an early warning signal that conditions are deteriorating dangerously, a signal that governments often miss. (Carnagie, 1997). The level of information made available to the international community during the intra-state political turmoil in the then Belgian Congo in the early sixties was what the UN troops, which come in rather late (on account of Cold War Squabbles), made use of to begin their peace keeping operations, the first on the soil of Africa.

However, if it is true that certain deficiencies captured in Track One Diplomacy made Track Two and other Tracks inevitable, it does not follow that Track One Diplomacy, which embodies political decision makers, should be rendered innocuous. Indeed, the activities of all other Tracks are subject to the policies put in place by Track One Diplomacy. That is why it is argued from the perspective of multi-track diplomacy that they combine for the overall good and happiness of the state and her indigenes. From this preamble, the NGOs' task would be seen done once necessary measures are made available to governments, while they revert to their humanitarian services. The reasons for this measure are that Governments and Trans-Governmental Organizations have unfettered access to political and diplomatic instruments for conflict prevention. Besides, the already set out systems of information gathering to keep the governments abreast of any development within seconds, are in place. These tools include state security service, military intelligence and other issues of expediency available to governments. It is not a novelty for government to set up print and electronic media for information gathering. A major problem confronting various governments in acting in time on early warnings received is the fear of misperception which the international community may entertain about such country. The concern of ban travels or relocation order by foreign governments to their nationals are part of the fears. Every where things are going wrong, foreign countries will continue to protect their nationals as they have imbibed the culture of listening to strong NGO warnings about certain developments in any state, which they often take as the gospel truth as the USA did on terrorism and religious fundamentalism in Nigeria, Afghanistan, Pakistan etc recently.

When in 1998, General Sanni Abacha ordered the execution of Ken Saro Wiwa and Ogoni Nine due to their longstanding insistence for government attention on environmental degradation in Ogoni land, the Nigeria Foreign Affair Minister, Tom Ikimi, pretended such a horrendous act ever took

place. It was not until the facts of the execution were shown to him and was ordered out of the conference before he knew the implication of taking lightly, early warnings. There had been early warnings about environmental problem in Ogoni land by local and international organizations for decades but unheeded. Being a diplomat under whose control the Foreign Ministry was, he could not have said anything less. This boils down to the fact that "for foreign service officers, the bureaucratic disincentives are arguably even greater. Because of uncertainty, they often adopt the stance that it is far better to wait and see. (Krumm, 2000). This is why Governments always find issuing timely warnings ahead beyond a few days difficult despite the fact that early warnings require the ability to foresee trouble early enough and steps taken to forestall it.

Conclusion

This paper has highlighted the significance of Track Two Diplomacy and early warning in conflict prevention and amelioration, particularly in the West African sub-region. The recalcitrance of various state governments notwithstanding, the ceaseless activities of the non-governmental organizations in achieving early warning of growing tensions, with violent escalation potentialities, remain commendable. We have equally made it known that while exposing areas of latent and smoldering conflicts are humanely pursued by the Track Two practitioners, creating an enabling environment for nipping in the bud any conflict therein remains that of the political decision makers. Inability to act on information received for various reasons, ranging from an absence of political will, undue prevarication, national interest and ego, among others, were equally highlighted. Consequent upon these views, the following recommendations are proffered.

Recommendations

1. Various governments in the West African sub-region should pay greater attention to early warnings as it is cheaper to dowse tension than spending a fortune on relief materials.
2. There must be co-ordination and co-operation between the Non-Government Organizations and Trans-Governmental Organizations for a holistic and timely review of any early warning on ground. This will aid government's acceptability and quick response.
3. State Actors could also collaborate with Non-Governmental Organizations as part of confidence building between the two. Accusation of doubt or wolf-crying, to the detriment of the governed, will be removed.
4. Unheeded early warnings by various governments in West Africa have encouraged cow-boy style of governance whereby respect is no longer accorded democratic institutions. Those in government should eschew corruption; ensure accountability, and transparency which will aid sustainable development.

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Impact of magnetized water on elements contents in plants seeds

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Abstract:
In this work a study of elements concentration in seeds of onion, sunflower and tomato plants growth irrigated with magnetized water compared to plant growth with non-magnetically treated water (normal water) in open land at winter season were determined. The elements Calcium,Potassium,Iron, and Zinc concentration in the seeds were measured using an Induced Coupled Plasma (ICP) spectrometer.Cropscontents of the plants were irrigated with magnetized water exhibited remarkable increases in elements concentration compared to cropsusing normal water, in addition to the increasing of products at harvest. The statistical assessment was judged using t-test and Eigenvalue indicates noticeably increasing of elements concentration in plants yields improvement quality using a static magnetic field.

Keywords: Static magnetic, water, elements, plants seeds, ICP-spectroscopy.

1. Introduction:

The water molecule consists of hydrogen and oxygen atoms are partly positive and partly negative that forming by weak attraction allowing to the formation of hydrogen bonds. The magnetic and electrical fields are extremely affected in liquid water through hydrogen bond that changes some physical and chemical properties of magnetic water, Samir.H.Nasher, (2008). The magnetic field on ion of positive charge will create magnetic force and move in the direction relative to the right hand rule of Lorantz, while the negative charge particle moved in the opposite direction Ameret al, (2006)). The motion in the direction of water molecules charges will increasing the velocity of the particles that create more collisions between the particlesM. Gholizadeh,et al (2008).The magnetic field is increased the strength of hydrogen bond,which leads to increasing in the refractive index. The weak magnetic field (15 mT) cause effect on tight bond of water molecules due to weakening of van der Waals bonding between water molecules, which reduces the thermal motion and generating dampening force relative to charges. Calcium is positively charge ions moved in the direction relative to right hand rule, which presents in natural water and responsible for permanent and temporary hardness, H. Banejad et al,(2009). These elements (Ca, K, Fe, and Zn) under study are positive charges elements and positive ions (cations).

Magnetic field is effecting potentially on water, which is subject of interesting for many applicationKai-Tai Changa, (2006). Currently, magnetized water is used to increased plant yields Lin &Yotvat, (1990), many benefits of human health and change in pH of the water Busche, (1985) (Basant L. Maheshwari, (2009),L. Kordas, (2002).The magnetic water treatment can improve acceleration of seeds metabolism and increased yield parameter of the crops; such as cereal sunflower and soybean Aladjadjiyan and Ylieve, (2003) , Özalpan et al., (1999), Yurttas et al., (1999) and Oldacay, (2002), M. RÃCUCIU1(2008). The influence of magnetic field was applied to the effect on seed and plant growth and that investigated by N.Hirota.et al (1999), which differences in germination of the plant. Recently, the research on plants growths were improved with seeds treatment using a magnetic field. Therefore, bipolar magnetized water treatment with north and south poles is affecting the plant production, O. Sadeghipour, P. Aghaei, (2013).
The experiments and investigation are explained that the magnetic treatment effect on the plant growth and increasing the seeds production depends on the time of exposure and strength of magnetic field. However, the magnetic field strength of 62 mT and 250 mT has shown significant difference in the effect on plant growth Odhiambo et al, (2009) ,Vashisth & Nagarajan, (2010). In the main time, the time exposure of 15 s and 24 hours investigation is reflected large variation effect on plant growth and quality improvement on seeds production, Muszinski et al.(2009) to 24 hours, Martinez et al., (2009), Mihaela, Răcuciu, (2011). The plant treatment with magnetic field has shown increasing in the germination of plant and improves the quality of seeds, Pietruszewski et al., (2007), Abdul R.H. Subber, et al, (2012), AhmadGholami1,et al, (2010).
The production of plants in foods quality is depending on minerals and trace elements to be enhanced in the seeds, Anna Aladjadjiyan**,**(2012). However the elements in human tissues are transferred to the body from foods used, which affects significantly by irrigation water and soil of the plant and groundwater basin and drinking water.

Consequently, some heavy elements such as iron, zinc, copper and manganese are very important in human tissues and all living organisms role of animal and human nutrition, which essentials micronutrients of various biochemical functions of the bodies, Hemn Othman Salih, (2013). However, the main source of heavy metals that is important to enhanced health growth of a human body and essentially for micronutrients requirement is seeds used in human foods, A.Liopa-Tsakalidi,et al (2011). The majority of seeds contents are good source of mineral elements such as

potassium, sodium, magnesium and calcium,Ajayi (2008), Samir.H.Nasher,(2008). Accordingly, the development of metals in seeds contents and investigation of the growths of these metals in seeds from mineral elements in the soil are essential for developing foods production, Kranner and Colville (2011), Gholamabbas Shams1, et al ,(2013), Dimitrios J. Bilalis, et al ,(2013).

2. **Materials and Methods**:

The experiment was arranged in an agriculture area in center of Sudan at White Nile agriculture area in double lands similar in dimension of 24 meters squares. Soil of the land was organized typical to method of planting techniques. Three types of plants were used for this application in the same duration. The irrigation of the experiment was continued at adequate water amount quantities for all types for magnetized water and normal water during plants growth. The water was flowed in PVC tube of inner diameter of 4 inch and radial static magnetic field of 250 mT used in this experiment. The duration period of irrigation between 55 and 60 minutes times to control the amount of water that used for irrigation of plants irrigated with normal and magnetic water with the same follow rate.

The experiment was applied in agriculture area still traditional agricultural system used for irrigation schedules. These plants under experiment are usually important for production of sunflower, onion and tomato in the area, which are irradiated from the White Nile. The period of this experiment was carried out in winter season from November to February that favorable weather condition in four months duration. Small area of farms was prepared using traditional land texture preparation technique in an open land area. The seeds of the three types of experiments were used for planting that produced by the local farmers.

The Induced Couple Plasma analytical methods are sensitive technique for trace elements determination prepared in soluble form relative to standard sample preparation procedure. The inductive couple plasma spectrometer was used to determining element Ca, Fe, K, and Zn in three types of seeds onion, sunflower and tomato. Sample was sprayed into ICP in aerosol form and the high temperature excites the atoms that produces ionic emission spectra can be detected as characteristics of atoms emission. The seeds samples of onion, sunflower and tomato were dry and grinded manual with grinder and the dry powder samples were added to normal HNO_3 acid.The solution of 2 % weight per volume of nitric acid and hydrogen peroxide (H_2O_2) was added to the sample and deionized water and then diluted solution filtered as stock solution, which can be injected directly in ICP spectrometer, UmranHicsonmez,et al,(2012), Kent W. Smothers,et al,(2001).

3.1 Result and discussion:

The results of elements concentration in seeds of the plants irrigated with magnetized water and the same plants in similar condition treated with normal water as control samples is used for comparative assessment.

Ca and Fe average contents in seeds of sunflower, tomato and onion are displayed in the figure (1) and figure (2) shows the increasing of concentration of plants irrigated with magnetized water (M.Onion, M.Sun.flio, M.Tomato) compared to normal water (Onion, Sunflow, Tamato) . The variation in seeds elements levels are demonstrated in the graphs shows highly enhancement of the crop products, which is encouraged by applying magnetic field to the irrigated water.

The results in figures (3) and (4) have shown that K and Zn concentration in sunflower, tomato and onion irrigated with magnetized water are highly riches with elements contents compared to normal water irrigation. The data can be seen in figure (5) is exhibiting significant difference percentage of

elements of the three plants products, which areirrigated with magnetized water above the concentration of seeds using normal water.

Metals concentrations in sunflower, tomato and onion were assessed using statistical data via various methods such as t-test, principal component analysis, communalities and Eigen value.

In tables (1) and (2) exhibits Ca and Fe statistical value are showed the t-test, communalities and principal component extraction method and eigenvalues reveal significant differences between evaluation of products irrigated with magnetic water and normal water. The calculation of t-test, initial Eigenvalues of the total and the percent of variance indicates different values of Ca and Fe in seeds irrigated with normal water compared to magnetic water. In addition to communalities extractions values associated with both elements between plants were irrigated with magnetized water reveal lower value compared to normal water, while Ca is differed in sunflower.

Tables (3) and (4) presents the statistical assessment of K and Zn concentrations in seeds under study that are included t-test, communalities extractions and principal component extraction method, initial Eigenvalues respectively. The results are showed the major difference of values in corps irrigated with normal water than that irrigated with magnetized water, while the communalities values are exhibited highly significant extraction for both elements. The communalities extraction for the elements under investigation Ca, Fe, K and Zn are showed lower values in tomato irrigated with magnetized water.

3.2 Conclusion:

The measurement of elements contents in plants irrigated with magnetized water has greatly affective effects on seeds product compared to normal water irrigation. The enrichment of Calcium, Iron, Potassium and Zincin seeds of plants irrigated with magnetized water reveals significant increasing in production quality compared to irrigation using normal water.The conclusion one can draw from data using t-test, communalities extractions and initial Eigenvalues are highly increasing in metals concentration of plants production and steadiness of increasing inseeds quality enhanced with static magnetic field. The data are evaluated using comprehensive analysis of the elements concentration, which is conformed an improvement ofminerals and trace elements in foods qualityof the plants.

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Fig.(1) Average Ca concentration in plants using magentic water and normal water

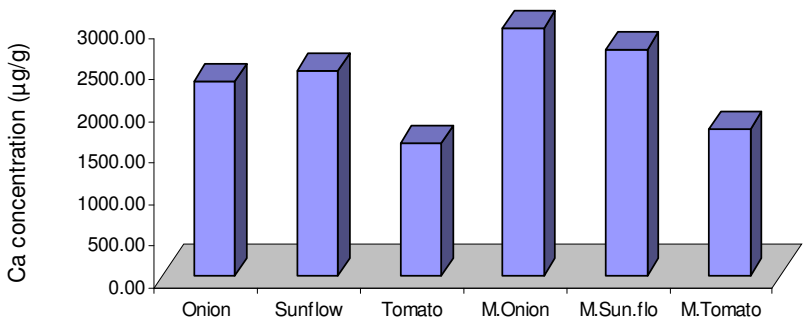

Fig.(2) Average Fe conceentration in plants using magentic water and normal water

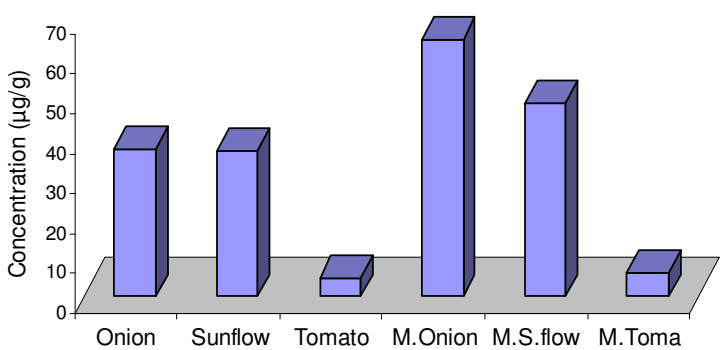

Fig.(3) Average K conceentration in plants using magentic water and normal water

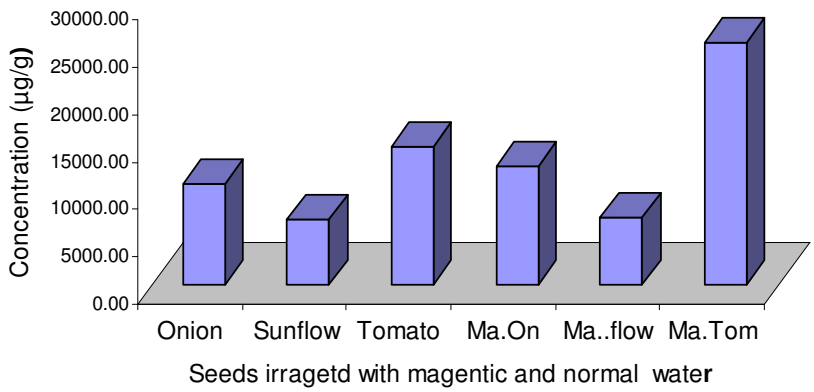

Fig.(4) Average Zn conceentration in plants using magentic water and normal wate

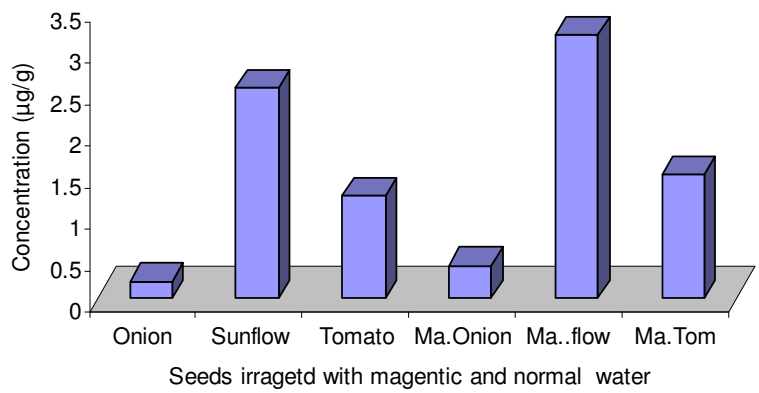

Fig.(5) The difference in elements concentration between plants irregated with magentic and normal water

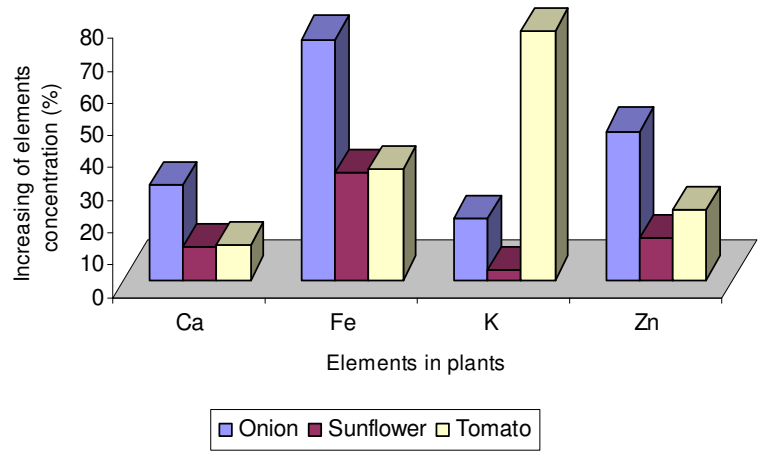

Table (1) Calcium statistical evaluation in seeds plants concentration.

Element, Calcium	Component	t (value)	Communalities	Initial	Eigenvalues
Plants			Extraction	Total	% of Variance
Onion	1	53.647	.887	2.114	35.234
Sunflower	2	24.600	.599	1.315	21.921
Tomato	3	66.450	.927	1.074	17.899
Onion (magnetize water)	4	40.971	.797	.801	13.352
Sunflower (magnetize water)	5	18.137	.626	.535	8.912
Tomato(magnetize water)	6	15.989	.667	.161	2.682

Table (2) Iron evaluation statistical evaluation in seeds plants concentration.

Element, Iron	Component	t (value)	Communalities	Initial	Eigenvalues
Plants			Extraction	Total	% of Variance
Onion	1	28.257	.877	1.720	28.673
Sunflower	2	20.688	.721	1.238	20.634
Tomato	3	31.890	.626	1.122	18.706
Onion (magnetize water)	4	53.360	.782	.844	14.073
Sunflower (magnetize water)	5	14.333	.720	.734	12.225
Tomato(magnetize water)	6	51.096	.355	.341	5.689

Table (3) Potassium evaluation statistical evaluation in seeds plants concentration.

Element,Potassium	Component	t (value)	Communalities	Initial	Eigenvalues
Plants			Extraction	Total	% of Variance
Onion	1	131.414	.636	1.644	27.408
Sunflower	2	23.239	.731	1.275	21.256
Tomato	3	81.396	.741	1.112	18.528
Onion (magnetize water)	4	104.893	.744	.966	16.104
Sunflower (magnetize water)	5	21.767	.752	.619	10.319
Tomato(magnetize water)	6	16.380	.427	.383	6.385

Table (4) Zinc evaluation statistical evaluation in seeds plants concentration.

Element ,Zinc Plants	Component	t(value)	Communalities Extraction	Initial Eigenvalues Total	% of Variance
Onion	1	37.000	.747	2.183	36.388
Sunflower	2	17.095	.844	1.176	19.594
Tomato	3	45.997	.700	1.166	19.428
Onion (magnetize water)	4	5.831	.870	.776	12.935
Sunflower (magnetize water)	5	16.878	.698	.493	8.218
Tomato(magnetize water	6	33.875	.667	.206	3.436

COMPARISON OF THE ACOUSTIC PROVISIONS IN THE NATIONAL BUILDING CODE WITH THE ACOUSTIC BUILDING CODES OF SOME SELECTED COUNTRIES

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Abstract

There are three problems that this present generation has to find solution to: Poverty, Population and Pollution. Industrialisation and urbanisation have taken the problems of noise pollution to an unprecedented catastrophic level both in the developed and the developing nations of the modern world. While the advanced countries have taken some legislative measures in the form of Acoustics Building Codes to control the problem of noise and its attendant effects, developing nations like Nigeria may not have fared well in this regards. This paper, therefore, is an attempt to compare the building codes in some selected countries of the world with emphasis on the acoustics regulations of the building codes. The countries include: the United Kingdom, United States of America, New Zealand, Australia and Nigeria. The building codes of these nations will be compared with that of Nigeria in terms of acoustics regulatory provisions.

Keywords: Acoustics, Noise Control, Pollution, Building Code, Nigeria

Introduction

A building code, according to Wordnet 3.0, is a set of standards established and enforced by local governments for the structural safety of buildings. Farlex (2011) defined building code as 'systematic statement of a body of rules that govern and constrain the design, construction, alteration, and repair of buildings'. The essence of building codes are for the protection of public health, safety and general welfare of the occupants of buildings and non-building structures. The codes are meant to proffer lasting solutions to the hazardous trends in the building industry. These problems might have resulted from planlessness of the built environment, use of non-professionals, use of substandard materials, insufficient referenced design standard for professional and lack of adequate regulations and sanctions against offenders (Toluhi, 2009). The resulting effects of these problems include frequent buildings collapse, fire outbreaks, environmental pollution and other disasters.

Noise can be defined as an unwanted sound and acoustics as the science of sound in general. However, acoustics is more commonly and technically used to describe the special branch of that science of sound. Architectural acoustics, however, deals with the science of sound as it pertains to buildings. The three major branches of architectural acoustics are: 1. Room acoustic which deals with the design of the interior of buildings for appropriate levels and qualities for music and speech; 2. Noise control or management which involves the reduction and control of noise between noise source and a listener; and 3. Sound reinforcement and enhancement systems which involve the use of electronic equipment to improve the quality of sounds heard in rooms.

The nuisance of noise is regarded as a health and safety issue for persons living in dwellings and all occupants of a dwelling should be allowed to follow normal domestic activities, including sleep and rest, without threat to their health from noise. Noise is transmitted in buildings by both airborne and impact sound sources, hence, both of these noise types should be controlled. Practical guidelines to ensure this should be provided in the relevant section of the building codes of every country. Sound insulation, in general terms, is the prevention of airborne and impact sound being transmitted from one part of the building to another through separating floors, ceilings or/and walls.

Statement of the Research Problem

The current patterns of urbanization and human activities have led to environmental degradation, and have created serious threat to continuous human existence (George, 2008). The rate of urbanization and industrialisation of the urban cities with its attendant high level of noise pollution is affecting the quality of life in the built environment. Hence, there is need to evaluate the adequacy of the provisions of the national building code with respect to noise control by comparing its provisions with that of some selected countries.

Research Aim

The aim of this study is to compare the Acoustic Building Codes of some selected countries with the acoustic provisions of the National Building Code of Nigeria with a view to identify areas of improvement required in the National Building Code for the betterment of the built environment.

Research Objectives

To achieve this aim, the following objectives have been set out; to:

i. review the Acoustic Building Codes of some selected countries,
ii. review the National Building Code of Nigeria, and
iii. compare the provisions for noise regulations in the national building code with the provisions in the acoustic building codes of these selected countries.

Scope of the Study

The scope of the research is limited to acoustic related issues in the selected building codes. Hence, only issues related to noise control and regulations in these codes shall be reviewed with a view to draw comparison with that of the national building code.

Research METHODOLOGY

The research method adopted for this study is essentially literature review and analysis of secondary data collected through internet surfing and relevant literatures. The selected countries are New Zealand, England, United States of America and Australia. The codes of these countries were selected based on their advancement in legislative matters, especially in areas of noise control.

Research Questions

This research intends to provide answers to the following questions:

i. What do the building codes of these selected countries specify with regards to acoustics?
ii. Do these building codes have provisions for noise control and regulations?
iii. How does the National Building Code of Nigeria compare with other building codes in terms of acoustics provisions?

Acoustics Building Codes of Selected Countries

Building Code of New Zealand

Introduction: The Building Code of New Zealand is a schedule to the building regulation, 1992 (Consumer Build, n.d.). The code is a performance-based code. It sets out performance standard that

building work must meet, and covers aspects such as structural stability, fire safety, access, moisture control, durability, services and facilities. The Building Code consists of two preliminary clauses and 35 technical clauses. Each technical clause contains:

1. Objective - The social objective that completed building work must achieve
2. Functional requirement - What the completed building work must do to satisfy the social objective
3. Performance criteria - Qualitative or quantitative criteria which nominates how far the completed building work must go in order to comply (Whare, 2006).

The Requirements: The section of the New Zealand Building Code that deals with acoustics is clause G6 under the title "Airborne and Impact Sound". It is aimed at safeguarding people from illness or loss of amnesty as a result of undue noise being transmitted between abutting occupancies or common spaces to habitable spaces of household units. It requires separating wall, floor and ceiling elements to have a sound transmission class (STC) of not less than 55 dB and the floors must have an impact insulation class (IIC) rating of not less than 55.

According to Clause G6/VM1, the performance of the airborne sound in the building code may be verified in accordance with ASTM E 336 (measurement) and ASTM E 413 (rating) while the performance for the impact sound insulation may be verified using the International Organization for Standardization ISO 140: Part VII (measurement) and ASTM E 989 (rating).

Verification Method G6/VM1 states that field (F) test results shall be within 5 dB of the performance requirements, and the general market interpretation of this is that onsite measurements of field sound transmission class (FSTC) 50 and FIIC 50 satisfy the requirements of the Building Code.

The provisions of this code are limited to habitable spaces within apartments intended for permanent living and do not apply to non-habitable spaces, temporary accommodation, offices and external or environmental sound.

England and Wales Acoustic Code Requirements
The section that deals with acoustics regulation for United Kingdom is given within the approved do**c**ument, Part E, under "Resistance to the passage of sound (England and Wales) 2003" which require that both airborne and impact sound sources were controlled (Building Regulations, 2010).

The Part E of the code focussed on four major areas:

- E1: Protection against sound from other parts of the building and adjoining buildings
- E2: Protection against sound within a dwelling house
- E3: Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes
- E4: Acoustic conditions in schools.

To ensure compliance, there are two routes:

1. **Robust Details** for new buildings which require no pre-completion testing. It is designed to achieve higher sound insulation standards than the minimum requirements in Part E. Each approved Robust Detail contains a checklist which must be completed on site. This is a quality

control check to confirm that all the critical factors that affect sound performance have been built correctly.

2. **Pre-completion Testing** for all new buildings, refurbishment, remedial and extension work in buildings with rooms for residential purposes. Part E of the building code calls for pre-completion testing of separating walls and floors before handover to ensure that the level of performance specified is being achieved. The tests are to be performed on a minimum of one in every ten dwellings of the same type before completion and to meet the standards of ISO 140 series.

United States of America Acoustics Building Code

Introduction: The noise regulations in U. S. A. were established in 1972 under the United States Noise Control Act. After the passage of the act, the United States Environmental Protection Agency (EPA) promulgated regulations setting maximum noise limits in a gamut of motor vehicles, industrial machinery and household appliances.

State and Local Planning: States passed two different types of legislation starting in the 1970s, echoing the Federal lead in noise control. Many states began requiring each municipality and county to have a Noise Element of the General Plan, a substantial noise data base and blueprint for making land use decisions in that jurisdiction. The Noise Element became an integral part of the municipal or county General Plan, especially in California. The Noise Element further states goals for each land use class and even numerical planning standards in order to evaluate future development proposals with regards to noise pollution.

Portland, Oregon continues to innovate through their almost 35years old Noise Control Office at the City's Bureau of Development Services. Today, their code is still one of the only comprehensive codes in the USA that not only regulates based on a given decibel level, but also includes sound limitations based on the specific pitch or frequency of the given noise.

Local Noise Ordinances: This is principally aimed at construction noise, power equipment of individuals and unmuffled industrial noise penetrating residential areas. Thousands of USA cities have prepared noise ordinances that give noise control officers and police the power to investigate noise complaints and enforcement power to abate the offending noise source, through shutdowns and fines. In the 1970's and 1980's, there was even a professional association for noise enforcement officers called "National Association of Noise Control Officials" (NANCO). Today, only a handful of properly trained Noise Control Officers remain in the United States.

A typical noise ordinance sets forth clear definitions of acoustic nomenclature and defines categories of noise generation; then numerical standards are established, so that enforcement personnel can take the necessary steps of warnings, fines or other municipal police power to rectify unacceptable noise generation. Ordinances have achieved certain successes but they can be thorny to implement.

USA Acoustic Code Requirements: In the case of construction of new (or remodelled) apartment, condominiums, hospitals and hotels, many US states and cities have stringent building codes with requirements of acoustical analysis, in order to protect building occupants from : (a) exterior noise sources and, (b) sound generated within the building itself.

Exterior Noise: With regards to exterior noise, the codes usually require measurement of the exterior acoustical environment in order to determine the performance standard required for exterior building skin design. The architect can work to arrive at the best cost effective means of creating a quiet interior (normally 45dBA). The most important elements of design of the building skin are

usually: glazing (glass thickness, double pane design, etc.), roof materials, caulking standards, chimney baffles, exterior door design, mail slots, attic ventilation ports and mounting of through the wall air conditioners. A special case of building skin design arises in the case of aircraft noise, where the FAA has funded extensive work in residential retrofit.

Interior Noise: Regarding noise generated inside the building, there are two principal types of transmission. Firstly, airborne sound travels through walls or floor/ceiling assemblies and can emanate from either human activities (e. g. voice, amplified sound systems or animal noise) in adjacent living spaces or from mechanical noise (e. g. elevator systems, boilers, refrigeration or air conditioning systems, generators, and trash compactors) within the building systems. The principle of regulation requires the wall or ceiling assembly to meet certain performance standards (Sound Transmission Class of 50), which allows considerable attenuation of the sound level reaching occupants.

The second type of interior sound is called Impact Insulation Class (IIC) transmission. This effect arises not from airborne transmission, but from transmission of sound through the building itself. The most perception of IIC noise is from footfall of occupants in living spaces above. Commonly a performance standard of IIC equal to 50 is specified in building codes.

Occupational Regulations: The U.S. Occupational Safety and Health Administration has established maximum noise levels for occupational exposure, beyond which mitigation measures or personal protective equipment is required. Noise Criteria (NC) are noise level guidelines applicable to cinema and home cinema. It is a measure of a room's ambient noise level at various frequencies. For example, in order for a theatre to be THX (Tomlinson Holman's eXperiment) certified, it must have an ambient sound level of NC-30 or less.

Building Code of Australia

Introduction: The Building Code of Australia (BCA) is the national technical document which sets the standards for building work in Australia. The Building Code of Australia is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government and State and Territory Governments. The Australian Building Codes Board (ABCB) which was inaugurated on 1st of March, 1994 and reaffirmed by ministers in July, 2001, is a joint initiative of all levels of Australian Government and includes representatives from the building industry (Planning in South Australia, 2011). The Building Code of Australia (BCA) which came into effect from 1st of May, 2004 in most parts of Australia requires that building elements have certain levels of insulation from airborne and impact sound.

The requirements of the Code: The Building Code of Australia (BCA) requires that the acoustic performance of a construction system (Rw) and correction factor relating lower to medium frequency noise (Rw + Ctr) should be determined in accordance with AS/NZS 1276.1 using results from laboratory measurements. The Code classifications for acoustic performance are categorized based on the building type as Class 1, Class 2 or Class 3, etc.

Class 1 buildings include single dwellings that do not have another dwelling above or below it, such as a stand-alone house or a row of townhouses. Class 2 buildings include buildings that contain two or more sole-occupancy units, such as an apartment unit. Class 3 buildings include residential buildings that contain a number of unrelated persons, such as a guest house or the residential part of a school, hotel, etc.

Table 1: Type of noise source grouped by corresponding correction factor

Correction Factor	Type of Noise Source
C	Living activities (talking, music, radio, TV) Railway traffic at high speeds Highway road traffic (>80km/h) Jet aircraft at short distance High and medium frequency factory noise
C_{tr}	Urban road traffic Railway traffic at low speeds Propeller driven aircraft Jet aircraft at large distance Low and medium frequency factory noise

Source: Sound Transformation Information, 2010

The Code requires common walls separating building units to have an Rw + Ctr of not less than 50. In addition, the construction must be discontinuous, if the wall separates a habitable room (living room, dining room, bedroom, study and the like) from a wet room (kitchen, bathroom, sanitary compartment or laundry). Discontinuous construction requires:

- A minimum 20mm cavity between two separate leaves
- Resilient wall ties such as those provided by Matrix Industries, if the wall is masonry, and
- No mechanical linkage if the walls are not masonry.

The weighted sound reduction index (Rw) describes the acoustic performance of a construction system. It is a single number quantity for the airborne sound insulation rating of building elements. As the acoustic performance of a material or construction improves, the higher the Rw value will be. This means that certain sound performance levels for different building situations are specified. Rw ratings are determined by laboratory tests of a specimen of the construction system.

Correction factors (C and Ctr) can be added to Rw to take into account the characteristics of particular sound spectra and indicate the performance drop of the wall in the corresponding sound frequency range. The factor C relates to mainly mid to high frequency noise, whilst Ctr relates to lower to medium frequency noise. Some typical noises have been grouped by their corresponding correction factor as shown in the table 1.

National Building Code, Nigeria

Introduction: The National Building Code is a document evolved to proffer lasting solution to the hazardous trends in the Nigeria building industry. The code was promulgated and signed into law on 25th January, 2007 (Toluhi, 2009; Oresegun, 2010, p. 2-3). The section 6 of the Code is titled 'Environmental Requirements' and is meant to 'govern the means of light, ventilation and sound transmission control required in all buildings intended for human occupancy'.

Sound Transmission Control: The sub-section 6.2.11 is dedicated to sound transmission control in residential buildings whose scope apply 'to all common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units or between a dwelling unit and adjacent public areas

such as halls, corridors, stairs or service areas in all buildings of Use Group H'. The section considered both the air-borne noise and structure borne noise.

a. Airborne Noise: The Code required that walls, partitions and floor/ceiling assemblies separating dwelling units from each other or from public or service areas shall have a sound transmission class (STC) of not less than 45 for airborne noise when tested in accordance with ASTM E90. This requirement shall not apply to dwelling unit entrance doors, but such doors shall be tight-fitting to the frame and sill.

b. Structure borne Noise: The Code required floor/ceiling assemblies between dwelling units and between a dwelling unit and a public or service area within the structure to have an impact insulation class (IIC) rating of not less than 45 when tested in accordance with ASTM E492.

Acceptable Noise Level: As preventive measure, the Code recommended the following daily maximum exposure to noise to avoid any hearing damage.

Table 3: Recommended maximum daily exposure to noise.

SOUND PRESSURE LEVEL (dBA)	MAX.EXPOSURE IN ANY 24 HOURS
85 or less	24 hours
87	16 hours
90	8 hours
93	4 hours
96	2 hours
99	1 hour
102	30 minutes
105	14 minutes
108	71/2 minutes
110	3-3/4 minutes

Source: Nigerian Building Code, 2007

Summary of Findings

Table 4 show the summary of findings of the (acoustic) building codes of the selected countries.

Table 4: Summary of findings of the (Acoustic) Building Codes of the Selected Countries

Country	Code Title & Year	Section & Section Title	Noise Types	Requirements	Verification /Compliance
New Zealand	New-Zealand Building Code	Clause G6, "Airborne and Impact Sound"	Airborne and Impact Sound	STC $\geq$ 55dB IIC $\geq$ 55.	ASTM E 336 Within 5dB ISO 140: Part VII, ASTM E 989
England	Acoustics Regulation for United Kingdom, 2003	Part E, under "Resistance to the passage of sound	Airborne and Impact Sound		ISO 140 series

United States of America	United States Noise Control Act, 1972		Exterior Noise Interior Noise	45dBA STC = 50 IIC = 50	THX certified, sound level of NC-30 or less.
Australia	Building Code of Australia, May, 2004		Airborne and Impact sound	Rw + Ctr ≥50 Rw ≥ 50	AS/NZS 1276.1
Nigeria	Nigerian Building Code, 2007	Chapter 9.2.12 Sound Transmission Control in Residential Buildings	Airborne Noise Structure Borne Noise	STC ≥ 45 IIC ≥ 45	ASTM E90 ASTM E492

Source: Researcher, 2011.

Recommendations

After the review of the selected acoustic building codes, the following recommendations are suggested for improvement of the national building code of Nigeria:

1. That the noise sources are better categorised as internal noise and external noise sources for easy understanding of the people, taking after that of the United States of America.
2. That the code should include practical and pragmatic means of measuring and verifying compliance with the specifications of the code.
3. That the code should specify punitive measures for violating the noise limits set in the code and ways of enforcing them as contained in the code of the United State of America.
4. That there is need to form and fund noise enforcement agents and associations.

Conclusion

The National Building Code of Nigeria can relatively be compared with other building codes around the world in terms of acoustics regulations. However, the provisions are not written in language that is comprehensible to a common man for easy compliance. The study revealed that the level of compliance with the provisions in the building code is very low and that there is no provision to enforce compliance.

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FACTORS AFFECTING MOTIVATION AND ACADEMIC EXPECTATIONS, ASPIRATIONS OF STUDENTS IN SECONDARY SCHOOLS: LAIKIPIA – WEST DISTRICT, LAIKIPIA COUNTY, KENYA

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ABSTRACT

The gap in gender enrolment and academic performance between boys and girls in secondary schools has been widening in the society. Girls and boys face challenges in their academic work which affects their self esteem, academic self concept and motivation. This study sought to find out the effects of motivation in girls' and boys' academic performance at Kenya Certificate of Secondary Education examination in Laikipia- West district in Laikipia County. The study adopted a survey research design. The population included 5206 students in the 18 public secondary schools. A random sample of 349 students (including 194 boys and 155 girls) and 18 school principals was drawn from 18 schools. Data was collected using two sets of self-structured questionnaires (one for students and another for school principals). The questionnaires were pilot-tested to validate and determine their reliability. The collected data were analyzed using descriptive statistics with the aid of Statistical Package for Social Sciences (SPSS) version 17.0 for Windows. The study findings indicate that there was a difference in motivation among students across the age categories, order of birth and gender of the student. The study recommends that there is a need to include more student factors beyond what was included in this study so as to identify other factors that may have more influence on student motivation.

Keyword: Motivation, Academic Expectations, Academic Aspirations and Students.

INTRODUCTION

The policy of the government of Kenya on education has always been to provide education to all children at all levels of the education system. This is in agreement
education. This is in line with the United Nations Universal Declaration on Education (1985) states that education is one of the basic human rights irrespective of an individual's socio –economic and political background, gender, religion, race and tribe.

According to the Government of Kenya (2005) in 2002, primary school enrolment for boys and girls was 78.5 percent and 76.5 percent respectively but after the introduction of free primary education in 2003, it has been rising steadily. In 2008 the national enrolment for boys was 94.5 percent and 90.5 percent for girls. At secondary school level, the national enrolment rate in 2002 was 29.8 percent for boys and 26.4 percent for girls. After the introduction of subsidized secondary education it rose to 46.3 percent for boys and 38.8 percent for girls. According to the Society for International

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Development (SID, 2010), in the academic year 2006/2007 the percentage of male to female students was 62 per cent and 38 per cent respectively in public universities. In 2007/2008 and 2008/2009 academic years the enrollment for both gender did not change as it remained at 62 per cent for boys and 38 per cent for girls.

The low number of female students in our public universities reflects the poor performance that is associated with girls in national examination at both primary and secondary levels. For example, in 2004 Kenya Certificate of Primary Education examination, while girls had a mean score of 53 per cent, boys had a mean score of 54 per cent (MOEST, 2009).

According to the Society for International Development (SID, 2010), despite an increment in secondary school enrolment, performance in Kenya Certificate of Secondary Education has been wanting. In 2009 and 2010 examinations, only 27 per cent of the registered candidates in each year attained the minimum aggregate grade for university qualification (C Plus) and above. According to Kenya National Examination Council (KNEC, 2009) report, the Kenya Certificate Secondary Education results show a lot of disparity. For example: from grade A plain to B plain in 2008, girls accounted for 32 per cent and boys accounted for 68 percent. In 2009, girls constituted 34 per cent and boys 66 percent while in the year 2010 girls accounted for 27 per cent and boys accounted for 73 percent.

Student's poor performance in Kenya Certificate of Secondary Education nationally is reflected in the results of Laikipia -West District in Laikipia County. According to the District Education Officer report (2012), out of the total 784 registered students, girls were 44 per cent and boys constituted 56 percent. Concerning their performance, boys had a better performance than girls. For instance, in terms of quality grades, that is, A plain, A minus, B plus and B plain, boys accounted for 86 percent and girls accounted for 14 percent. In the same district majority of the students who missed Kenya Certificate of Secondary Education examination in 2010, girls accounted for 83 percent and boys accounted for 17 percent. The reasons for high percentage of girls scoring poorly while others could not sit for Kenya Certificate of Secondary Education examination could have been: early marriages, teenage pregnancies, involvement in menial jobs and domestic chores and also absenteeism due to lack of school fees. Poor academic performance in Laikipia- West District of Laikipia County in Kenya Certificate of Secondary Education examination may also be attributed to low motivation of students in their academic work. According to Beihler and Snowman (2002), motivation to perform academically can result from being stimulated to achieve better grades. Students are said to be internally motivated to learn when they attribute their academic results to factors that are under their control, such as being interested in mastering a topic rather than rote learning for the sake of better results and a belief that they have the skills that can help them attain grades they aspire to achieve. On the other hand, students are extrinsically motivated to learn if their drive to learn is as a result of motivating factors from their learning environment.

According to Kibera and Kimokoti (2007) students' academic performance can be affected by characteristics such as gender, age, and socio-economic and political background, and birth order. Chege and Sifuna (2006) further stated that school factors such as the type of school attended, teachers' attitude, availability of learning resources, provision of guidance as well as involvement in co-curricular activities have an influence on students' academic performance.

Richard and Deci (1985) observed that students are motivated to learn if they are physically comfortable, feel safe and relaxed, and have a sense of belonging and a strong feeling of self-esteem. Given that a number of factors influence motivation to learn and academic performance, it was important to establish the grades students expected to attain at the end of secondary level of education as well as the academic aspirations of secondary school students in Laikipia-West District of Lakipia County.

Objectives of the Study

The specific objectives of the study sought to:

1. assess the academic expectations of students at the end of secondary level of education by gender.
2. determine academic aspirations of students after secondary level of education by gender.
3. establish academic aspirations of secondary school students by school category.

Research Design

This study adopted a survey research design. In a survey design, information is collected from respondents about their experiences and opinions about a particular topic under study in order to generalize the findings to the population represented by the sample (Gall, Borg & Gall, 1996). This design was the most appropriate for obtaining factual and attitudinal information for research questions with regards to self-reported beliefs, opinions, and present or past behaviors (David & Sutton, 2004). The study assumed that all the respondents had/or information or experience that bore on the problem of investigation.

Sampling Procedure and Sample Size

In this research, stratified random sampling was applied to select 341 girls and 419 boys respectively in Laikipia-West District from Form Four class for this study. Also purposive sampling was applied to include all the 18 secondary principals.

Data was collected using both closed and open- ended questions items. The instruments were piloted on a population that was similar to the target population. Reliability was tested using Cronbach's Coefficient Alpha in order to determine the internal consistency of the items in questionnaire (Gall, Borg and Gall, 1996). A reliability coefficient of 0.8345 was established and assumed to reflect the internal reliability of the instruments.

DATA ANALYSIS AND INTERPRETATION

Data was processed, coded and analyzed using Statistical Package for Social Sciences (SPSS) version 17.0. The descriptive statistics: percentages, frequencies and means which were presented in Tables, Pie Charts and Cross-tabulations. With regard to gender 155 (44.4) and 194 (55.6) females and males respectively responded to the questionnaires. The gender variation of students conformed to the general enrollment of male and female students in secondary schools in the country and study area. In general, there were more boys than girls in the sampled secondary schools due partly to cultural beliefs that education of girls is not as important as that of boys since girl's education is perceived to benefit families where they get married to compare to their biological families. The analysis of the age of students by gender is presented in Table 1.

Table1: Age Distribution of the Sample by Gender

Age	Boys		Girls	
	Frequency	Percent	Frequency	Percent
≤ 14	4	2.1	4	2.6
15	27	13.9	40	25.8
16	43	22.2	33	21.3
17	60	30.9	45	29.0
18	28	14.4	21	13.5
>18	32	16.5	12	7.8
Total	194	100.0	155	100.0

The findings in Table1 indicate that 81.4 percent of boys and 89.6 percent of girls were aged between 15 and 18 years. This conforms to the standard age of secondary school students in the

country. This also shows that majority of the respondents were in their adolescent stage as expected. In general, it is in this stage that majority of the students develop a sense of independence and identity. This is supported by Erik Erikson's psychosocial theory which postulates that in the adolescent stage, the adolescents face the dilemma of identity versus role confusion. Therefore, failure to have a fully developed sense of independence and self identity may lead to role confusion and poor academic performance. This in turn influences their development of self-concept (Erikson, 1950).

The order of birth is also said to influence the level of motivation. The tapped information from respondents about order of their birth is captured in Table 2.

Table 2: Order of Birth of the Sampled Students by gender

Order	Boys		Girls	
	Frequency	**Percent**	**Frequency**	**Percent**
1	71	36.6	43	27.8
2	63	32.5	52	33.5
3	27	13.9	26	16.8
4	24	12.4	27	17.4
>4	9	4.6	7	4.5
Total	194	100.0	155	100.0

The analysis in Table 2 shows that the 36.6 percent and 27.8 percent of boys and girls, respectively, were firstborns. The rest of the respondents occupied second and third position of birth.

After capturing the profile of students by gender, age and order of birth, analysis of students' level of motivation was assessed based on their *level of agreement or disagreement with statements on a point likert scale ranging from 1 to 4 (where, 1= Strongly disagree - SD, 2 = Disagree - D, 3 = Agree - A and 4 = Strongly Agree - SA).* The higher the score, the higher was the level of influence of that aspect on the motivation of the learners, and vice versa. The results of their responses are summarized in Table 3.

Table 3: Student's Perception about their performance and liking of their school by gender

Statement	SA			A		D		SD		TOTAL	
	Gender	F	%	F	%	F	%	F	%	F	%
I feel satisfied with my last term examination results	Boys	11	5.7	17	8.8	73	37.6	93	47.9	194	100
	Girls	8	5.2	15	9.7	83	53.5	49	31.6	155	100
If I perform the way I perform in KCSE I will qualify for my dream course	Boys	3	1.5	11	5.7	77	39.7	103	53.1	194	100
	Girls	4	2.6	5	3.2	45	29	101	65.2	155	100
I feel that am not performing to my best in school examination	Boys	128	66	34	17.5	11	5.7	21	10.8	194	100
	Girls	106	68.3	27	17.4	8	5.2	14	9	155	100
I owe my academic performance to hard work	Boys	179	92.3	15	7.7	0	0	0	0	194	100
	Girls	149	96.1	6	3.9	0	0	0	0	155	100
I am proud to be a secondary school student	Boys	171	88.1	16	8.2	5	2.6	2	1	194	100
	Girls	131	67.5	10	5.2	8	5.2	6	3.9	155	100
I feel disadvantaged when compared with boys students in academic wok	Boys	44	2.3	21	10.8	63	32.5	66	34	194	100
	Girls	39	2.5	43	27.7	34	21.9	39	25.2	155	100
Given a chance I would opt out of my current school	Boys	4	2.1	49	25.3	83	42.8	58	29.9	194	100
	Girls	1	0.6	19	12.3	64	41.3	71	36.6	155	100

The results in Table 3 have revealed that both boys (85.5%) and girls (90%) did not feel satisfied with their last term's examination results. In addition, 71.3% and 94.2% of boys and girls respectively felt that they would not attain pass mark at Kenya Certificate of Secondary Education (KCSE) to enable them to join their "dream" courses. Further, both boys (83.5%) and girls (85.7%) they were aware that they were not performing well in their school examinations. All the boys and girls attributed their performance to their hard work. These results suggest that students were not able to see the relationship between hardwork and performance because it is expected that hard work would produce good results and would lead them to attaining good grades that would enable them to join their preferred courses after secondary level of education. Finally, students were asked to indicate if they would opt to transfer to another school. The results showed that only (27.4%) and 12.9% of boys and girls respectively would have opted to leave their current school. This strongly suggests that the majority of students were happy with their school environment. It is therefore important in a future study to find out why students were not satisfied with their performance given that they did not want to change their school.

The expected Mean grade and Academic Aspirations of Boys and Girls

The analysis of motivation of boys and girls was also gauged on students' expected academic achievement in terms of grade score. The students reported their overall average grade expected in all the subjects based on the Kenya National Examination Council criteria. These grades included A, A-, B+, B, B-, C+, C, C-, D+, D, D- or E. The study transformed the overall grade into numerical scale to obtain grade point average, in which A = 12, A- = 11, B+ = 10, B = 9, B- = 8, C+ = 7, C = 6, C- = 5, D+ = 4, D = 3, D- = 2, and E = 1 points. The grade point average obtained, served as the student's expected academic achievement. The results in Table 4 contain students' expected academic achievement in terms of overall grade points by gender.

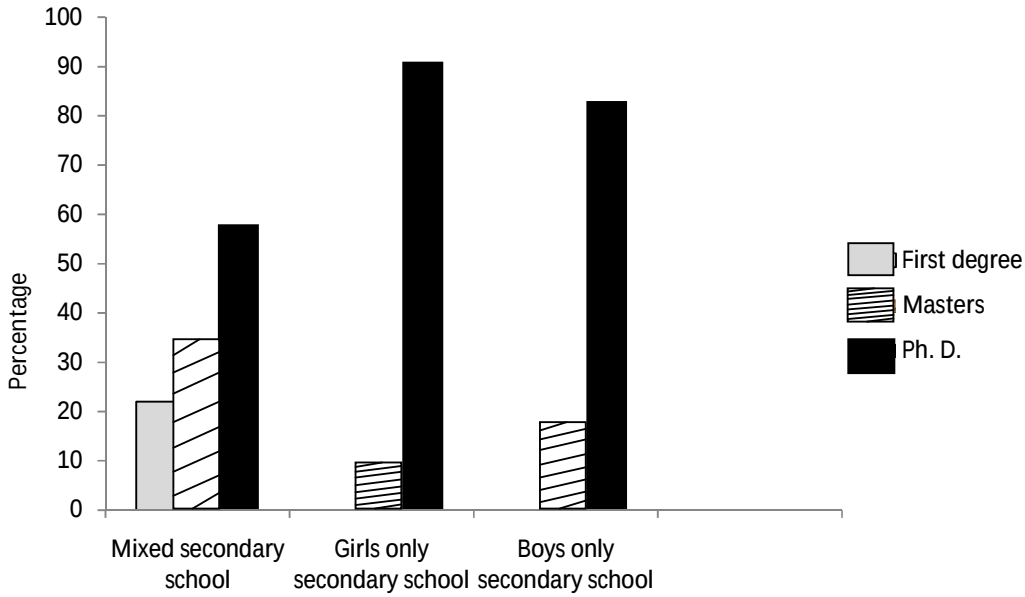
Table 4: Expected Academic Achievement Grades in Kenya Certificate of Secondary Education by Boys and Girls.

Expected grade	Boys		Girls	
	Frequency	**Percent**	**Frequency**	**Percent**
12 = A	59	30.4	28	18.1
11 = A-	24	12.4	9	5.8
10 = B+	73	37.6	65	41.9
9 = B	17	8.8	12	7.7
8 = B-	5	2.6	11	7.1
7 = C+	14	7.2	22	14.2
6= C	2	1.0	6	3.9
5 = C-	0	0.0	2	1.3
Total	194	100.0	155	100.0

The analysis in Table 4 indicates that 99.0 percent of the boys and 94.8 percent of girls expected an average grade point ranging between 7 points (C+) and 12 points (A). These results suggested that although all students expected higher academic achievement, boys hoped to attain better results than girls. However, considering the past performance of past students in this district, it appears that they are not realistic about their performance.

Finally, the study sought information on students' academic aspirations by school type. This analysis is summarized in Figure 1.

Fig 1. Academic Aspirations of Students from Mixed Secondary, Girls Only and Boys Only Schools



Data in Figure 1 indicates that all the students in Laikipia- West District had very high academic aspirations. The majority of the respondents aspired to attain Ph.D. level of education. Thus 91 per cent of the respondents from girls' only secondary schools aspired to attain Ph.D. level followed by students from boys' only schools with (83 per cent). Students from mixed secondary schools manifested lowest academic aspirations at 58%. These findings are in agreement with those of (Kibera, 1993).

Summary Findings

Based on the study objectives, research questions and data analysis, the following research findings emerged:

(i) The results have shown that gender of the student has a marked influence on students' motivation to learn.

(ii) The respondents were drawn from different types /categories of schools showed slight difference in their motivation to learn.

(iii) On the whole, the majority of students have unrealistic academic expectations and aspirations. Overwhelmingly, majority of students expected to attain good grades and consequently aspired to achieve high academic qualifications at masters and doctoral levels respectively.

Conclusions

(i) Based on the summary findings, the study concludes that learner characteristics were influential in determining students' level of motivation.

(ii) The findings have also established that students in single sexed secondary schools have slightly higher academic expectations and aspirations compared to students in co-educational secondary schools.

Recommendations

In view of the above conclusions, this study recommends that there is a need to include more learner factors beyond gender, age, order of birth, and school category. Institutional and socio-cultural factors should be investigated in future studies. Further, more Counties should be studied for comparative purposes and generalization of results to the rest of the country.

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INTRA-REGIONAL INEQUALITIES IN THE LEVEL OF DEVELOPMENT IN IKOM LOCAL GOVERNMENT AREA CROSS RIVER STATE, NIGERIA

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ABSTRACT
This research focused on intra-regional inequalities in the level of development in Ikom Local Government Area, using the wards as the basic unit of analysis. The aim was to determine the level of variation in the spatial pattern of development, as well as identify the factors that influence and create the conditions for the existing pattern of development in the study area. Ten indicators of health (2) and educational (8) development were collected and analyzed. The analysis was done using the Gini-index and the cluster analytical techniques. The results of the analysis revealed significant variation in the distribution of the selected development indicators among the wards. Ikom Urban I, the political-urban headquarters emerged among the privileged (developmentally advantaged) wards in all the selected development indicators a1ongside Nde, Abayom and Akparabong. There were still marked variations in the level of development among the wards. The findings revealed a significant relationship between development indicators of the wards and population size. This research also highlighted the influence of political factors on the level of development. While supporting development from below as a viable strategy for reducing rural-urban imbalances within the region, we propose the creation of new centers of development (growth nerves) objectively selected.

Introduction

The present geographical entity called Ikom Local Government Area dates back to the 16th century pre-colonial era (Local Government Information Unit-LGIU, 1998). It has since undergone several restructuring over the years to what we have today. According to the Cross River State Development Policy (1976) Ikom urban the administrative headquarters is recognized as an urban centre. It is politically among the six urban centres outside Calabar so recognized in the state when 17 Local Government Areas were formed in the State by the 1976 Local Government reforms (Bisong, 1987). Presently Ikom Local Government comprises of eleven (11) wards. The wards include Abayom, Akparabong, Nde, Nta-Nselle, Ofutop I, Ofutop II, Ololumo, Nnam, Ikom urban I, Ikom II, and Yala. There are about 365 villages and a variety of ethnic groupings and traditions.

This study primarily seeks to determine the inequalities that exist in the spatial pattern of development in Ikom Local Government Area. The choice of the Local Government is based on the definition of a region as a sub national area unit (Richardson, 1974). Friedman and Alonso (1964) have also asserted that the very definition of a region will vary with purpose, and the nature of the space in any case will depend both on the type of interrelations being considered and the purpose in mind.

This research opines that disparities can also exist within a region (intra-regional) as long as there are demarcations between rural and urban areas of that region. Bisong (1987) has emphasized the need to consider the role of the size and territorial extent of the Local Government, in relation to its expectation in spreading development. This study notes that despite the creation of two Local Government areas, Boki in 1991 and Etung in 1996, out of Ikom, the development gap has persisted, especially between the urban headquarters and its surrounding rural hinterland.

We propose further decentralization as a strategy for reducing intra-regional inequalities and bringing about the spread of development within the Ikom Local Government Area. Decentralization here does not necessarily imply the creation of more local government areas; rather it entails the objective and strategic selection of productively vibrant rural areas that will act as growth nerves for planning. These growth nerves will constitute an additional category in the existing planning hierarchy (see Fig. 1.1 below).

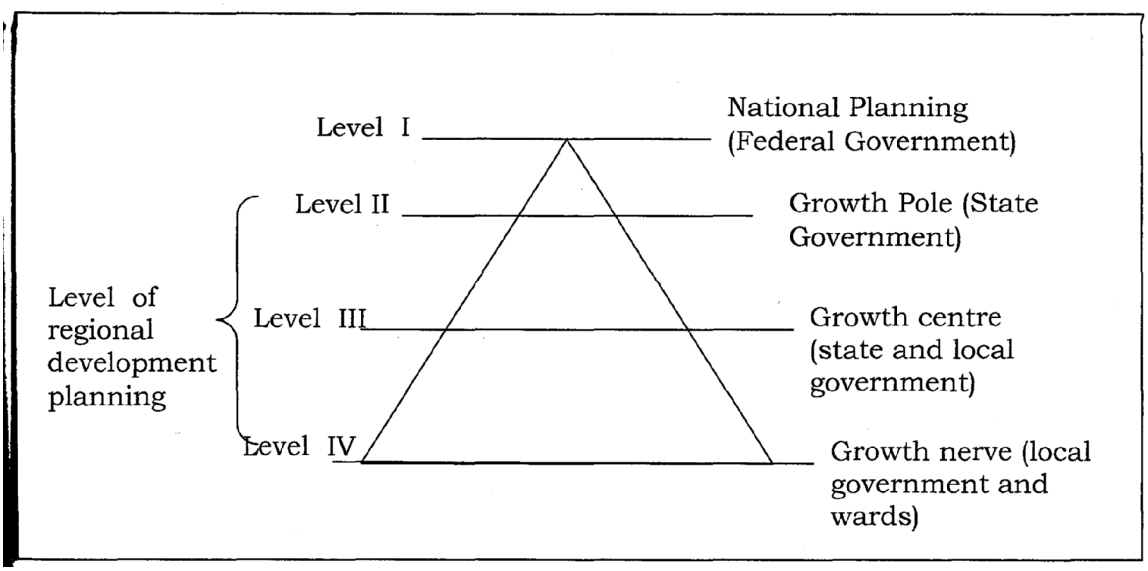

Fig 1.1: The Planning Hierarchy

Modified from Arokoyu, (2004).

The growth nerves are expected to attract the development of educational and health facilities as well as socio-economic infrastructure to the rural hinterland which in the long run will bring about other

investments in these rural areas. Hypothetically, this will bring about the much desired 'trickle-down' or 'spread effects' to redistribute development so concentrated in the urban headquarters. It is also expected that the kind of investment eventually established in these growth nerves be made in relation to the available natural resources to make it sustainable. The findings from this study, apart from being a tool for planning Policy at the grass roots is also meant to contribute to existing knowledge on regional development planning with particular reference to development inequalities within a region.

Among other things this study places emphasis on inequalities in educational and health development within Ikom Local Government Area, under the current system of eleven wards which came into existence in 1997. The thrust of this study is directed at answering the following questions;

i. Is there any difference in the level of educational development among the wards?
ii. Is there any difference in the level of primary health care development among the wards?
iii. Is there any relationship between population size and the level of development among the wards in Ikom Local Government Area?

Unequal Development at the Local Level

A common pattern in the development trend in Nigeria has been the concentration of infrastructure, socio-economic activities and growth in state capitals and a few urban centres. This pattern has more often than not, been attributed to political influence than anything else. Incidentally, this trend has extended to the Local Government areas, at the grassroots. The provision of a headquarters secretariat with other centralized social services in one location, as part of the local government headquarters establishment, can be said to have marked the beginning of the primacy of the Local Government Headquarters, resulting in development inequalities between the headquarters and its surrounding rural hinterland.

Ikom urban the administrative headquarters of Ikom Local Government Area, has been recognized as an urban area (CRSDP, 1976). And, since the initial elevation of Ikom urban as the Local Government Headquarters in 1976, the pattern of development has proceeded in a rather polarized manner, concentrating a lot more in the headquarters thereby maintaining a steady and widening gap in development especially between the urban headquarters and the surrounding rural hinterland. Ironically, these rural areas contribute both agricultural produce and the human resource that contributes to drive development in the headquarters.

The researcher has observed that inequalities in development exist in the study area is due to 'urban bias' development initiatives which favour the concentration of population and investment in the political and urban headquarters to the disadvantage of the surrounding rural hinterland. This investment is in the form of health and educational infrastructure, potable water, access roads, modern housing, security, industry, etc. These are regarded as pre-requisite, for meaningful development of an area. However, where these facilities are available, they have been concentrated in the political- urban headquarters.

The combined effect of policy, commerce (agglomeration economies), population, investment and infrastructure in favour of the headquarters, over time, has resulted in 'backwash effect' to the disadvantage of the surrounding rural hinterland. In simple terms, it can be said that the concentration of development infrastructure in the headquarters has attracted more population and the concentration of population has attracted much more development to the headquarters. The consequence of these has been unbalanced overall development of the entire Local Government Area, with its attendant problems, including; rural-urban migration, low-productivity of the rural areas, lower incomes and lower access to needs, among others.

Despite the creation of Boki and Etung Local Government Areas with separate headquarters in 1991 and 1996 respectively, Ikom urban has remained a vital urban nerve centre, servicing a tremendously vast

rural hinterland that extends well beyond its administrative jurisdiction. This is due partly to the unique location of Ikom as it is well linked by road to the northern and eastern parts of the country and part of the republic of Cameroon (Bisong, 1987). This location makes Ikom a potential and viable marketing centre capable of revolutionizing the rural surrounding. There is no doubt that Ikom-urban has grown tremendously, but the spread of this growth attributes significantly to the surrounding rural hinterland, especially among the eleven wards that make up the Ikom Local Government Area, leaves a lot to be desired.

Methodology

Ten development indicators have been analyzed in relation to the population size of each ward. Descriptive statistical techniques of data analysis have been used to show the degree of deprivation or advantage in development among the wards in Ikom L.G.A. The Gini-index of concentration is used here to examine the extent of concentration of each of the development indicators among the wards. The Gini-coefficient describes the area of concentration between the Lorenz curve and the line of equality. This method has the advantage of providing a single measure of the extent to which a condition or activity (in this case, educational and health development) are concentrated in space by comparison with some other distribution (population). The Gini-coefficient of spatial variation measures the performance or variation of the chosen variables among observation or the cases. It compares the percentage share of an item by the different areas against their percentage population or distributional criterion.

The Gini-coefficient equation is given as;

$$Gx = 1/2 \sum_{i=1}^{N} |x_i - p_i| \quad or \quad \%x - \%y.0.5 \qquad 1.1$$

where:

Gx = Gini-Coefficient

xi = the percentage of the value of the variable shared by the wards (development indicators).

P1 = the percentage of total population.

(Note: population is the distributional criterion).

Furthermore, to appreciate the level of deprivation or advantage revealed in the Gini-index, the Lorenz graphical representation is adopted. The Lorenz curve is based on the Gini-coefficient, a cumulative frequency curve that compares the distribution of a specific variable, with the uniform distribution that represents equality. This equality distribution is represented by a constant diagonal line. The greater the deviation of the Lorenz curves from this line, the greater the inequalities. The Gini-coefficient ranges from zero to one, with zero representing perfect equality. Inequalities increases from one to infinity.

The Lorenz curve is the graphical representation of the inequalities in the distribution of the chosen development indicators as given by the Gini-coefficient. The curve is gotten by arranging the percentages or cumulative scores for a variable in an ascending order of magnitude. The cumulative/percentages of the population (or any other criterion function), are then arranged against the values accordingly. The cumulative/percentages are then plotted against each other on a graph. In the Lorenz curve, a straight diagonal line of 45° indicates perfect equality and is equivalent to zero Gini-coefficient. The degree of inequalities is then measured in terms of the departure from the diagonal line.

In addition, cluster analysis has been used to attempt a classification of the wards, based on their respective performance on the chosen development indicators. The cluster analysis attempts to produce optimum clustering for a given number of clusters, regardless of the previous stages in the analysis (Abumere, 1978). The cluster analysis uses distance similarity matrix observations in the different

groups. Distance similarity matrix is calculated using the Pythagorean Theorem, while the distance between any two points is defined as:

$$D_{ij} = \sum_{i=j}^{n} \frac{(smi - smj)}{n} \qquad 1.2$$

where:
smi and *smj* are the scores of the *ith* and *jth* observation, respectively.
n = the total number of variables used in the multivariate groupings.
Cluster analysis is used when in a set of variables there is the suspicion that the data may be homogenous and thus needs to be classified into distinct groups. The technique computes clustering of a set of observation on the basis of approximating a local minimum for the sum of the squared distances between the observations and their cluster centres. Cluster analysis is an exploratory data analysis tool for solving classification problems. Its objective is to sort cases (people, things, events, area, etc) into groups, or clusters, so that the degree of association is strong between members of the same cluster and weak between members of different clusters. A cluster is a group of relatively homogenous cases or observations. Objects in a cluster are similar to each other. They are also dissimilar to objects outside the cluster, particularly objects on the other clusters. The analysis starts with a large number of groups and progresses to provide a smaller number of groups. The number of clusters into which the observations are to be grouped is reduced and there is a recalculation of the new clustering.

Spatial Performance of Development Indicators in Ikom Local Government Area
The analysis of the level of spatial inequalities among the eleven wards in Ikom Local Government Area is as set out in the table below;

Table 1.1 Summary of Gini-coefficient for development indicators in Ikom L.G.A

Development variable	***Development indicators/'000 population/ward***	***Gini-coefficient (%x-%y.0.5)***	***Total Gini-coefficient/varaible***	***Mean of total***	***Rank***
Health	No. of maternity/primary health centres	63.90689715			
	No. of nurses/midwives	52.29691509			
			116.2029122	**58.10145612**	**1**
Educational	Teacher:student ratio	62.0145645			
	Teacher:pupil ratio	63.90690353			
	No. of sec. sch. Teachers	59.8035475			
	No. of pry. Sch.	50.67185182			

	Teachers				
	No. of sec. schools	57.70114138			
	No. of pry. Schools	55.69613615			
	Secondary school enrolment	63.69093495			
	Primary sch. Enrolment	50.70451568			
			464.1895985	**58.02369981**	**2**

Data Source: field work (2010)

The table above represents a summary of the calculated Gini-coefficient for each of the ten development indicators under study. The data analyzed above was derived from records showing the distribution of health facilities and educational facilities in Ikom local government area (LGIU, 1998). The total Gini-coefficient in the table above was gotten by adding all the development indicators under each development variable. In other words, to get the total (Gini-coefficient) for health variable, we added the Gini-coefficient for number of maternity/health centres/'000people/ward and number of nurses/midwives/ '000 people/ward. And to get the mean of the total we divided the total by the number of health development indicators that make up the total.

The high values of the Gini-coefficient indicate that there is significant variation in the level of development among the eleven wards. The Gini-coefficient was discovered to be within the range of 52.3 to 63.9 for health development indicators and 50.7 to 63.9 for educational development indicators. Overall, the Gini-coefficient from this study was noted to speak of high inequalities in the level of development among the eleven wards. This fact is more so when viewed on the scale of the Lorenz curve in a normal distribution, where Gini-coefficient is equal zero (G=0, perfect equality) the distribution is spread on the constant diagonal line of perfect equality. However in this study, the Lorenz curve for all the development indicators had a marked demarcation from the constant diagonal line of perfect equality. On the scale it is given that G=0 represents perfect equality and inequalities increases from G=1. With a range of G=50.7 to G=63.9 as was derived from this study, the inequalities is clearly high.

It was further discovered that the mean of total Ginicoefficient for health development indicators (58.1), from table 4.8 was slightly higher than that of educational development indicators (58.0). Ordinarily, the reverse would have been expected, considering that more educational development indicators were treated compared to health development indicators (a ratio of 8:2). The implication of this is that inequalities in the level of health development, is relatively more widespread among the wards. In addition, it was noted that the Gini-coefficient for number of maternity/primary health centre/'000 people/ward (G=63.9), Teacher:pupil ratio/'000 people/ward (G=62.0), Teacher:student ratio/'000 people/ward (G63.9) and secondary school enrolment/ '000 people/ward (G=63.7) were higher than the other development indicators, which fall within the range of G50 to G=59. This outcome implies wide spread inequalities in the distribution of development indicators.

Classification of Privileged and Under-Privileged Wards in Ikom Local Government Area Based On Cluster Analysis

The findings from the Gini-coefficient and the Lorenz curve have proven that there are widespread inequalities in the level of development among the eleven wards. However there was still the need to determine which ward(s) is (are) better off. Remember the cluster analysis is used when in a set of variable, there is the suspicion that the data may be homogenous and thus requires classification into distinct groups.

Table 1.2: Data for Cluster Analysis.

Ward	Grand Total of ten Development Indicators
Ikom urban I	**97.07257119**
Ikom II	4.534647417
Ololumo	37.825392
Ofutop I	40.11229679
Ofutop II	37.36480852
Akparabong	**64.2415472**
Yala	39.0762915
Nde	**70.26219776**
Abayom	**70.25918018**
Nta-nselle	28.80045806
Nnam	17.1264573

Data source: Field work (2010)

The cluster analysis was used to classify the eleven wards as privileged or underprivileged in terms of their level of development. Using the sum total of the ten development indicators for each ward in cluster analysis built into the SPSS software (from the table above), two groups of privileged and underprivileged wards was derived. Ten points was allocated for each of the ten development indicators, giving a scale of 100 (10 x 10). On a scale of 100%, four wards performed above average that is above 50% the wards include: **Ikom urban I (97.07), Nde (70.26), Abayom (70.25) and Akparabong (64.24).** The cluster analysis further revealed that despite the classification of the urban headquarters as privileged, alongside three other wards, there were still marked difference in the development indicators, with the Headquarters outstanding as a 'prime' ward **(with 97.07).** This outcome corroborates the findings from the Gini- coefficient and the Lorenz curve, thus confirming the existence of a development gap between the Local Government Headquarters and the surrounding rural hinterland. By implication, there is strong indication that the provision of developmental amenities in the study area has proceeded in a polarized manner, concentrating more in the political-urban headquarters to the disadvantage of other areas that make up the surrounding rural hinterland. The table below is a representation of the groups emanating from the cluster analysis.

Table 1.3: Privileged and under-privileged wards in Ikom L.G.A based on cluster analysis

Group	Serial number	Wards in the group	Remarks
1	1	Ikom urban I	privileged
	2	Nde	-do-
	3	Abayom	-do-
	4	Akparabong	-do-

2	5 6 7 8 9 10 11 12	Ofutop I Yala Ololumo Ofutop II Nta-nselle Nnam Ikom II	Under-privileged -do- -do- -do- -do- -do- -do-

Data source: Field work (2010)

The table above shows the outcome of the sum total of the ten development indicators treated in this study, applied in cluster analysis built into the SPSS software.

Classification of privileged and under-privileged wards using GIS

Further analysis of the sum total of development indicators using Geographic Information System produced the map interpretation given below;

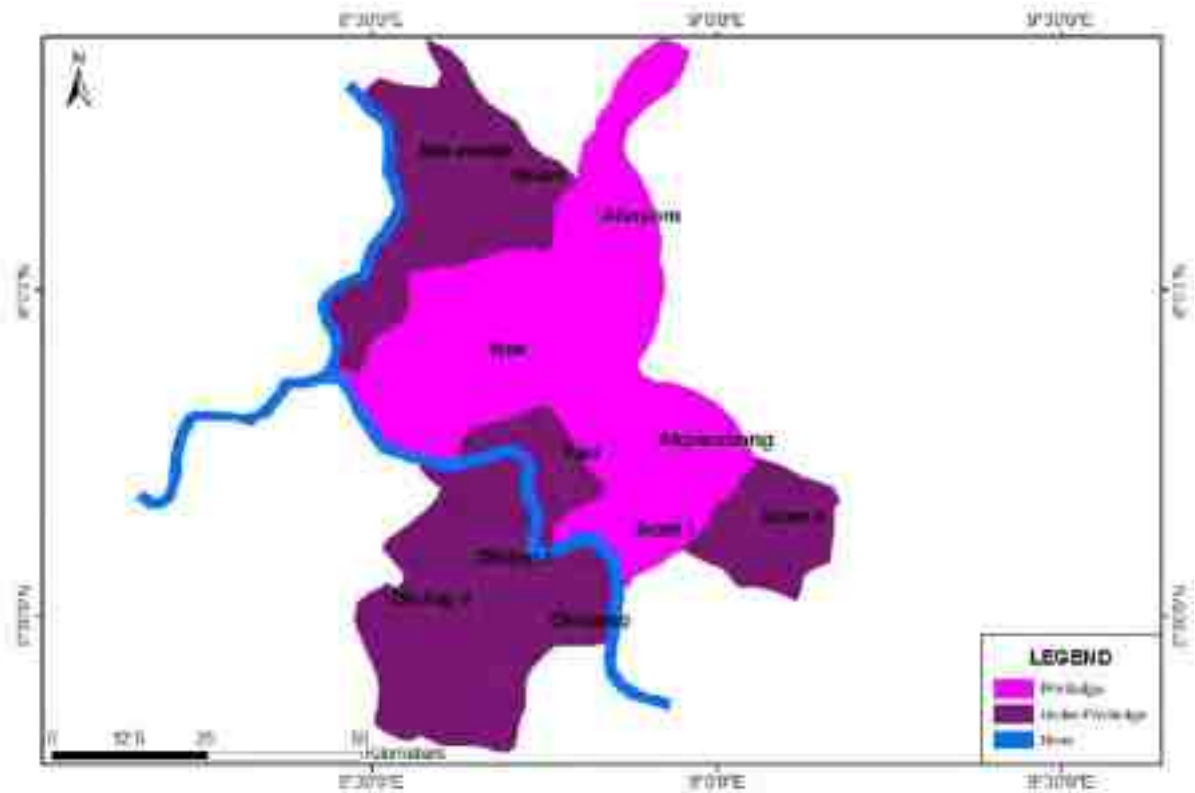

Fig. 4.1: GIS Presentation of Privileged and under – privileged wards

The map above shows, Ikom urban I the Political headquarters of Ikom Local Government Area as the 'prime' concentration of development indicators, alongside other privileged wards namely; Abayom, Nde and Akparabong. The map was extracted from the topographical map of Ikom Local Govrenment Area, using Geographic Information System applications.

Population size and level of Urbanization

The population figures used in this study are derived from the 1996 projections given by the National Population Commission (Census, 1991). The projection was derived using the exponential formula. It is given as: $Po(1+r)^n$

where Po = population

r = annual exponential growth rate

n = exponent.

Table 1.4: Projected Population distribution among the Wards in Ikom L.G.A from 1996

Ward	*1991 total (both sexes)*	*1996 projection*	*2010 projection*	*National growth rate (%)*
Ikom urban 1	40,772	47,062	66,828	3.18
Ikom II	5,555	6,412	9,105	3.18
Ololumo	8,566	9,886	13,840	3.18
Ofutop I	12,559	14,490	20,576	3.18
Ofutop II	11,451	13,222	18,775	3.18
Akparabong	10,691	12,339	17,521	3.18
Yala	4,321	4,978	7,069	3.18
Nde	15,472	17,857	25,357	3.18
Abayom	14,557	16,802	23,806	3.18
Nta-nselle	9,254	11,835	16,806	3.18
Nnam	5,166	5,961	8,465	3.18
Total	**138,364**	**160,844**	**228,145**	**NIL**

Modified from National Population Commission (1991)

The table above shows the population distribution for Ikom Local Government Area from the 1991 census, as well as the 1996 projections given by the National Population Commission. From these, the 2008 projections were derived using the current annual growth rate of 3.18% given by the National Population Commission census results (Nigeria 2007). This was done, bearing in mind that some localities included in the 1991 census, are no longer part of Ikom Local Government Area. This rigorous procedure was adopted because the recently released census results (2006) did not give a breakdown of the population according to localities/wards. Ikom urban I, the urban headquarters clearly dominates, from the population distribution shown above, accounting for 29.3% of the total population of the area. It is followed by Abayom accounting for 11.1% of the population. The population size is used here as an indicator of the level of urbanization of the wards.

Summary and Conclusions

In discussing the research findings, it is important to note that the human development situation in Nigeria as a whole is deplorable. The use of the phrase “inequalities in level of development” is relative for the purpose of this study and should not be misconstrued. The results of the analysis from this study proved that there is significant variation in the level of development among the eleven wards in Ikom Local Government Area. It was also discovered that there is a significant relationship between development indicators and population size of the wards.

The findings also proved that Ikom urban I, the political headquarters, is the ‘prime’ among the other developmentally privileged wards. This research noted that the spatial pattern of development in Ikom Local Government Area is in conformity with the “primacy of the political and urban headquarters”. The situation is more critical when viewed from the perspective that the findings from this study provide an

insight into the overall pattern of development. That is development within a wider context, including socio-economic and infrastructural development in the area.

The findings are in line with the works of Myrdal. Myrdal (1963) was one of the first to notice that 'backwash' was a more significant consequence of development intervention than 'trickledown' or spread effects. Also, Dicken-son et al (1996), have noted, that the tide of human migration towards major urban centres is both a symptom and a cause of rural poverty and imbalances with many third world cities developing a parasitic role in relation to the surrounding countryside. In the same light, Tanimowo (1987) has asserted that there is often a convergence in the fact that, there is a positive relationship between the population size of an area and its level of development. This study also highlighted the influence of political factors on the development trend in the study area. This in line with a number of scholars; Bisong (1987), Gana (1985), Ayeni and Mabogunje (1982:1), they all agree that the most potent factor in the transmission and spatial diffusion of development impulses in developing countries is political in nature and operation.

However, the findings reduce the emphasis on the influence of distance from the centre on the level of development, especially since the focus was rather, on the imbalances in the distribution of development impulses, than accessibility to facilities. In other words, while it could be said that development levels among the Local Government Areas in Cross River State, declines with distance from the State Headquarters (Enoch, 1981), the same cannot be said for levels of development among the wards in Ikom Local Government Area, in relation to the urban headquarters. From the analysis of the Gini-coefficient for development indicators, it was discovered that Ikom II, which ordinarily by distance could be regarded as an extension of the urban headquarters, did not fair better from the distribution of health and educational facilities, compared to Ofutop I, Ofutop II, Nde, Abayom, Ololumo and Akparabong. These wards, though relatively farther from the headquarters, were better-off in terms of development levels.

The effectiveness of decentralization of governance at the grass roots cannot be overemphasized. Overall, it was discovered that there is enhanced spatial interaction among the eleven wards, albeit inequalities exist. Hence the recommendations are directed towards creating new development centres (referred to in this work as growth nerves) as focal points for the distribution of development impulses, where the Local Government Headquarters is known to lose touch with communities in the rural hinterland.

In conclusion, we maintain that since the most potent factor in the transmission and spatial diffusion of development impulses in developing countries is political in nature and operation, fighting poverty at both regional and rural levels is not just a question of relevant production techniques but a highly political issue. Hence, the task is to understand the political facts and constraints. Political will demonstrated through development planning, should be directed towards spreading development impulses, as these have been proven to attract population concentration and vice versa.

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Appendix: 1

Ikom Local Government Area showing wards

PROXIMATE, PHYSICOCHEMICAL AND SENSORY EVALUATION OF ICE CREAM FROM BLENDS OF COW MILK AND TIGERNUT (*Cyperus esculentus*) MILK

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Abstract

Ice cream was produced from blend of cow milk and tigernut milk. Cow milk and tigernut milk were used in the formulation of the ice cream at different compositions. The compositions were 100% cow milk, 50% cow milk and 50% tigernut milk, 60% cow milk and 40% tigernut milk, 40% cow milk and 60% tigernut milk and 100% tigernut milk to give samples A, B, C, D and E respectively. The ice cream made from 100% cow milk served as the control (sample A). The proximate composition showed that sample B (50% cow milk and 50% tigernut milk ice cream) had the highest percentage crude protein of 14.17±0.42 while sample A (100% cow milk ice cream) had the least protein content of 7.38±0.20. The percentage crude fat content for the control sample (100% cow milk ice cream) had the highest value of 10.33±0.08 but was not significantly different with the other samples at P<0.05. The ash content ranged between 0.60±0.03 to 1.71±0.01. The % moisture content increased as the level of substitution of cow milk with tigernut milk increased. Sample E had the highest value of 70.01% moisture content while the control sample (100% cow milk ice cream) had the least value of 51.34%. .The percentage crude fibre content ranged between 0.25±0.02 to 0.03±0.02.The carbohydrate content of all the ice cream samples were below 28.98 ±0.29. In terms of the physicochemical properties of the ice cream, the pH values ranged from 6.43 to 6.73. The value of the specific gravity (S.G) increased as the quantity of cow milk used in the production of the ice cream increased except for sample B (50% cow milk and 50% tigernut milk ice cream).The same trend was repeated for the solid non-fat (SNF) and the % total solids. The percentage total titratable acidity (TTA) had the highest value of 0.146 for sample B (50% cow milk and 50% tigernut milk ice cream) while the least value was sample A and C with both having value of 0.141. The ice cream samples were evaluated for sensory attributes of colour, taste, flavour, mouth feel (texture) and general acceptability. In terms of colour, taste, flavour and general acceptability the panelist preference decreased with increased addition of tigernut milk in the ice cream production. The texture of the control sample had the highest value of 6.08±1.16 while sample E (100% tigernut milk ice cream) had the least score for texture with a mean value of 4.08±1.31. This work showed that acceptable ice cream could be produced by substituting cow milk with tigernut milk with good sensory properties preferably at 40% - 50 % substitution of cow milk with tigernut milk. In addition there is improved nutritional content with respect to the percentage protein content which will go a long way to alleviate protein malnutrition. The pH of all the samples were near neutral pH, this could negatively affect the shelf stability of the ice cream as a result of possible microbial infestation and thus there is every need to keep the product always refrigerated before use.

Key words: cow milk, tigernut milk, blend, ice cream

INTRODUCTION

Ice cream is a frozen dessert usually made from dairy products, such as milk and often combined with other ingredients and flavours. In addition to dairy products, ice cream contains sugar, stabilizers, emulsifiers, flavouring materials, water and air. The mixture of these ingredients, before air is incorporated and the mixture frozen is known as ice cream mix. The composition of ice cream varies depending upon the ingredients used in the preparation. The percentage composition of good ice cream is: 12% milk fat, 14% milk solid non–fat, 15% sugar, 0.2% stabilizer, 6.2% emulsifier, 55-64% water which comes from the milk or other ingredients and a trace of vanilla. This composition is exclusive of air. That is they are based on the weight of ice cream mix because ice cream is a whipped product and contains a great deal of air to prevent it from being too dense, too hard, and too cold in the mouth. The total solid is about 38.4%, the remainder would be water. Addition of ingredients such as nuts, fruits, chocolate and additional flavour will result in the change of the composition.

Over the years, attempts have been made to find cheaper substitutes for cow milk, due to the rising cost of cow milk and its products irrespective of its high nutritional quality in terms of proteins. The development of tigernut (*Cyperus esculentus)* based milk is a cheap substitute for traditional cow milk. In Nigeria, cow milk is predominantly used to produce commercial ice cream, while hardly any attention has been given to the use of nuts, milk extract or in combination with milk to produce palatable ice cream (Mordi, 2003). Tigernut is included as one of the underutilized crop and commonly known as “earth almond”, “chufa” and “zula” nuts. Tigernut can be eaten raw, roasted, dried, baked or be made into refreshing beverage called “Horchata De Chufas’ or tigernut milk. Tigernut is rich in dietary fibre, minerals like potassium, phosphorus and Vitamins E and C. Thus the objective of this study was to evaluate the physicochemical, proximate and sensory properties of ice cream from blends of the cow and tigernut milk.

MATERIALS AND METHODS

Sample collection

Fresh tigernut seeds were purchased from Ekeukwu market in Owerri municipal council of Imo state, Nigeria. Commercially available ingredients such as stabilizers, vanilla, sugar, egg, and milk were obtained from one of the stores in the market.

Sample preparation

Preparation of tigernut milk

About 500g of tigernut seeds were sorted and washed in mixture of water and salt. It was then grinded with kitchen blender and the milk extracted with a muslin cloth that was placed on a plastic jar. One liter of water was used to aid the extraction of the milk leaving behind the chaff (Mordi *et al.,* 1999).

Preparation of cow milk

About 100g of powdered milk (Cowbell) was reconstituted with 1000ml of warm water at about 40^0C.

Preparation of ice cream

The ice cream samples were prepared with the recipe described by Bear (1993). It was done by blending cow milk with tigernut milk in the following ratios: Sample A= (100:0), Sample B= (50:50), Sample C= (60:40), Sample D= (40:60) and sample E is 100% tigernut milk = (0:100). Sample A which consists of 100% cow milk ice cream served as the control. The liquid ingredients were mixed together in a mixing vat and brought to about 43^0C. The dry ingredients were added to the warm mix and were stirred very well after which it was pasteurized at 71^0C for 30min. It was later homogenized, cooled and freezed prior to analysis.

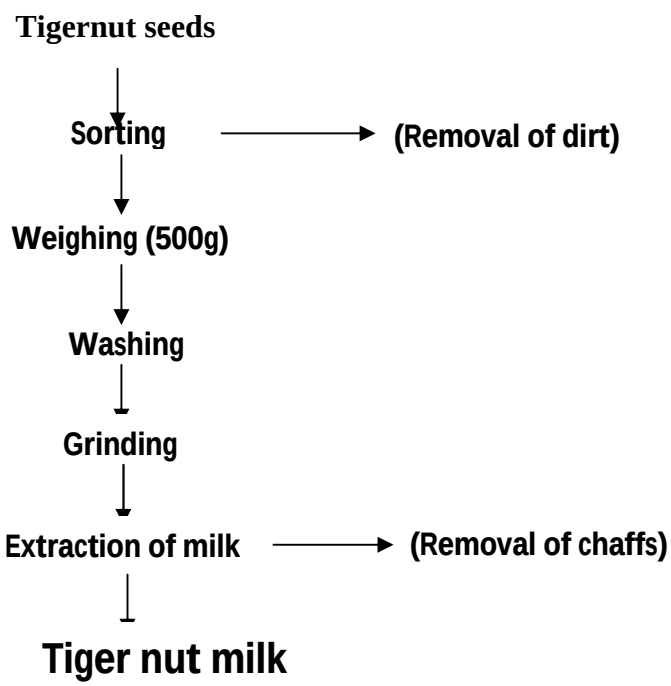

Fig. 1.0 Flow diagram for the production of tigernut milk

Source: Mordi *et al.*, (1999).

Table 1.0 The recipe for the production of ice cream from blend of cow and tigernut milk

Samples	Egg	Cow milk (ml)	Sugar (g)	Water (ml)	Vanilla (ml)	Stabilizer (g)	Tigernut milk (g)
A	2	200	10	10	5	10	-
B	2	100	10	10	5	10	100
C	2	120	10	10	5	10	80
D	2	80	10	10	5	10	120
E	2	-	10	10	5	10	200

Sample A = 100% cow milk ice cream

Sample B = 50% cow milk and 50% tigernut milk ice cream

Sample C = 60% cow milk and 40% tigernut milk ice cream

Sample D = 40% cow milk and 60% tigernut milk ice cream

Sample E = 100% tigernut milk ice cream

PROXIMATE ANALYSIS

The percentage moisture, crude protein, fat, fibre, ash and carbohydrate were determined by the standard methods of AOAC (1990).

Determination of physicochemical properties of ice cream from blend of cow milk and tigernut milk

pH Determination

The pH was measured directly using a pH meter (Jenway model-England). This was turned on and allowed to become stable; 20 ml of the buffer solution was poured into a clean 50ml polypropylene beaker. The electrode was immersed into the buffer solution. After this, the temperature was adjusted to buffer solution temperature using the temperature control knob. The buffer solution was removed and the electrode rinsed with distilled water. About 20ml of sample was put in a 50ml polypropylene beaker. The electrode of the pH meter was put inside the sample while gently agitated. Finally the pH was read directly from the screen of the meter when the point was steady.

Total Titratable Acidity: This was determined by the method described by A.O.A.C (2000).

The Specific gravity determination

This was determined by the pycnometer gravimetric method described by James (1995). A specific gravity bottle (pycnometer) was washed and allowed to dry at room temperature. It was stopped and weighed (w), it was then filled with distilled water up to the capillary of the stopper. The outside of the bottle was carefully dried with a blotting paper and it was weighed full of water, then the water was decanted and the bottle was rinsed with ethanol and allowed to dry. It was filled with the test juice sample. It was re-weighed. The weight of the sample and that of its equal volume of water were determined by difference.

Calculation

$$\text{Specific gravity} = \frac{Ws-Wa}{Ww-Wa}$$

Where;

Wa=weight of empty pycnometer

Ws=weight of pycnometer filled with sample

Ww=weight of pycnometer filled with distilled water

Determination of total solids

The gravimetric method described by AOAC (1990) was used. A measured weight of the sample was weighed into a previously weighed moisture can. It was first evaporated to dryness over a steam-bath and was dried in a Gallemkamp (made in England) moisture extractor oven at 105^{O} for 3h. It was cooled in a desiccator and weighed. The weighed sample was returned to the oven for final drying. Thereafter, it was cooled and weighed at an hourly interval until no further difference in the weight was observed (this is, constant weight is observed). The moisture content was calculated as a percentage ratio of the weight of moisture content, to that of the weight of sample analysed. The formula below was used.

$$\% \text{ M C} = 100 \times \frac{W_2 - W_3}{W_2 - W_2}$$

Where

MC =Moisture content

W_1 = Weight of empty moisture can

W_2 = Weight of moisture can + sample before drying

W_3 = Weight of moisture can + sample after drying to constant weight.

% dry matter (Total solid) = 100 -% MC

Determination of solid non-fat

This was estimated by difference as the solid non-fat (SNF). It was calculated as shown below

% Solid non-fat = % Ts -% fat

Where Ts = Total solids

SENSORY EVALUATION

Sensory evaluation of the five ice cream samples produced from blend of cow milk and tigernut milk was conducted using 12 member panelists. Ice cream quality was judged in terms of appearance/colour, taste, flavour, mouth feel (texture) and overall acceptability. The 7-point hedonic scale (7 -like extremely, 4 – neither like nor dislike, 1 – dislike extremely) as described by O'Mahony (1986) was used.

STATISTICAL ANALYSIS

All data were subjected to analysis of variance (ANOVA) and means were separated by Fisher's Test at 5% level of significance to establish where there were significant differences between the means (O'Mahony, 1986).

Results and Discussion

Proximate Composition of ice cream samples from blend of cow milk and tigernut milk

The result in Table 2.0 shows the proximate composition of the ice cream samples formulated through the blend of cow milk and tigernut milk at different ratios to give five ice cream samples.

The percentage crude protein content

The crude protein content for ice cream samples A, B, C, D, and E were 7.38±0.02, 14.17±0.42, 9.05±0.21, 9.53±0.21, and 8.06±0.21 respectively (Table 2.0). The ice cream sample produced from the blend of 50% cow milk and 50% tigernut milk had the highest percentage protein content of 14.17± 0.42 (Sample B) while the least protein content was recorded for the 100% cow milk ice cream (Sample A) with a value of 7.38±0.02. The reason for sample B having the highest protein content could be that the tigernut milk contained substantial amount of protein that added up to the protein of the cow milk. According to Adejuyitan (2011) tigernut is high in protein, starch and glucose. Proteins help to incorporate air into the mixture helping to form small bubbles of air. They modify the texture of ice cream in other ways as well making it chewier and giving it body. It also help to emulsify the fats, keeping the fat globules suspended in the mix. The high protein and calorie content of the tigernut milk could solve the problem of protein-calorie malnutrition in Africa more so that the high price of imported milk and milk products coupled with poor milk production in Nigeria (Adejuyitan, 2011).

Percentage fat content

The fat content of the of the ice cream samples made from blend of cow milk and tigernut milk ranged from 8.64±0.02 to 10.33±0.08. The fat content of all the samples were not significantly different at $P<0.05$. The relatively low fat content of 100% tigernut milk ice cream (8.64±0.02) implies that tigernut milk extract contains low fat compared to cow milk (Table 2.0). Thus the fat content in the ice cream samples decreased as the quantity of tigernut milk blended with cow milk increased except for sample B

(50% cow milk and 50% tigernut milk ice cream). This is because cow milk and cream are sources of butterfat. Goff (2008) reported milk fat content of ice cream to be greater than 10% and could be as high as 16% in some premium ice creams. It is only the 100% cow milk ice cream that agreed with the report of Goff (2008) of all the samples of ice cream with a value of 10.33±0.08. Milk fat and milk solid non-fat constitutes about 60% of the total solids of ice cream. These component give ice cream a rich flavour, improve body and texture. This implies that the control sample (100% cow milk ice cream) may likely have better sensory qualities than ice creams made from blend of cow milk and tigernut milk.

Percentage ash content

The ash content of the ice cream samples ranged from 0.60±0.03 to 1.71±0.01. The ash contents were not significantly different at $P<0.05$ for all the samples. Sample A (100% cow milk ice cream) had the highest ash content of 1.71±0.01 while the least was sample E (100% tigernut milk ice cream). The value of ash content decreased as the quantity of tigernut milk blended with cow milk increased except for sample B (50% cow milk and 50% tigernut milk ice cream). This implies that cow milk had more ash content than tigernut milk. Ash content is an indication of mineral content of the ice cream samples.

Table 2.0: Mean proximate composition of ice cream from blend of cow milk and tigernut milk.

*Samples / Parameters	A 100:00	B 50:50	C 60:40	D 40:60	E 0:100	LSD
% Protein	7.38±0.20^{e}	14.17±0.42^{a}	9.05±0.21^{c}	9.53±0.21^{b}	8.60±0.21^{d}	0.44
% Fat	10.33±0.08^{a}	9.69±0.03^{a}	9.91±0.03^{a}	9.57±0.03^{a}	8.64±0.02^{a}	-
% ash	1.71±0.01^{a}	0.74±0.01^{a}	0.80±0.02^{a}	0.65±0.03^{a}	0.60.±0.03^{a}	-
% MC	51.34±0.02^{e}	65.37±0.34^{b}	62.24±0.02^{c}	67.27±0.07^{d}	70.01±0.45^{a}	0.18
% Crude fibre	0.25±0.02^{a}	0.17±0.02^{a}	0.12±0.02^{a}	0.09±0.02^{a}	0.03±0.02^{a}	-
% Carbohydrate	28.98±0.29^{a}	7.85±0.62^{e}	14.87±0.22^{c}	17.90±0.12^{b}	11.54±0.51^{d}	0.61

Means in the same row with the same superscript are not significantly different ($p<0.05$).

* The samples ratio represents the blend of cow milk and tigernut milk for the production of the ice cream.

Sample A = 100% cow milk ice cream, Sample B = 50% cow milk and 50% tigernut milk ice cream, Sample C = 60% cow milk and 40% tigernut milk ice cream, Sample D = 40% cow milk and 60% tigernut milk ice cream,

Sample E = 100% tigernut milk ice cream

Percentage moisture content

The percentage moisture content (%MC) for ice cream samples A, B, C, D, and E were 51.34±0.02, 65.37±0.34, 62.24±0.02, 67.27±0.07, and 70.01±0.45 respectively (Table 2.0). The moisture content of all the samples were significantly different at $P<0.05$. The moisture content increased as the quantity of tigernut milk blended with cow milk increased in all the samples. This implied that the tigernut milk contributed more to the moisture content of the ice cream samples than the cow milk with respect to the recipe used. This is because fresh tigernut is high in moisture content with value of 88% as reported by Elana Sanchez-zapata *et al* (2012). According to Goff (2008) the moisture content of ice cream ranged between 55% -64% which comes from the milk or other ingredients.

Percentage crude fibre

The crude fibre content of the ice samples produced from blend of cow milk and tigernut milk ranged from 0.03±0.02 to 0.25±0.02. The crude fibre contents were not significantly different at $P<0.05$ for all the samples. It decreased as the quantity of tigernut milk blended with cow milk increased. The crude fibre content of all the samples were relatively low compared to some other food products. The reason may be that the tigernut which is naturally rich in fibre contributed little fibre to the ice cream since only the milk extract was used and not the whole nut. According to Adejuyitan (2011) tigernut were valued for their nutritious dietary fibre, starch content and carbohydrate. This implied that tigernut milk extract (unlike the whole nut) used in the blend to produce ice cream was low in fibre and may not help solve the health challenge of those whose diet are low in fibre like constipation.

Carbohydrate content

The carbohydrate content of the ice cream samples made from blend of cow milk and tigernut milk were 28.98±0.29, 7.85±0.62, 14.87±0.22, 17.90±0.12 and 11.54±0.51 for samples A, B, C, D, and E respectively. The samples were all significantly different at $P<0.05$. The carbohydrate content of the ice cream was highest in the control sample (100% cow milk) with a mean score of 28.98±0.29 while the least value was obtained with ice cream produced with 100% tigernut milk-Sample E with a value of 11.54± 0.51 (Table 2.0).

Physicochemical properties of the ice cream produced from blend of cow milk and tigernut milk

pH of the samples

The physicochemical composition of ice cream produced from the blend of cow milk and tigernut milk is as shown in Table 3.0. The pH values for all the samples ranged from 6.43 to 6.73. The pH of all the samples were near neutral pH and since lower pH (acidic) in foods helps to reduce the activity of spoilage microorganism it implies that all the ice cream samples may have low shelf stability. Thus there is need for cold storage in order to extend its shelf stability.

The Specific gravity

The specific gravity of the ice cream samples were 1.249, 1.218, 1.236, 1.250, and 1.246 for samples A, B, C, D and E respectively (Table 3.0). The values of the specific gravity (S.G) increased as the quantity of cow milk used in the production of the ice cream increased except for sample B (50% cow milk and 50% tigernut milk ice cream). Sample A (100% cow milk ice cream) had the highest S.G of 1,249. The

high content of the S.G of some samples of ice cream could be attributed to the high content of total solids present in the ice cream sample. This implied that samples with high total solids had less moisture content which added weight to the ice cream mix resulting in higher specific gravity.

Percentage solid non-fat

The solid non-fat for all the ice cream samples ranged from 21.35 to 38.33. The solid non-fat decreased as the amount of tigernut milk increased. It was highest for the controls sample A (100% cow milk ice cream) with a value of 38.33% while the least was ice cream made from 100% tigernut milk (sample E) with a value of 21.35%. Ice cream recipe low in solids results in foam collapse and loss of overrun and excessive shrinkage can result from partial melting at too high a freezer storage temperature.

Percentage Total Solids

The percentage total solids for the ice cream samples ranged from 29.99 to 48.66. The value of % total solids increased in all the samples as the proportion of cow milk added increased except for sample B (50% cow milk and 50% tigernut milk ice cream). Insufficient total solids in ice cream results to poor textural quality such as coarse texture, weak body etc.

Total Titratable Acidity

The percentage total titratable acidity (TTA) had the highest value of 0.146 for sample B (50% cow milk and 50% tigernut milk ice cream) while the least value was sample A and C with both having value of 0.141. The percentage TTA did not follow a reverse trend with the pH. Ice cream with very low total acids could encourage the growth of proteolytic and lipolytic bacteria which are implicated for deterioration of ice cream not adequately refrigerated.

Table 3.0: Physicochemical composition of ice cream from blend of cow milk and tigernut milk.

*Samples / Parameters	A 100:00	B 50:50	C 60:40	D 40:60	E 0:100
pH	6.43	6.48	6.44	6.73	6.64
Specific gravity	1.249	1.218	1.236	1.250	1.246
% Solid non-fat	38.33	22.95	28.16	24.84	21.35
% Total Solids	48.66	32.63	37.73	34.76	29.99
Total Acids	0.141	0.146	0.141	0.116	0.119

* The samples ratio represents the blend of cow milk and tigernut milk for the production of the ice cream.

Means in the same row with the same superscript are not significantly different ($p<0.05$).

Sample A = 100% cow milk ice cream, Sample B = 50% cow milk and 50% tigernut milk ice cream, Sample C = 60% cow milk and 40% tigernut milk ice cream, Sample D = 40% cow milk and 60% tigernut milk ice cream,

Sample E = 100% tigernut milk ice cream

Sensory evaluation of ice cream samples from blends of cow milk and tigernut milk

The sensory scores of the ice cream samples were as shown in Table 4.0. The scores of the taste of the ice cream samples ranged from 4.25±0.97 to 6.50± 0.67. The highest score for taste was recorded for the 100% cow milk ice cream (control) with a mean score of 6.50± 0.67 and the lowest was sample E (100% tigernut milk) with a mean score of 4.25±0.97. The mean score for taste in all the ice cream samples decreased as the amount of tigernut milk blended with cow milk increased. This indicates that increase in the tigernut milk content alters the normal taste of ice cream. This agrees with the work of Mordi *et al* (2005). In terms of colour and flavour a similar trend with the mean scores for the taste was repeated Table 4.0 .The panelists scored highest with respect to general acceptability for the control sample (100% cow milk ice cream) with mean score of 5.83±0.58 followed by sample B (50% cow milk and 50% tigernut milk ice cream) while the least accepted was sample E (100% tigernut ice cream). This implied that the more tigernut milk blended with cow milk in the production of the ice cream the less its acceptability by the test panel and vice versa

Table 4.0: Mean sensory scores for ice cream made from blend of cow milk and tigernut milk

*Samples / Parameters	A 100:00	B 50:50	C 60:40	D 40:60	E 0:100	LSD
Taste	6.50±0.67^{a}	5.58±0.67^{b}	5.83±0.58^{ab}	5.08±0.90^{bc}	4.25±0.97^{c}	0.84
Colour	6.25±0.62^{a}	5.67±0.78^{ab}	5.83±0.58^{a}	4.67±1.72^{c}	4.08±0.67^{c}	0.88
Flavour	6.08±0.29^{a}	5.33±0.49^{b}	5.5±0.78^{ab}	5.00±1.04^{bc}	4.58.±1.13^{b}	0.62
Consistency (Mouth feel)	6.08±1.16^{a}	4.92±1.93^{ab}	4.75±0.97^{b}	4.83±0.94^{b}	4.08±1.31^{b}	1.19
Acceptability	5.83±0.58^{a}	5.25±0.45^{b}	5.00±0.43b^{c}	4.42±0.10^{d}	3.67±0.98^{e}	0.44

Means in the same row with the same superscript are not significantly different ($p<0.05$).

* The samples ratio represents the blend of cow milk and tigernut milk for the production of the ice cream.

Sample A = 100% cow milk ice cream, Sample B = 50% cow milk and 50% tigernut milk ice cream, Sample C = 60% cow milk and 40% tigernut milk ice cream, Sample D = 40% cow milk and 60% tigernut milk ice cream,

Sample E = 100% tigernut milk ice cream

Conclusion

In conclusion an ice cream with acceptable sensory attributes like taste, flavour and consistency (mouth feel) could be produced from blend of cow milk and tigernut milk at 50% level of substitution of cow milk with tigernut milk but preferably at 40% cow milk substitution with tigernut milk. In addition the high protein and calorie content of ice cream produced from blend of cow milk and tigernut milk could solve the problem of protein-calorie malnutrition in Africa more so that the high price of imported milk and milk products coupled with poor milk production in Nigeria (Adejuyitan, 2011). In addition considering the nutritive and health benefit of tiger nut which is considered to be one of the underutilized tubers, its incorporation in ice cream production has increased its utilization and health benefit derived from it.

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GENDER –F. REOGRANIZATION VIZ–A-VIZ GENDER –M ASSOCIATION AND DISSOCIATION EMPOWERMENT: A SOCIAL-ECONOMIC VALUE RE-ENGINEERING IN TANZANIA (AFRICA)

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A B S T R A C T

The current literature review the dynamics of value creation and recreation (v = B/c) in the context of gender – F and Gender – M. Models are generated to review association and dissociations summarized in table 3 and figure 2 networks as expressed by Msaki (2011) models and re-evaluated through wealth re-engineering arithmetic, whereby gender balance is needed through value –redistribution association between gender – F and gender – M. The spirit of dominance needs to be diffused through cost – benefit approach, so as to empower gender – F and promote gender equity.

The dynamics behind gender – F, motivates gender – M to act towards positive direction, with reflection from past, present and future dimensions (fig. 3). Experience through association dissociation in gender roles, recreate valuable and experienced gender balanced economy and society, strategically through behavior and attitude transformations, qualitatively with technology and skills in place (G-M1:R_1) viz society B. in (fig. 2). Men (G-M1:R_1) progress and gender – F should be taken as a dynamic stimuli towards organizational context to motivate gender – M for associative progress with experience (G-M1:R_1).

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Key Words: Transformation, Gender –F, Gender –M, Gender Mix, Social Drift, poverty degradation, environmental degradation, dissociation, association, participation Model E-P, competition, Disempowerment, value stereotype, abiotic, biotic, development, progress

1. Historical Ground and Re-thinking Necessity (Review)

One of critical and germinating ground of social ideas and research is that it faces a constant engagement of biotic and abiotic dynamisms. The current paper takes not only perceptional approach but also transformational approach, to re-link between empirical context and theoretical framework. One can re-think on acceleration in processes of global integration and interdependence forces at sociological and psychological perspectives. The essence of gender empowerment variables struggle is to reduce social deficits, whereby a theoretical linkage appears not to foster empirical discharges. The image in academics of gender and empowerment not only show abstract feature, but also dynamism in class struggle between men-women classical relationships…. Much needs to be researched and re-thinked.

Stiglitz (2003:318) comments in his book that, "There is a common ground to which politicians of all persuasions appeal. "democracy," "family values" Community", "opportunity" "equity", "free markets", "freedom", "justice" …. But what is meant by these slogans can differ markedly….." Considering sharing and distribution and empowerment, one cannot avoid the complexity within which the minds of society need to pass through by reconsidering the roles of men-women in the dynamic sociology, for the re-approach of gender being referred to women and men roles and responsibilities that are socially determined. How the society is perceived and expected to think and act as women and men because of the way the society is organized, not because of biological differences considering a financial or economic approach, on needs to think critically to a degree in bringing a concern of gender and empowerment into the mainstream of development.

2. What Needs to Change to Suit Development Resources?

Much have been said on transformational approaches for example, evaluation of the implementation of gender to empower policies in the mainstream of development, reveals policy evaporation as it fails to reflect commitment within gender systems. Who should own the critical part of financial organization of the society? Who has been a resource searcher and who has been a resource organizer? A compelling financial system and enterprises should question the gender role, based on efficiency of allocation of funds for example for social development with the immediacy of circumstances, example; social dimension, economic dimensions and environmental dimension. A new set of rules should therefore be made to ensure gender participation for future sustainability…. What needs to be cemented? Is it more beneficial for a local community to maintain its industry and its social cohesion or should it aim for quick, but unsustainable financial profit?

Social dimension in gender and empowerment, in the context of development economies calls for greater acceptance of diversity, to re-value with equal access to financial services, for basic and extended needs in the whole society …. Is this a good practice for gender financial capacity building? Who has power to organize for financial capacity building? Who ahs power to organize for financial capacity women or men? Can the society re-organize itself to suit its priorities? Who has to re-organize the financial means to create sustainable development to nurture the community (whose role)? Who has

to re-define it? With cultural re-definition H.E. Mr. Abdou Diof, the President of Republic of Senegal, 1994 commented that, "Development will not be suitable, unless it originates from the concept of local development based on efforts of the local population who respect priorities that they themselves defined". ….what should be a gender linked principle, while re-considering re-distribution of financial resources? …..shared goals, shared planning? Something to teach and learn among gender systems?

Though the resources under discussion appear to be majority finances, more of essential resources need to be reconsidered on gender and empowerment. To review the complementary and interdependent nature of gender roles, it is significant to challenge those stereotypes and attitudes that keep people or one social sect in low status ….what is the role of finance>? What power in terms of value generics, re-defines women and men roles in development? What prevent them to attain their full potentials?

Women and men have to build respect for each other's roles and goals in life to ground on reality of social-economic dynamics…. This becomes the true nature of empowerment, though African cultural set up has been used to justify inequalities and constraints in sharing and making social decisions in terms of financial matters. Re-visiting the conceptual power, men physical strengths may have transform the social psychology to be linked to the power to make financial decisions…. Furthermore, women's capability to give birth may have pushed men to asset power over women's mysterious capability…. so as power to re-organization of finances and resources. Does wives income increase means more peace in the household? Why have gender studies have been focusing with emphasis on women empowerment?

According to Economic and Social Council of the United Nations: Mainstreaming a gender perspective is the process of assessing the implications for women and men of any planned actions, including legislation; policies or programs in any area, and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension in the design, implementation, monitoring and evaluation of policies and programs in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality". From the cultural dynamics, equality comes through legal consensus being reinforced to streamline control mechanisms in the resources.

3. Gender and Empowerment: From Thinking to Conviction Mechanism

Charlotte Perking Gilman highlights that; "there is no female mind. The brain is not an organ of sex as well speak of female liver….."

Therefore gender-empowerment dynamics in finance needs specialty on how one move from thinking to conviction to achieve not sex differences. This becomes the competence development needed. The problem in most society is to re-think an option by changing the thinking which is traditionally not suitable to current dynamics. Real development lies in the capacity building of the community, based on their own ideas and strategies as a community.

For gender mainstream to be institutionalized in the financial industry, collective choices could be done in two distinct areas.

(a) **Social Choice Theory**: An abstract analysis of non-market decision making, without institutional structure other than preferences. Therefore social existence and stability through flexibility to create social equilibrium.

(b) **Public Choice Theory**: Pays more attention on structural set-up this rules which prescribe collective choice.

The linkage of the above options will automatically, create a process of Gender mainstreaming for equitable development in men and women. Joshua T. B. on the "Confession of the Faith", enhances the transformational change of mind to reality as: "They would begin to grow in our mind and gains supremacy over the thinking processes when we come to the point of conviction…. The words we speak determine the kind of life we enjoy. Our life will always go to the level of our thoughts, our world and words express our thoughts which are the seeds of our life…. When you think right you are training yourself to act right". Gender mainstreaming based on the choice should start with mind re-engineering for both women and men towards resource re-engineering therefore from thinking to conviction to reality. What is in the mind needs to be used.

The terms and theories in gender and empowerment should never be fanciful constructions, but theories to apply from thinking dynamics to action benefits. Rahnema (1992:122). Create the notion that; empowerment was originally intended to support the idea of participation and to equip development again with another source of legitimacy …logically.

When **A** considers it is essential for **B** to be empowered, **A** assumes not only that has no power – or does not have the right kind of power, but also that **A** has the secret at formula of power to which **B** has to be initiated.

In the current world women in the context of culture, economy and social aspect are to be empowered to think otherwise from the shadow of men dominance few skills considered are shown under table 1: Value should be created fro empowerment.

Table 1: Empowerment through skills reconsideration: women

W – Strategic Skills (A)	W- Behavior skills (B)	W-Quantitative Skills (C)	W – Multiples
- Strategic thinking and doing - Strategic alliance and relationship - Strategic learning and applying - Strategic cost reduction action - Learn frameworks such as Law, Policy	- Adaptive behavior to be learnt - Learning behavior - Creative and innovative behavior in every action - Positive Attitude - Change to positive action and mind - Collaborating in qualities. - Thinking capacities	- Computational skills to measure both feedback and feed forward - Literacy and education to manage and control - Specific needs to develop technical skills - Learn multiple skills and surviving techniques - Collaborate in Quantities	- Take a Multiple - Role in society - Create Multiple Platforms to support growth and surviving.

Source: Dr. Msaki J. L. (2010): Through review of Major Literature (References)

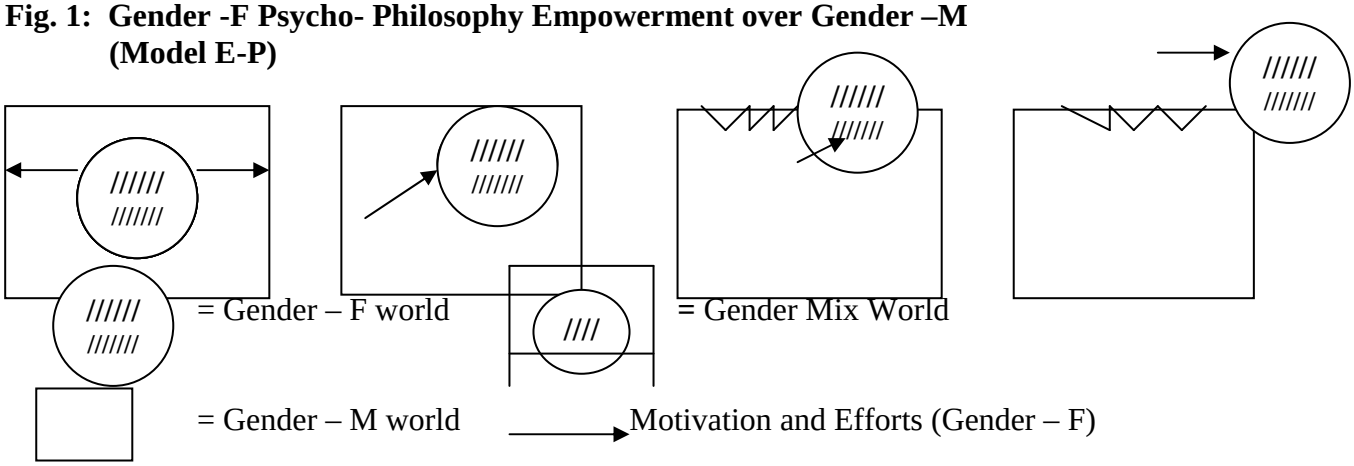
From the above table, gender issues are linked through participatory mechanism, to empower gender F, from traditional structures were by men (Gender –M) is not ignored but, learning mechanism allows gender –F to be independent and motivated to act as a self-reliant element as shown in figure 1 by Dr. Msaki J. L. Participatory Approach to whatever we do within gender – mix diffuses negativity in a supportive, motivating environment.

The gender analysis therefore in this context will lead to sustainable, equitable and effectiveness in whatever individual need to achieve. Women need not to wait for men to act responsibly towards social economic development. From quantitative nature, in Table 1, Resources and Benefit and who uses and control them, stands to be an important concept to be discussed between men and women viz (gender –M) and (gender –F) respectively. The two genders become gender – mix. The concept of gender is more linked by many to female perspective, but this is not the truth rather one can ask a simple question: What can we do to better involve both women and men in forestry?

The role of women in social and economic issues is very much known, based on their organizing efforts and contribution to the society and economy. Women appear to exceed men in terms of population structure, yet men dominate the economic and social structure in Africa. The touch of resources, through forestry, women can be censored by the significance of the resource-trees and climate, in serving their family so their society. Focusing on dependence in Tanzania fore example, Agriculture sustains 80 percent of population, where women participate actively on, especially in rural areas. Suitable environment in favorable climate for their social and economic sustainability needs empowerment mechanism, through skills mentioned in table 1. The empowerment for gender –F is not to overpower gender –M but to improve their efforts to be reliant and independent as discussed in figure 1 by Dr. Msaki J. L., to be the index of gender F progress. Progress to act against negative value

creation; where poverty degradation is linked to environmental degradation and therefore social drift. …. Gender F need o negotiate with gender –M, not to fight but to be empowered through skills to train gender –M skill based on tale 1 in order to be able to create social and economic reconstruction based on their natural power or organization viz. figure 1.

Fig. 1: Gender -F Psycho- Philosophy Empowerment over Gender –M (Model E-P)



Source: © Dr. Msaki J.L. (2008)

Rahnema (1992:122) highlight that; the concept of powerlessness and empowerment is only useful to the "development machine" itself, because it helps to convince targeted groups of people that economic and state authorities have the real power and that the power is everyone's reach when people actively and willingly participate in the intended development scheme, participation and empowerment thus have close relationship". The economics of participation defines participation as a dynamic group process in which all members of the group work for the attainment of common objective …think of decisions, gains, relationship, and rules in common, power and activities.

Figure 1, by Dr. Msaki J.L. creates a participatory experiment for gender –F, while seeking independence to grow and develop as an opportunity cost. Currently in several world spaces we see and observe the power of women to control and improve societal organization by identifying their social and economic roles socially and economically while stabilizing their families. This creates a timely Gender –F empowerment through Psycho-learning philosophy. Model E-P in figure 1 – therefore emphasizes that in development of social and economic worlds, development per-se has no cultural barrier, gender barrier, religion barrier or environmental barrier…it concerns the "prism" through which multilateral partnership could be assessed and therefore needs a full evaluation to evolve practical remedies appropriate responses which are universally valid .Africa prospects, focusing on millennium Goals improve, but how should we see the effects on women (Gender –F) across cutting cross issues such as climate? Who gets affected? Think on women (Gender – F) all over the world platform and performance with different roles; This includes reproductive work that is child bearing and rearing responsibilities, preparing food what not? The situation in Africa is rather complex. How should gender –F be supported? Think of table 3 and table 4 perspectives for example.

In 2003 agriculture in Tanzania, accounted for half of the country's gross domestic production (GDP) provided 51 percent of foreign exchange and employed 80 percent of the labour force (Agricultural Marketing Policy 2005). There are evidences that female (Gender –F) food crop – entrepreneurs in Tanzania form an essential distribution link in ensuring food security in big sites and town (Ellis *et al.*,

2007; Eshola 2005) demonstrated that there is an important element of female entrepreneurs as a group in supporting both economic growth and food security in Tanzania. What needed by women (Gender – F) according to table 1, in summary, is kno3ledte, self confidence and skills and sometimes very small amount of funds (money), to be empowered to move positively the society. This needs a support from men (gender –M) therefore at the later stage whatever created, takes both efforts gender –F and gender – M becomes gender –Mix (see Fig. 1 and Fig. 2 perspectives). For both gender –M, gender –F, critical link in observed as joint group (gender –Mix), that "The people who succeed in this world are the people and if they cannot find them they make them". George Bernard Shaw. Ghamuga (1998) indicated the benefits, which women (gender –F) get through working in groups (associations) viz the concept related to (gender –mix).

Table 2: Associative Benefits and Members Responses

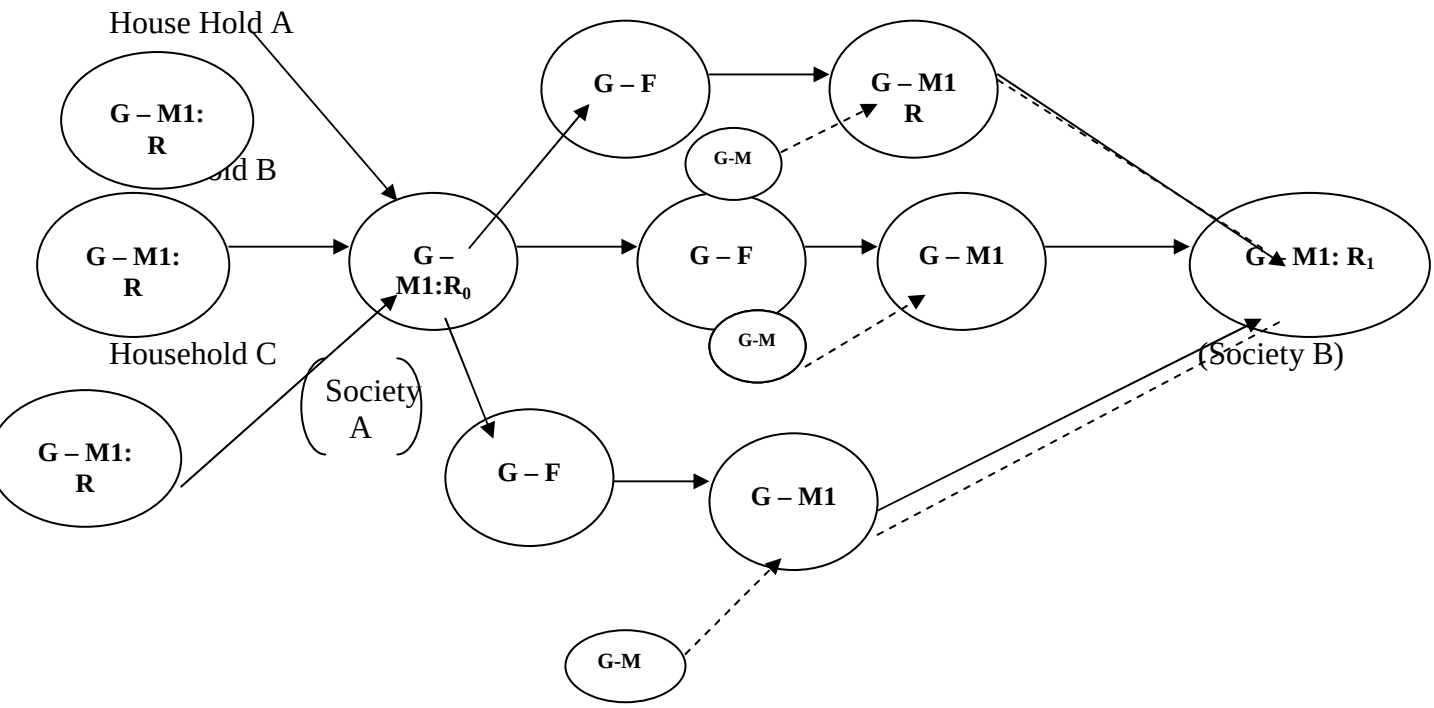
S/N	ASSOCIATIVE BENEFIT – B	RESPONDENT SUM	RESPONDENT PERCENT – B	GENDER REFLECTION
1.	Acquisition of Knowledge and Skills	110	50.7	?
2.	Raising of One's Economic Status	40	18.4	G – F? : G - M
3.	Forum for Exchanging Ideas and Experience	23	10.5	G – F? : G - M
4.	Assistance in the Time of Difficult	23	10.2	G – F? : G - M
5.	Sympathy from others	12	5.6	G – F? : G - M
6.	Availability of Market	10	4.6	G – F? : G - M

Source: Ghamunga (1998) Modified by Dr. Msaki J. L. on Gender F –M.

The core aspect of gender –F power and the concept of empowerment therefore are not for "competition," but for associative development. The problem with our policy to link this is not the structure, but the psycho - implementation and action – implemented and management end. Poverty is still widespread in Tanzania and the gap between poor and rich keeps on widening ….what is our role associatively? Tanzania is number 18 from the bottom on Human Development Index (HDR, 2008), ranking 15th out of 177 countries. With this women (gender – F) reflects its critical means and ends. Mothers have always been sources of courage, family organization and multiple tools to restructure household living in connection to mother – earth …. a unique gender – F pre-occupation.

Millennium Goals need to be attained through social re-organization and social mobilization. Change of the attitude for both men (gender – M) and gender F (women) has great force at an individual level and group level (Participatory approach). Differential attitude in both genders is not for competition but for cooperation associatively…. This should be tracked down in all sectors of the economy (see table 3) where a comparative contribution could be keenly restructured in terms of employment balance tuning. The table 3 support figure 2 dynamism (associative links between gender –F and gender –M in context) - A value chain Association.

Fig. 2 Empowerment: Gender –F vis-à-vis Gender –M Associations



Source: © Dr. Msaki J.L. (2011

Phase I	Phase II	Phase III	Phase IV	…….	Phase V
(Fig. 2 = A	(Fig. 2 - B	(Fig. 2 = C	Fig. 2 = D		(EXTENSION)

Fig. 1 contemplates fig. 2. Mechanism with 5 -phases and motives. The philosophy behind figure 2 is association to dissociate to associate. In this context gender – F enters the world of gender –M through family perspective whereby each gender defines its roles whether socially or economically and resources are linked and shared (expected to be shared equitably with a balanced power) therefore the gender mix in relation (G)M1:R). The identities fro male and female become clearly defined but still are shared (G-M1: RO). The phase extends to phase III where there appear a conflict of interest, distribution, sharing, responsibility socially and economically between genders in terms of power, organization, contribution and roles. Therefore separation of gender psychology, actions and philosophy become the reality and from above model groups become visible G-F, G- M, which shows the same separation can be attached at the societal level whereby G-F tries to organize itself and become powerful and responsible for economic and social value. The value of organization is shown clearly in G-F than G-M; therefore the cycle for gender –F is bigger than gender –F.

The power to re-organize family power and resources continues under the umbrella of G-F and this attracts and enhances gender, G-M to get attracted towards value based established by family lie ups and social economic organization power from gender –F. Phase IV, gender – mix become prominent to

enhance the same value towards gender: G – MI:R_1, that is the phase V, which again the process can repeat itself.

G – MI: R1: The Link between Fig. 1, Figure 2 and Value in Associates

In the society both genders, F and M consider their roles in terms of value creation (v) and value addition v+) which need both strategic skills, behavior skills and quantitative skills to be discharged to the societies (society A and Extreme of society B) see table 3 below: This is the creation of an enterprise which becomes not only an economic unit but a social unit through the power of association. Gender concept does not only involve gender –F but both gender –F and –M. (Gender Mix). With the aim to provide the community (see phase V of figure 2) with the commodities and services it needs ….being contributed through our roles and skills mentioned in table 3. Phase IV or figure 2 part D, appreciates the organizational dynamics of G-M in G-M1 towards phase V or society B in re-formulation of G-M1:R with multiple skills mix.

S/N	Phase I	Phase II	Phase III	Phase IV	Phase V
1.	G-M1:R	G-M1R_O	G-F/G-M	G-M1	G-M1:R_1
2.	Household (Family context)	Society A	Active Gender F Passive Gender M	Organized G-F	Society
3.	Fig. 2 A	Fig. 2 B	Fig. 2C	Fig. 2D	Fig. 2 … Yet extended
4.	Family structure Economy	Gender – Mix Identity Sharing Economy	Critical Role and Contribution on Economy	Learn Roles with Associative Reflex Economy	Experienced Gender – Balanced Economy
5.	Strategic Skills	Behavior Skills	Quantitative Skills	Strategic and Behavior Skills	Strategic behavior Quantitative Technological Skills

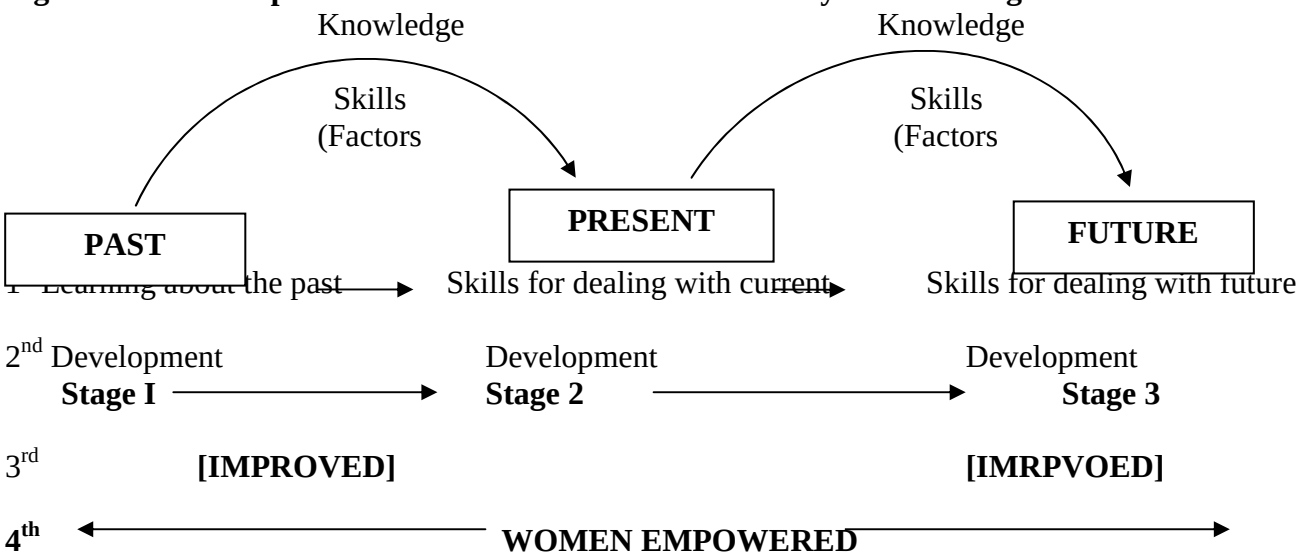
Source: Dr. Msaki J. L. (2011) Interpretational Linkage (Fig. 1 & 2).

The process of gender empowerment, through skills should be a continuous, timely and participator8o6 approached focusing on phase V to improve both reflection from past (feedback) and reflection from future (feed forward) a model development by Dr Msaki J. L. in his work Gender Structure And Women Empowerment (2009), takes time dimension and skills linkage to create value in both reflections (feed forward and feedback) vide concept in figure 3.

From the past, present and the future, women (gender –F) partners are men) Gender –F) are said to have powerless …..How? From the time immemorial, women have been the producer of children, mothers and wives, doing various works to contribute to their inner core families … can all these happen without gender –M?

One can ask on potentially focused behavior …should women contribute outside by forming their associations as a surviving strategy. Who empowers women (gender –F)? Knowledge and skills are critically emphasized in figures above and table. Les has been emphasized on the mechanics of value – recreation among gender professionals and stands to be the challenge in the context of gender empowerment not gender –F only.

Fig. 3: Women Empowerment and Time Dimensions: A Psycho-Learning Focus



The Learning Process Improved: (Empowerment) Source © Dr. Msaki j. L. (2009)

A measurement of past resources and present resources for future resources contribution through figure 3 does not only involves only women being a dynamic element, but also men as well. Women currently in Africa, appear to be an emerging power, especially in semi-urban and urban areas. One of the key set up and force comes from entrepreneurship motives. This becomes a supporting structured to empower and develop women hence developing a nation as a whole. Time has being changing so as skills, knowledge and capacity to empower them and the nation. This needs a supporting mechanism in figure 3. Think of employment.

Table 4: Employment by Sector, a Gender – Based Tanzanian Definition (%)

S/N	Period / Sector	2000/2001			2005/2006			POTENTIAL +VE □		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
1	Central / Local Government	3	1.5	2.2	3.3	1.6	2.4	Y	X	?
2	Parastatal	0.8	0.23	0.5	0.5	0.2	0.4	Y	X	?
3	Informal Sector	6.7	4.6	5.7	10.4	8.2	9.3	Y	X	?
4	Other Sector	6.7	2.1	4.4	11.5	4.2	8	Y	X	?
5	Agriculture	80.7	87.6	84.2	72.9	79.9	76.5	Y	X	?
6	Domestic Work	2.1	4.1	3.1	1.4	5.5	3.5	Y	X	?
7	**Total**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Integrated Labour Force Survey, 2005/2006: Modified by Dr. Msaki J.K.

Women appear to dominate on two sectors as per the survey viz, agriculture and domestic work. What is the context and drive of empowerment in sectors? What are the knowledge and skills contexts from past, present and the future as per figure 3? What should be a changing mechanism from Table 3 perspective? From the survey above on table produced by integrated labour force survey 2005/06, it is claimed that 18.3 million people were employed of which 9.0 million were male, while 9.3 million were female. But the sectors which have been dominated by women population shock has been reduced in percentage from 77.0 percent in 2006 compared to 84.0 percent in 2000/2001; which shows a decline of employment in agricultural activities by 8.0 percent for the past five years. What needs to be changed then from the perception above?

4. Gender Structure and the Spirit of Dominance: Cost Benefit Approach

The concept of empowerment is significantly linked to the psychology and the behavior of women. The drive from the past experience could be added with value and its components of knowledge, skills, attitude and other factors reaching the present. One needs to reflect past, future and present on both genders critical contributions. From above, statistical figures one cannot say or conclude exactly that the current paradigm in Tanzania shows that the 3rd Millennium Goal (Promote Gender Equality and Empower women) happens based on the quantitative approach! Much needs to be done in each of the sectors. From figure 3 there must be an enhancement of the past reflections as the late 1950s and 1960s saw women issues in development were increasingly being observed. Empowerment occurs when ordinary people discover that they have the capacity to solve the problems they have control the means to do so and have final responsibility to take up final decision. ….from figure 2, table 3 and pervious model by Dr. Msaki J. L. (2008) in figure 1, can one conclude that empowerment needs disempowerment before the final stage to empower?

Are women ready to surrender their power so as to learn and associate thereafter to motivate men to support the move, because on group or the other feels alone with problems? (The feel of being devalued), should the conflict be happening to avoid extreme disempowerment? Does perception influence gender empowerment? What are values of statistics on gender matters? Several Variables through available records enabling women gain economic equality …… how? Do they feel it? The nation needs to uplift their value in terms of uplift social-economic contribution of women (gender –F) in the society not to discriminate, to overuse or exploit them! Women are the most vulnerable beings of the society to be affected by whichever social or economic waves and other dynamics. In modernity, man sees himself not as part of nature, but a subject distinct from nature … How should a man associate himself with critical links to solve his problems and create value addition to this society (See figure 3).

The problems fro devising alternative development strategies seems to lie not only with deciding on philosophical principles, but with more practical question of implementation …. (Atu Emberson – Bain) on his article “Mining Development in the Pacific: Are we sustain the unsustainable? (1994) …..Philosophies need to change with time as proposed by Dr. Msaki J. L. model (2009) in figure 3. Waring, 1989; Vickers, 1991a; Pietila and Vickers; 1990) highlight that; “Yet another linkage in the picture of the worlds problems is that complex set of issues surrounding the role of women which is forcing another re-thinking of the “development” debate. Why? “Women (gender –F) are less educated than men, have less occupational option and earn less when they work ….. Poverty is very much a woman’s issue at least in part because of the double roles. Women both affect and are affected by development process …. In fact the “women’s issue” once though as no more than a welfare issue,

affects the prospects for efficiency, growth and development in the economy as a whole (Vuvini, Lycette and Mc Greevery, 1983:313).

From Tanzania perspective, participation of women in the development activities and their role, through employment capacity is expressed quantitatively in comparison to gender –M in table 4, for the year between 2000/2001 and 2005/2006 the last part of the table is the questioning mechanism as to how and why haring of employment ratio and capacities should be re-evaluated, focusing to available resources and contribution by d=gender – M and gender –F. the number of employment is ever reduced in women as compared to men except for agriculture and domestic work ….Why.

Sen and Grown (1989:79, 81) highlighted that, Transformation of the structures of subordination that have been so inimical to women is the other part of our vision of new era. Changes in law, civic codes, systems of property rights, control over our bodies, labour codes and the social and legal institutions that underwrite male control and privilege are essential if women are the attain justice in society ….At its deepest level, it is not an effort to play "catch up" with competitive, aggressive, "dog eat dog" spirit of dominant system. It is rather an attempt to convert men and the system to the sense of responsibility, nurturance, openness and rejection of hierarchy, that are part of our vision. Feminism has its unstable core a commitment to breaking down the structure of gender subordination as a vision for women as full and equal participants with men at all levels of societal life" (Moser, 1993; Kabeer, 1994) highlight that, More specific consideration are required of marginalized groups, disabled, aged and young people and gender sensitivity. Many studies have shown that women are particularly vulnerable to being excluded from rapidly expanding attempt at participatory development.

From table 3, Dr. Msaki J.L., tries to observe that, a variety of framework to analyze gender perspective (vide fig. 2) and gender relations used in development work. It is true that stereotypical assumptions about women's positions in the society and in the household are prevalent in developing and development cooperation. Gender stereotype should be avoided when indicators are formulated. Therefore gender sensitive indicators should provide and important basis for gender analysis, based on empowerment, critical skills, opportunities, capabilities, security and dynamics of empowerment need re-observations.

The human Development Report (example UNDP 2003 and Annul) include the following indicators (indices) through country by country.

(1) Gender related development index …… How in Africa?
(2) Gender empowerment measure …….. How in Africa?
(3) Gender inequality in education …….. Why in Africa?
(4) Gender inequality in economic activity ……. How and Why?
(5) Gender work burden and time allocation ……... How and Why?
(6) Women political participation …… How? Why? When?

Question …….. Is this sufficient?

All these appear significant, but an evaluation in the context of figure 2 and table 3, challenges the qualitative quantitative approach of the above to be re-thinked. The organization machinery needs to discover who have the capability of leading the community organization …. Think on the quote by the East African of September 12 – 18, 2011, p. 33 that "340,000is the number of deaths of women from pregnancy related causes in the world. About half of these deaths occur in Africa, almost all in anonymity" how can gender issues address the above fact in statistics? Who has power to re-engineer

the above fact? Who has sympathy and empathy on how resources, power needs to solve the above figure in problem?

Taking the conceptual approach of Cooperative Report of 1997; United Republic of Tanzania comments on policy statement that "The Government will encourage women participation in cooperative by removing inhibiting traditional laws, customary values and other constraints". Associative economy is very much linked to cooperative based institutions and the power sharing mechanism items of social and economic perspectives.

Boltive highlights that; "The Discovery of what is true and practice of which is good are two most important objectives of philosophy" …..the concept of wealth re-distribution in gender system is ever sensitive but significant for equitable mechanism vis-à-vis poverty incidences in the context of skewed power, wealth, contribution sharing in the gender systems, especially in Africa. Figure 2 shows a context between association and dissociation of gender –F and gender –M, where Dr. Msaki J. L. tries to explain in the context of family – societal extremes, while sharing power, responsibilities and wealth (economics). Figure 2 and table 3 create value dynamics to be interpreted as value creation and value addition concepts, for gender –F to be empowered and society as a whole (Phase V in table 3, G-M1:R_1) as an experience paradigm. Time and change dimensions are of critical importance based on knowledge skills and attitude (creativity), expressed by figure 3….creation of values.

The enhancement of women wealth and power (empowerment) will enhance her family (G-M1:R) to enhance the society (G-M1:R_0), society **A** and extreme of experienced society **B**; (G-M1:R_1)……. expressed and analyzed by Dr. Msaki J. L. (2011) in figure 2 and table 3 respective (Re-distribution concept).

5. Wealth Re-engineering and the concept of Gender Parameters

Value addition is a critical philosophy in empowering the society and all genders fro that matter. In simple arithmetic value is the ration in comparison between benefit and cost.

Therefore: Value (V) = Benefit (B) ÷ Cost (C) = $^{B}/_{C}$ ……. 1.
Gender –F to enhance total value ($^{V}_{T}$) = Σ = $^{B}/_{C}$ ……. 2.
Therefore: = $\Sigma^{B}/_{C}$ = Σ V = $^{V}_{T}$ = Wealth in Women ……. 3.

This is more apparently in Phase III (Fig. 2C) or Phase III in table 3, whereby women (Gender –F) appear to be more dynamic than Gender –M.

Note: From function 1; 2, and 3; B = Benefit C = Cost and V = Value and
Σ = Sum of ……. (Link with fig. 2)

From arithmetic above, the enhancement of women wealth will enhance her family and a nation as a whole. This is what is termed as Critical role land Contribution of Gender –F in the economy. Though the main stream organization, the concept of men (Gender –M) cannot be ignored though in figure 2 above appears to be passive (G-M), but dominates family backgrounds in terms of resources control and power rationing (in most societies of Africa) ….what is needed?

(A) Wealth Control in Men and Power → (B) Wealth in Women → (C) Wealth in the Family and hence the society (Whole)

(Distributed) **(Re-distributed)**

(G-M) $(np + nq)$ → (G-F) $(np \pm nq)$ → (G-M1:R_1) $(np + nq) + (np \pm nq)$

Source: © Dr. Msaki J.L. (2009)

Above takes the role of psycho – quantitative approach, to the phase III and fig. 2 of the current literature to support and active and dynamic role of gender –F (women) to support the society, which needs gender –M (Men) to create (G-M1:R_1) the phase V as a society with experienced gender vis, balanced economy …… expressed in table 3 vis society **B**.

Notations:
np = Quantum (Paternal Wealth) ……. A
NQ = Quantum (Maternal Wealth ……. B
$\pm$ = Redistributive Capacity (Wealth could be reduced either in A or B
→ = Linear Transformation in Wealth Content and its re-distribution
……..though Women Empowered.

Note: (A) + (B) = (C) …….. Family (Household ……. C
Wealth – $V_1 + V_2 + V_3$ …….. $Vn = \Sigma V = {}^{V}_{T}$ …….. D

The Transformation and Re-engineering in the value creation and re-creation take time dimension in gender participation from past perspective, present perspective to future perspective. According to phases in Fig. 2 and table 3 Phase I and Phase II are in past dimension, Phase III and IV are in the present dimension and phase V express the future dimension…. The key connection and reflection is diagrammatically expressed in gender-pscholearning focus in figure 3. The value ${}^{V}_{T}$, is expressed through value (wealth) generated and distributed and estimated through wealth. Functions A, B, C, D are really needed to create efforts I terms of men and women, to understand surroundings and how value systems work in gender perspective ……wealth in the literature carries both tangible and intangible connotations…..Women in fig. 1 concept appears to pronounce that, "Give us the wealth and we shall do the work" …..Therefore the concept of women empowerment as a matter of not only human rights, but also human security! as it cuts all walks of life.

From fig. 2, the concept of movement through women empowerment and re-organization in tune with a motivated motive of men to join the stream for social benefit vis-à-vis cost, could be one of essential tools to ease corruption and violence, promotion of greater supporting environment and society sustainability …what not? Therefore; re-creation of gender mix, G-M1:R_1 society B extreme …. The authors therefore conclude that the Holistic approach of the present literature in economic and social perspective is though; Gender –F Reorganization vis-à-vis Gender –M Association and Disassociation in the Empowerment Value Mechanics to measure and conceptualize a Benefit – Cost in the social Economic Paradigm is the essence of Development.

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