All Nations University Journal of Applied Thought (ANUJAT)

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ISSN 2026-691X

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All Nations University Press
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EDITORIAL

As routine, the Managing Editor and I, sincerely thank all the authors who have contributed to this issue. We also thank our in-house and external reviewers for their continued support. Papers submitted that are not in this issue will be published in the November 2016 issue.

ANUJAT is an international journal, as such we continue to encourage writers in every academic discipline interested in academic publishing to send their papers to us. We assure of a vigorous and prompt peer-review of your work.

The papers/essays are expected.

Professor Prince S Conteh
Chief Editor
Experimental Simulation of Crowd Animation using Fuzzy Logic System IF - THEN Conditional Rule

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ABSTRACT

When computers were introduced to alleviated the tedious and time consuming nature of traditional animation, not only was it successful, it also paved the way for opportunities beyond the functional movements of objects and subjects of animators with more fluid and realistic animation. Current deviations from traditional animation has witnessed Computer programmers and Animators collaborating to write snippets which are used to manipulated the dynamics of animated sequence to achieve a desired effect or purpose. These snippets are like functions with their objects having methods, attributes and variables which are fired whenever such functions are called. Zadeh introduced Fuzzy Logic Systems (FLS), a Mathematical application with a degrees of truth rather than computing boolean value of yes or no and real values between 0 and 1. Fuzzy logic has certain properties such as fuzzy sets, membership functions, linguistic hedges etc which are used together with other processes to arrive at roles or 'degree of truth' to an entity. Fuzzy Logic Systems has been applied to many fields, from
control theory to artificial intelligence. This paper seeks to experiment how entities in a simple crowd could be assigned roles using Fuzzy IF-THEN rule.

Introduction

Fuzzy Logic almost seem to be based on the idea that reality can rarely be represented accurately. Often, knowledge used to construct the rules in fuzzy logic system is uncertain. One of the ways uncertainty rule can occur is that, the words used in antecedent and consequents of rules can mean different things to different people. The concept of fuzzy logic was introduced by Zadeh (Liang and Mendel, 2000), in his theory, Zadeh proposed using membership function with range of covering the interval of [0 and 1]. In a real life crowd simulation where members of the crowd (entities) do not know what will happen or to expect next, in the cause of the event or an emergency, each member of the crowd will react differently to the event. For instance, when a group of people in a boat traveling and the boat capsizes, there could be three possible scenarios, (a.) members who may not know how to swim and have hydrophobia, it can be deduce that this taxonomy will be drown and will scream for help (b.) the second taxonomy are members who knows how to swim and may consider swimming for their safety without thinking of trying to save anyone and the last scenario (c.) could be those who knows how to swim and want to save members in the first category or scenario. In this case, we use fuzzy logic to illustrate or assign tasks to each entity of the various taxonomies by looking at the vital element that is the inference engine that processes IF-THEN statements.

Fuzzy IF-THEN or fuzzy conditional statements are expressions of the form “If this Then that”, where this and that are labels of fuzzy sets characterized by appropriate membership functions. Due to their concise form, fuzzy If-Then rules are often employed to capture the imprecise modes of reasoning that play an essential role in the human ability to make decision in an environment of uncertainty and imprecision. (Zadeh, 1975: 199) gave an example that, in treating Truth as a linguistic variable with values such as true, very true, not very true, completely true etc. leads to fuzzy logic by providing a basis for approximate reasoning,
that is, a mode of reasoning which is not exact or very inexact, such logic may offer a more realistic framework for human reasoning than a traditional two-valued logic such as *yes* or *no*. Similarly, in computer generated animation, a simple high fidelity realisticity of crowd simulations could be achieved by employing fuzzy logic conditional statement with a linguistic characteristics and their accompanied membership functions.

Considering a simple fighting animation simulation in a scene with definite and "loose" rules, a definite concluding *rule* could be "IF an enemy pulls a dagger at you, THEN kill the enemy" and a softer or loose *rule* could be "IF an enemy pulls a dagger AND is in yonder, THEN the enemy is not a threat". In these above scenarios, a careful consideration have to be made to determine functional set of the enemy we are referring to because a protagonist may also have its own member pulling a dagger towards/around the member to save member from an enemy. In doing this, a more precise was of attributing roles to members of each *set* by using *linguistic hedges* and *membership functions*.

**Problem Statement**

Procedural taxonomy and time-consuming practices have constituted the amalgamation of animation and other branch of knowledge such as *animatronics*, which employs mechatronics to create machines that seems more of animations than robotics, and *autonomatronics* an advanced audio-animatronics created by the Walt Disney studios to achieve pre-programmed shows (Smith, 2009). In the event of crowd animations, *character modelers, riggers, animators* have to create hundreds of models and sometimes thousands of *functional movements* to achieve a simple crowd system or movements, even with this procedure, *tasks* assigned to characters in a *crowd* during an animation sequence are usually duplicated among entities or members of the crowd, giving the animated crowd sequence some level of repetition and a low fidelity of realisticity. In recent years, software programmers have written or developed snippets or an entire software based on natural science such as physics to manipulate *flow* and *dynamics* of animated objects in scenes. Consequently, a software called MASSIVE (*The
Hollywood Reporter, 2010), developed by WETA DIGITAL to give each entity or member of crowd unique task through fuzzy logic and artificial intelligence which makes the animation realistic, hence the purpose of this experimental research work, to experiment the use of fuzzy logic. With fuzzy logic's characteristic of uncertainty, this paper seeks to use this logic to simulate a crowd in an animation since uncertainty is also the basis of entity preparation in crowd simulation.

Fuzzy Sets

Understanding of Fuzzy sets will better complement the concept of a fuzzy logic as used in this experimental research. A fuzzy set could simply be defined as a set with clearly defined boundary or terms. To understand what a fuzzy set is, first consider what is meant by a classical set. A classical set is a container that wholly includes or wholly excludes any given element. For example, the set of months of the year certainly includes January, February, through to December and incontestably excluding pineapples, onions, chilli, garden eggs, avocado, bananas, tomatoes but similarly, chilli, tomatoes, onions and garden eggs could qualify for a vegetable sets so as pineapples, oranges avocado and bananas will institute a set of fruits.

![Example of a classical sets](image)

Reasoning in fuzzy logic is just a matter of generalizing a Boolean logic of yes or no (true or false) answer. If we give "true" the numerical value of 1 and "false" the numerical value of 0, we're saying that fuzzy logic also
permits in-between values like 0.5 and 0.85. e.g. could be 1.) Is January a month of the year? and the boolean logical answer will be 1 (yes or true) 2.) Is First day of December a new year? and the boolean logical answer will be 0 (no or false) and 3. Is leap year March? and the boolean logical answer could be any value between 0 and 1 because this answer could be affected by factors such as, specific time and whether that particular year is a leap year with reference to the above illustration Fig.1, we can deduced that special characteristics could be assigned to distinguish entities of the antagonist from that of the protagonist in the case of a fighting animated sequence or any sequence that involves clearly two opposite sides, we can use linguistic variable such as short as a characteristic of either side, hence we delve into assigning a linguistic variable and membership functions.

**Linguistic Variables and Membership Functions**

Linguistic variables simply means variables whose values are words or sentences in a natural or artificial language. Zadeh (1975) cited an example, Age could said to be a linguistic variable if its value are linguistic rather than numerical i.e. young, not young, very young...etc rather than numerical values such as 18, 14, 30, 32...etc. This could also mean that the range of possible values of a linguistic variable represents the universe of discourse of that variable. For example, the universe of discourse of the linguistic variable speed might have the range between 0 and 220 km/h and may include such fuzzy subsets as very slow, slow, medium, fast, and very fast (Rhodes University, 2014). A membership function (MF) is a curve that defines how each point in the input space is mapped to a membership value (or degree of membership) between 0 and 1. Novák and Vilém (1985) used a set of tall people to illustrate. In this case the universe of discourse is all potential heights, say from 3 feet to 9 feet, and the word "tall" would correspond to a curve that defines the degree to which any person is tall. If the set of tall people is given the well-defined (crisp) boundary of a classical set, we might say all people taller than 6 feet are officially considered tall. But such a distinction is clearly absurd. It may make sense to consider the set of all real numbers greater than 6 because numbers belong on an abstract plane, but when we
want to talk about real people, it is unreasonable to call one person short and another one tall when they differ in height by the width of a hair. But if the kind of distinction shown above is unworkable, then what is the right way to define the set of tall people? Much as with our plot of months of the year, the figure following shows a smoothly varying curve that passes from not-tall to tall. The output-axis is a number known as the membership value between 0 and 1. The curve is known as a membership function and is often given the designation of $\mu$. This curve defines the transition from not tall to tall. Both people are tall to some degree, but one is significantly less tall than the other.

![Fig. 2 Degree of Membership](image)

Subjective interpretations and appropriate units are built right into fuzzy sets. If I say "She's tall," the membership function "tall" should already take into account whether I'm referring to a six-year-old or a grown woman.

**IF-THEN RULE**

Fuzzy sets and fuzzy operators are the subjects and verbs of fuzzy logic. These if-then rule statements are used to formulate the conditional statements that comprise fuzzy logic.

A single fuzzy if-then rule assumes the form

$$\text{if } x \text{ is } A \text{ then } y \text{ is } B$$

where $A$ and $B$ are linguistic values defined by fuzzy sets on the ranges (universes of discourse) $X$ and $Y$, respectively. The if-part of the rule "$x$ is
"A" is called the antecedent or premise, while the then-part of the rule "y is B" is called the consequent or conclusion (Rhodes University, 2014). In a fuzzy system, all rules can fire to some extent, or in other words fire partially. If the antecedent is true to some degree of membership, then the consequent is also true to some degree. A fuzzy rule can have multiple antecedents, for example:

\[
\begin{align*}
&\text{IF} & \quad \text{road is long} \\
&\text{AND} & \quad \text{fuel in the car is less} \\
&\text{AND} & \quad \text{distance to the next fuel station is far} \\
&\text{THEN} & \quad \text{risk is high} \\
&\text{IF} & \quad \text{you have your pass} \\
&\text{OR} & \quad \text{ready to pay} \\
&\text{THEN} & \quad \text{you'll cross the toll booth}
\end{align*}
\]

Interpreting an if-then rule involves distinct parts: first evaluating the antecedent (which involves fuzzifying the input and applying any necessary fuzzy operators) and second applying that result to the consequent (known as implication). In the case of two-valued or binary logic, if-then rules don't present much difficulty. If the premise is true, then the conclusion is true. In other words, fuzzy inference is the process of formulating the mapping from a given input to an output using fuzzy logic. The mapping then provides a basis from which decisions can be made, or patterns discerned. Fuzzy inference systems have been successfully applied in fields such as automatic control, data classification, decision analysis, expert systems, and computer vision. Because of its multidisciplinary nature, fuzzy inference systems are associated with a number of names, such as fuzzy-rule-based systems, fuzzy expert systems, fuzzy modeling, fuzzy associative memory, fuzzy logic controllers, and simply (and ambiguously) fuzzy systems.

Mamdani's fuzzy inference method is the most commonly seen fuzzy methodology. Mamdani's method was among the first control systems built using fuzzy set theory. It was proposed in 1975 by Ebrahim Mamdani (Vrusias, 2006) as an attempt to control a steam engine and boiler combination by synthesizing a set of linguistic control rules.
obtained from experienced human operators. Mamdani's effort was based on Lotfi Zadeh's 1973 paper on fuzzy algorithms for complex systems and decision processes.

Mamdani-type inference, usually expects the output membership functions to be fuzzy sets. After the aggregation process, there is a fuzzy set for each output variable that needs defuzzification. It's possible, and in many cases much more efficient, to use a single spike as the output membership function rather than a distributed fuzzy set. This is sometimes known as a singleton output membership function, and it can be thought of as a pre-defuzzified fuzzy set. It enhances the efficiency of the defuzzification process because it greatly simplifies the computation required by the more general Mamdani method (Earl, 1994), which finds the centroid of a two-dimensional function. Rather than integrating across the two-dimensional function to find the centroid. Sugeno-type systems could also be used to support this experiment, Sugeno-type systems can be used to model any inference system in which the output membership functions are either linear or constant but for the purpose of this research, Mumdani's is preferred.

In elaborating more on the Mamdani's fuzzy inference algorithm, we can categorize it into four steps, thus (1.) Fuzzification (2.) Rule evaluation (3.) Aggregation of the rule output and (4.) Defuzzification. We can examine the scenario below:

RULE 1       --------  IF \( x \) is A3 OR \( y \) is B1 THEN \( z \) is C1
RULE 2       --------  IF \( x \) is A4 AND \( y \) is B4 THEN \( z \) is C4
RULE 3       --------  IF \( x \) is A2 THEN \( y \) is C4

Fig. 3. Fuzzification
Using the above diagram for fuzzification, we take the crisp inputs, \( x \) and \( y \) and determine the degree to which these inputs belong to each of the appropriate fuzzy sets and the second step is to take the fuzzified (Vrusias, 2006: 6) inputs, thus, \( \mu_{x=A1} = 0.5 \), \( \mu_{(x=A2)} = 0.2 \), \( \mu_{(y=B1)} = 0.1 \) and \( \mu_{(y=B2)} = 0.7 \), and apply them to the antecedents of the fuzzy rules and after, if a given fuzzy rule has multiple antecedents, the fuzzy operator (AND or OR) is used to obtain a single number that represents the result of the antecedent evaluation and the number (the truth value) is then applied to the consequent membership function.

To evaluate the disjunction of the rule antecedents, we use the OR fuzzy operation. Typically, fuzzy expert systems make use of the classical fuzzy operation union:

\[
\mu_{\text{disj}}(x) = \max [\mu_A(x), \mu_B(x)]
\]

Similarly, in order to evaluate the conjunction of the rule antecedents, we apply the AND fuzzy operation intersection:

\[
\mu_{\text{conj}}(x) = \min [\mu_A(x), \mu_B(x)]
\]
The original membership function of the rule consequent is adjusted by multiplying all its membership degrees by the truth value of the rule antecedent (Rhodes University, 2004) and we take the membership functions of all rule consequents previously clipped or scaled and combine them into a single fuzzy set. The input of the aggregation process is the list of clipped or scaled consequent membership functions, and the output is one fuzzy set for each output variable. In the last step which is Defuzzification, we find the point where a vertical line would slice the aggregate set into two equal masses.

Summary

Time has proven to be of great value and essence to filmmakers especially animators, because a simple functional movement of a human body could take an animator hours, if not days to achieve that when a traditional animation method is used. There's no doubt about the tremendous role technology has played in the field of animation since its inception and so has the concepts of natural science and other branches of knowledge in the quest for finding innovative ways of achieving a convincing level of realism, e.g. the use of Bidirectional Scattering Distribution Function (BSDF) in the cycles rendering engine in Blender (Blender Stack Exchange, 2013) and using fault fractal to achieve a convincing landscape, just to mention a few. In Peter Jackson's Lords of the Ring, a software specially designed for the crowd fighting scene was developed to give the scene the realism the director was looking for, the falling fishes from the sky in a scene from Ang Lee's film Life of Pie, all these were achieved with the help of a special software called "MASSIVE". This software gives each and every entity or member of a proposed crowd a unique task, the bedrock of this research has been to mimic the algorithm of MASSIVE by using fuzzy logic in achieving that.

The fuzzy logic system was used due to its nature of:

- being able to handle large numbers because a fighting scene for example could involve very large number of entities taking both the protagonist and antagonist sides into consideration.
- use in the finding of uncertainties in variables, with this scenario,
members or entities in a animated crowd do not or may not know what to anticipate in every action, hence the reaction of every entity or member will be different to the same *action*.

The IF-THEN conditional rule makes it possible in assigning roles to entities in a crowd system by the use of linguistic hedges which helps to create crisp membership functions and for better definition of both *antecedent* and *consequent* which either the antecedent or the consequent can have multiple fuzzy rules which made it easier to define characteristics of entities.
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Christian-Muslim Marriage In Ghana: Prospects and Challenges

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ABSTRACT

Marriage remains one of the most complex human realities, and one of the most challenging concepts in contemporary times and Christian-Muslim marriages, considered to be the ideal model for inter-religious relations, are not exception. The article argues that despite the prospects of Christian-Muslim marriages taking place in Ghana, facilitated by the multi-religious environment and encouraged by the traditional culture, it is not without its challenges. The article further discusses some of the intricacies of Christian-Muslim marriages and contends that the challenges of Christian-Muslim marriages go beyond the difficulties of acquisition of dispensation for temporary impediment to include some serious liturgical and pastoral challenges which cannot be ignored.

Introduction

A marriage of a Christian and a Muslim is expected to be the ideal model for Christian-Muslim relations. This is because besides inevitably bringing two great traditions of faith into a covenant relationship of marriage it also attempts to reconcile their teachings of marriage, divorce (separation/annulment) and even inheritance for mutual enrichment. However, Christian-Muslim marriage is one of the most complex and
complicated issues in the whole arena of Christian-Muslim relations because of the religious and even cultural diversity between the partners. In some areas, members of each tradition actually use such marriages to get new members (although this is not clear approach, but an unofficial part of *da 'wa* and missions. A further difficulty is that there is no clear, official statement from the both Muslim and Christian communities. Thus, Christian-Muslim marriage remains a difficulty and sensitive issue. The fundamental problem arises between a Muslim male marrying a Christian female, and a Christian male marrying a Muslim female. These are two very difficult situations. There are many questions and aspects to be considered. At the pastoral level of practical relations between the Muslim and Christian communities, inter-religious marriage is often a poisonous issue, seen (by one or other side) either in terms of ‘defeat’ or ‘victory.’

Marriage remains one of the most complex human realities, and one of the most changing concepts. Though an essential value of humankind, marriage is expressed in diverse cultural and religious forms. In the Qur'ān and Islamic traditions, marriage is a clearly stated religious prescription (Sūrah, 24:32). It is a religious duty, but in its celebration there is no precise religious structure. The whole process is more social and juridical, seen more as a social contract than permanent reality of life. The Qur'ān and tradition follow the juridical aspects of a social contract (Sūrah, 4: 23). The difference of religion is seen as a temporary impediment in that the non-Muslim is expected to convert (Sūrah, 2:221). The general rule is the total prohibition of marriage between a Muslim (male or female) and a non-Muslim. For two non-Muslims who become Muslims, the marriage continues. If only one of partners becomes Muslim, the ideal is the former marriage is broken and divorce is immediate. Christian marriage, in its ideal form, is a permanent reality, often presented as a typically Christian achievement and value. In this basic, permanent and unique reality, Christian marriage is a sacrament and a sign of God's faithfulness to humankind: equally, the sign of the connection between Christ and the Church.
Prospects of Christian-Muslim Marriage

Multi-religious Environment

The contemporary Ghanaian religious context prepares the grounds for interreligious marriage. Like other nations of the world, the religious climate is culturally and religiously pluralistic. In fact, the Ghanaian environment, like all Sub-Saharan Africa countries, has been always pluralistic both culturally and religiously. Religious plurality, the fact that there are many different religious traditions active or co-existing in the country, is a statistical fact in Ghana backed by data. The 2010 population census indicates that 60% of Ghanaians are Christian, 17% are Muslim and 23% are adherents of African traditional religion and others (Hindus, Buddhist, Jewish etc.). Diversity or plurality in Ghana is not only evident at the level of religions but also that of denominations. Christian denominations are the Catholic Church, Protestant Church, African Independent Churches, Pentecostal and Charismatic Churches. Islam, in Ghana, has its share of diversity. There are the Mainstream Muslims of the various moderate sufī traditions, the more modern Ahmadiyya Movement, the Shīʿa group and the strict, legalistic and puritan Ahlus Sunna sect. Christian denominations and Islamic sects are found in almost every town and village in Ghana.

According to John Pobee, a Ghanaian theologian of high repute, this religious plurality poses challenges for Ghana especially when these religious institutions and their belief systems do not exist in what he calls “watertight” compartments. Pobee comments that belief systems of these religious traditions “... flow into each other; indeed, sometimes the views of one system are paraded as the views of the other” (Pobee 1979). Plurality of Ghanaian society has far-reaching consequences for peace and stability as it becomes latent threat to national identities and security. It has consequences for evangelisation and mission strategy in that religious groups would have to decide on the ways in which they want to approach and relate to members of other groups - whether they opt for mission, confrontation, indifference or even dialogue. The plurality most importantly engenders a general religious worldview which develops a certain religious and doctrinal apathy, enabling a significant number of
religious people to overlook religious differences. For instance, many Ghanaian religious are not necessarily spiritually formed by their own religious and spiritual leaders. They also listen to other pastors and imams on radio FM stations for spiritual nourishment. They go to prophets for personal prophecies, healing and sometimes to the Mallams and fetish priests for solutions to life's challenges. To the faithful, it is not a question of lack of depth of faith or “unconversion” but a question of who can do what and when (Berinyuu 1988:147). People who have apathy for religious and doctrinal differences are more likely to consider religious affiliation an insignificant prerequisite for marriage.

**Traditional Society**

Christian-Muslim marriages do take place in Ghana not only because Christians and Muslims are now more exposed to each other in a pluralistic environment they find themselves (Fitzgerald & Borelli, 2006:68), but also because the traditional society also permits and facilitates inter-religious marriages. In an Akan society for instance where traditionally, religious background of prospective partner is not a prerequisite for marriage and the ultimate objective of marriage is forge alliance between families, it is not a surprise that Christian-Muslim marriages do often happen. Furthermore, interreligious marriage does not pose any problem in traditional Akan society. Traditionally, marriage is not a religious institution. It is a social institution that brings a man and woman together as husband and wife. The marriage makes the man socially accepted husband and the woman socially accepted wife. This marriage also provides the offspring with a socially recognized father and a socially recognized mother. The marriage establishes special relationship between the spouses which lays the foundations for and begins the nuclear family. With regard to the religious tradition of individuals before and after marriage ceremony, customs and tradition stipulate clearly the spiritual affiliation of both parties and the children. Traditionally, a person, male or female, husband or wife worships his or her father's god (Busia, 1951:1; Meyerowitz, 1958:14; Pobee, 1979:49; Ackah, 1988:126). The basis of this is the “ntoro” (animating spirit) which a person derives from their father (Busia, 1951:1; Meyerowitz,
1958:14; Pobee, 1979:49; Ackah, 1988:126), hence the Akan saying: 
Egya ye sumsum (the father is a spiritual force). Among the Akan the 
ntoro is what determines a person's characteristics such as personality 
and disposition, and the spiritual bond between father and child. The 
ntoro cult, later instituted among the Akan, gave authority to the father as 
the priest of the family and in charge of all the rites of passage. A child is 
bound by religious and educational ties to his father (Busia, 1951:1; 
Arthur, 2001:84) and he/she joins their father's asafo (military 
organization). Religion is, consequently, one of the important cords 
linking a person to his father. Many fathers are not ready to let go this 
association to their children. Often, fathers do not take it kindly when that 
religious association to their offspring breaks as a result of conversion or 
marrige. There are cases when Muslim and Christian fathers have 
disowned children for denouncing their religious tradition even in the 
case of marriage. Christian denominations and Islamic sects often 
demand religious background as a requirement for marriage. Often 
times, religious affiliation is required by the individuals.

In addition to worshipping their father's god, an Akan also pays 
allegiance to the ancestral stool of his or her lineage, without been 
accused of syncretism. This means that the various approaches offered 
by society to the divine, the Supreme Deity, are meant to be 
complementary and not incompatible in view of offering spiritual growth 
to the individual, a feat which is not quite easily tolerated by Islam and 
Christianity. Despite the suitable traditional socio-cultural environment 
Christian-Muslim marriage is to be allowed with caution especially 
when both Christianity and Islam, though believe in one God, are still 
incompatible in many ways. Though Muslims and Christians access or 
appropriate each other's spiritual gifts on daily basis in Ghana, 
theoretically and officially, the practice and in particular Christian-
Muslim marriages are not encouraged. It is in this spirit that impediment 
spelt out by both Christianity and Islam for the temporary prohibition of 
mixed marriages such as Christian-Muslim marriage is to be understood.
The Challenges of Christian-Muslim Marriage

Temporal Impediment

In both Islamic and Christian traditions, the extraordinary status of mixed marriage implies a prohibition, which constitutes an impediment to be removed only by dispensation. In other words, the temporary prohibition could be dispensed under certain conditions. A Christian-Muslim marriage constitutes a Christian-Muslim relation in an extraordinary way. Christian-Muslim marriage, a perfect example of marriage of disparity of cult (mixed marriage), is considered extraordinary in both Christianity and Islam. A marriage is extraordinary when the parties involved do not belong to the same faith tradition. In the Catholic Church, a mixed marriage takes place between a baptised (the catholic partner) and a non-baptised (the Muslim partner) and is considered ordinarily invalid and non-sacramental (Can 1086§1). Likewise, Islamic law places a temporary ban on mixed marriage to the effect that a Muslim woman may not marry a non-Muslim man, but a Muslim man may marry a non-Muslim woman so long as she comes from a religion having revealed scripture (e.g. Judaism and Christianity). The Qur'ān puts non-Muslims into two main categories: those with revealed scriptures (ahl al-Kitāb–people of the Book) and the others who are generally categorised 'idolators' (mushrikūn). The first category consists of Christians and Jews and since the Holy Qur'ān refers to itself as a confirmation of the earlier revealed scriptures it recognises (Sūrah, 2:41, 91) as valid, marriage between a Muslim man and a woman of any of these religions (Sūrah, 5:5). A clear distinction is thus made between marriages within the ahl-al Kitāb and the ahl-al-Mushrikūn. Ibn Abū Zayd states that: “God has forbidden intercourse with unbelieving women: but marriage with a scriptural woman is permitted” (Russell & Suhrawardy, 1906:15). Some scholars opine that even the Jewish or Christian women are not good enough. The Malikī School declares such marriage blameable (makrūh) and imply that it should be avoided as much as possible (Ruxton, 1978:106). From the life of the prophet himself, we feel reluctant to agree with such opinions. At least three of the wives of the prophet were not Muslims at the time they were married.
Mārya was a copt while Ṣafīyyah bint Huyayy and Raiḥānah bint Zayd were Jewish women. Mention is also made of Nashāh bint Rifā′ah, a Jewess, who lived with the prophet (Montgomery Watt, 1981). There is no evidence to the effect that the prophet required these women to renounce their faiths before living with them even though their eventual embrace to Islam cannot be doubted (Buaben, 1985:21). Though there is no express provision in the Holy Qur′ān to support their view, Muslim scholars have claimed evidence from the tradition and hence maintained that a corollary to the verse prohibiting Muslim men from marrying women who are not of the <i>ahl al-Kitāb</i> is that a Muslim woman should not marry a non-Muslim man, not even a man from the <i>ahl al-Kitāb</i>. Although men are allowed to marry from the people of the Book, women are unequivocally forbidden. The Qur′ānic assertion that “men are in charge of women” (Sūrah, 4:34) would make it hard for a woman to practice her faith while married to a non-Muslim. Anyone who wants to marry a Muslim woman must be a Muslim first (Dharmaraj & Dharmaraj, 1999:247, 248).

**Dispensation of Impediment and its Conditions**

Both Christian and Muslim communities have set in place certain conditions the satisfaction of which justifies a dispensation for mixed marriage. For the Catholic Church and probably all Christian denominations, the reason usually given for the impediment associated with mixed marriage is twofold: (1) the difficulty the catholic partner may encounter in practising his or her faith, and (2) the danger that children of the marriage may not be brought up as Catholics or Christians. At a deeper level, because a marriage of a Muslim and a Catholic is not sacramental, it is understood not to completely reflect either the covenant between God and his people or the relationship between Christ and the Church as Christian marriage should. Although, marriage is also a strong covenant (Sūrah, 4:21) for Muslims, its covenant nature does not seem to have anything to do with the Islamic legal impediment of mixed marriage. Religious compatibility seems to be a major reason for impediment. ‘Abd al-'Atī, a reputable Islamic scholar, says of mixed marriage: “The general rule is that religious
homogamy takes preference as the first choice. When both parties adhere to Islam, the probability of mutual harmony is highly assuring. But it is not an absolute condition that mates be of the same religion.” (‘Abd al-'Atī, 1977:137-138)

Thus, Al-'Atī indicates that religious compatibility is vital for “mutual harmony” between the couple. People like Buaben, however, fear the Muslim woman would eventually renounce her faith when she marries a non-Muslim. Critics of Islam find this as another bone of contention that Islam limits the freedom of the woman (Buaben, 1985:21). The faith of the Children of mixed marriage is also of concern to Muslim scholars. In all, the children born in mixed marriage must be raised as Muslims (Dharmaraj & Dharmaraj, 1999:247). To allow for Christian-Muslim marriage, most Christian Churches particularly the Catholic Church require of the catholic partner to declare formerly that he or she is prepared to remove dangers of defecting from the faith, and is to make a sincere promise to do all in his or her power to ensure that all the children be baptised and brought up in the Catholic Church. This requirement is to be interpreted carefully in the light of the Vatican Council II's teaching on ecumenism and religious freedom. It is not to be understood in an absolute sense as though the Muslim party had no rights in the matter. For, any decision on the religious upbringing of the children must take account of the potential effects on the marriage relationship itself as well as on the faith commitment and rights of the Muslim party. Clearly, these are matters which ought to be discussed fully with both parties before marriage, so that misunderstanding may be avoided and possible conflict prevented. This promise of the catholic (Christian) partner does not mean that the children are not to be taught to appreciate the religion of the Muslim partner, nor does it mean, if it happens that the children are not in fact baptised, that the Catholic (Christian) partner should give up any idea of teaching them about the faith. They will need encouragement to do this (Fitzgerald & Borrelli, 2006: 69).

The Muslim partner is to be informed in good time of these promises to be made by the catholic party, so that it is certain that he or she is truly aware of the promise and the obligation of the (Christian) catholic partner. The Muslim partner is not required to make any promise. He is only to 'be informed in good time' of the promises made by
the catholic partner. This is a further recognition of the Muslim partner's equal rights within the marriage. Before a mixed marriage takes place, the Muslim partner must be in no doubt concerning the undertakings given by the catholic partner and the obligations entailed. Both partners are to be instructed about the purposes and essential properties of marriage, which are not to be excluded by either contractant. They are to receive special instruction on the nature of marriage. Since members of other Christian Churches (or Islam) sometimes have views on marriage different from catholic teaching, the law requires that both partners be fully informed of the purposes (Can. 1055 §1) and essential properties of marriage (Can. 1056). The aim of this teaching is to ensure that both partners consent to marriage as understood and taught by the church. In view of the fact that a dispensation could be acquired for Christian-Muslim marriage to take place, it is convenient to say that such marriages are permitted but not encouraged by both religions.

**Liturgical and Pastoral Challenge**

The challenges of Christian-Muslim marriage should not be reduced to whether or not a dispensation will be granted by the local ordinary (or the elders of a church), it also poses pastoral and liturgical challenges. In the first place, both partners would have to decide on the liturgical rite to be adopted for the marriage ceremony. Should a couple decide on an Islamic rite would the Christian community accept the marriage as valid and licit? Or, should two liturgical rites be used for the marriage of disparity of cult? This liturgical problem is compounded when the partners eventually live together as couple. The difficulty of adjusting to each other's faith practice is very evident in many ways (different periods of prayers and fasting, understanding of almsgivings, marriage, communal life etc.), reaching its height in the spiritual life and practice of their offspring. Even though both Christian and Muslim traditions would require that the children be raised in their respective tradition yet, in practice, children of mixed marriage could belong to any of the traditions, which could also means belonging nowhere.

Pastorally, the couple of any mixed marriage will need constant support and encouragement from the Christian community or the
Muslim community just as all marriages. Thus, pastoral care of the couple is more important than juridical correctness in these marriages (one of the aims of such pastoral care is to help the Christian partner to continue practicing the faith. Though prudence and reserve must always be present in marriages, great pastoral care must be offered when Christian-Muslim marriages do take place (for example, women married to Muslim men in a Christian community can suffer greatly and vice versa). People in inter-religious marriages are easily marginalised in both communities, and pastoral care must aim at preventing this. The question is: to what extent can the Christian or Muslim aid go in order not to make the Muslim or Christian partner feel their religious right been infringed upon? It is to deal with the liturgical and pastoral concerns that Christian-Muslim marriage raises that the Catholic Church, and some other Christian Churches, require of both Muslim and Christian (catholic) partners to receive sufficient education regarding the rationale and essential properties of marriage (Can. 1056), fully aware that other religious traditions and denominations and sects may have divergent teachings on marriage. During the time of preparation, the basic requirements of the Christian concept of marriage (permanent, unique, mutual and spiritual faithfulness and respect for each other's faith) must be made clear to both partners. So too must the question of the religious upbringing of children. This must be discussed before the marriage takes place-such a crucial question cannot wait until after the marriage. Children of mixed marriages often end up belonging nowhere and their spiritual upbringing is often thwarted. It is also highly important that the Christian/catholic partner is provided with sufficient information concerning the unique marriage teachings of Islam in addition to the catholic/Christian teaching. Among other things adequate instruction on polygyny and divorce is essential and is highly recommended especially when traditional society permits Christian-Muslim marriage. Islamic law could permit a man to marry up to four wives (Sūrah, 4:3); a permission which is hardly accepted by any Christian Church. Muḥammad ʿAbduh (d.1905) argues that the Islamic ideal was monogamy on the basis of Sūrah, 4:3 and 4:129. Up to four wives were allowed on condition of fair treatment. Since fair treatment was impossible, the Muslim should only take one wife. The former head of al-
Azhar Maḥmūd Shaltūt (1963) said that this reasoning violated the plain meaning of Sūrah, 4:3 and that this verse permitted polygyny. According to Shaltūt, the purpose of the second verse (Sūrah, 4:129) is not to state the impossibility of fairness. Instead, its purpose is to explain the “equality” enjoined in the first verse (Sūrah, 4:3). The equality imposed by Qurʾān (Sūrah 4:3) is not an absolute equality; that would be impossible. Rather, it simply means not favouring one wife completely over another (Shaltūt, 1988: 182, 183). In any case, the Christian woman ought to be concern that her Muslim partner could be polygynous. The issue of polygyny is especially vital when the Canon (Christian) law does not require Muslim partner to make any promise. The Muslim man also should know that under no circumstance is polygyny allowed by Christian tradition. The question of divorce should also be discussed thoroughly. Some Christian denominations, with the exception of the Catholic Church, give in to divorce as the last resort. Even though in Islam marriage is to be a permanent institution and that all efforts should be made to salvage a failing marriage a divorce is an option as the last resort (Shaltūt, 1988: 162-171). If the wife is causing difficulties in marriage, the husband may resort to discipline (Sūrah, 4:34). If the husband is causing difficulties, the wife should seek peace and reconciliation (Sūrah, 4:128). In the case of marital difficulty the couple cannot resolve themselves, they should resort to a process of mediation whereby an arbiter is appointed from the husband's family and one from the wife's family to help resolve the dispute (Sūrah, 4:35). A Muslim about to marry a catholic, for instance, should know that under no condition is divorce granted. A divorced catholic can marry again in the Catholic Church with the death of the partner.

Conclusion

Despite the strong opposition to them, Christian-Muslim marriages have gained currency in Ghana. As argued above, this prevalence is not only because Christians and Muslims live in a pluralistic environment and are more exposed to each other's beliefs (Fitzgerald & Borelli, 2006:68), but also because the traditional customs, which do not consider religious background of prospective partner a prerequisite for marriage, allows
and facilitates it. In both Islamic and Christian traditions, the religious impediment could, in some cases, be removed by dispensation if the prospective partners truly want to marry. In other words, the temporary prohibition could be dispensed under certain conditions. The fact that dispensation could be granted means that issues of Christian-Muslim marriage should not be reduced to whether or not a dispensation will be obtained, or challenges they pose to the couple but also that such marriages could help forge a bond of friendship not only between the spouses but also their families and lineages (Rattray 1929:126; Daniels, 1964:355; Hagan, 1967:61). The tie established between the families of the spouses begins a relationship of affinity amongst them for the promotion of peace in the larger community (Nukunya, 1992:41). The affine relationship is regarded, among the Akan people for instance, as kin relationship and it is treated as such though they may not be blood related, either true or imaginary (putative) (Nukunya 1992: 39). In case of a Christian-Muslim marriage the affine relationship that ensues involves kin relations of Christian and Muslim families. This mixed marriage, considered the ideal interreligious encounter, would set in motion ideal Christian-Muslim relations at the level of the family in the spirit of dialogue of life (Dialogue and Proclamation, 42). This relationship enables Muslims and Christians to live peacefully together, either in a compound house often built by their grandparents or in the same vicinity. Christians and Muslims are obligated by tradition to relate to one another at the personal level. They at times share rooms and meals. They are united as relatives at home and only separated on Fridays and Sundays in the mosques and the churches. Christians and Muslims in affine relationship may argue, quarrel and even fight over religious difference as to whether or not Muhammad is a prophet and Jesus is God, they are always united by virtue of their affine kinship. In this way, Christians and Muslims co-exist not so much because their various religious traditions encourage them to but for their affine kin connectivity.

Furthermore, when Christians and Muslims are as close as the affine association brings them, the rampant and wild characterization of each other without any justifiable evidence would be given a stricter scrutiny. The Christian would readily reject the wild claim that Muslims
are all terrorists, evil and violent when they have Muslim relatives who are not and vice versa. He would eagerly accept that interpersonal relationship and Christian-Muslim exchanges have more to do with personal attitude and temperament than religious stances.
References


Enhanced Millimeter Wave Radio Receiver Design and Simulation at 60 Ghz for Wireless Communication

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ABSTRACT

To evaluate the performance of a 60 GHz Receiver design and simulation using Agilent's Advanced Design Systems (ADS) software. Where the 60 GHz carrier frequency can withstand high-throughput wireless communications. The unlicensed frequency allocations at around 60 GHz in each region do not match exactly, but there is substantial overlap; at least 3.5GHz of contiguous spectrum is available in all regions that have allocated spectrum. Unlike the 2.4 GHz and 5 GHz unlicensed bands, the 60 GHz area is also relatively uncongested. Transmission at 60 GHz covers less distance for a given power, mainly due to the increased free space path loss (loss over 1 m at 60 GHz is 68 dB, which is 21.6 dB worse than at 5 GHz), compounded by propagation losses through materials and human body shadowing (losses from a few dB to 30dB+). The substantial RF absorption peak in the 60GHz band due to a resonance of atmospheric oxygen molecules is often cited as a limitation on range in this band, but this absorption effect only starts to become significant at >100 m range, which is not really relevant to the low-power transmissions. The 60 GHz band has unique characteristics that make possible many other benefits such as excellent immunity to interference, high security, and frequency reuse. This Receiver operating at 60 GHz with data rates up to 1.0
Gbps with Quadrature Amplitude Modulation (QAM) modulation. The design exhibits a very low noise figure.

**Introduction**

A key for future communication networks is "Trinity" i.e., providing a simultaneous service for voice, video, and data. This requires access networks with very high capacity. High data-rate requires broad frequency bands and a sufficiently broadband spectrum can be obtained in the millimeter-wave (mm-wave) bands. The mm-wave band has several advantages such as large spectral capacity and compact and light equipment for the 60 GHz band where the oxygen absorption has its maximum, 10–15 dB/km. Hence, the 60 GHz band also benefits of reduced co-channel interference providing dense, short reach (1km) wireless communication due to shorter cell re-use distance as well as access to worldwide allocated non-regulatory frequency bands. Now several companies provide 60 GHz data links for Gigabit Ethernet (1.25Gbit/s) bridges between LAN networks. It is expected that the use of 60 GHz technologies will extend to other fixed wireless areas, such as access networks. To achieve telecom carrier class link availability (99.999%) it might be necessary to reduce the impact of heavy rain using a Hybrid Free-Space Optical (FSO) Radio (HFR) system. Inter-vehicle and roadside communication in Intelligent Transport System (ITS) applications, as well as the quasi-cellular Mobile Broadband Systems (MBS), are other areas where 60 GHz technologies will be implemented in the future. The ultimate application area would certainly be for 60 GHz WLAN and WPAN, which would require mass production of small, low-cost and highly integrated receiver products. This would extend existing broadband WLAN systems providing high-speed hot spot access points (APs), as well as a fall-back option for the 60 GHz WLAN during temporarily worsened channel conditions due to wall attenuation or shadowing. The European IST project Broadway is addressing these issues for scenarios including hot spots in vendor areas and cyber-cafés, high-density residential dwellings and flats, and corporate environments. Which would allow very high data rate (2 Gbit/s) applications such as high-speed Internet access, streaming content download (video on
demand, HDTV, home theater, etc.), real-time streaming, and wireless data bus for cable replacement. The millimeter wave spectrum at 30-300 GHz is of increasing interest to service providers and systems designers because of the wide bandwidths available for carrying communications at this frequency range.

Block Diagram and Schematic Diagram Analysis

This section gives a descriptive analysis and the methodology approach.

Block diagram

![Block Diagram](image)

Figure 1.1

**Mixer**

![Mixer Diagram](image)

Figure 1.2

Amplifiers

For the amplifiers, the most relevant parameters are gain, noise figure and output power for the amplifier. In this model, I use two different
amplifiers: a low noise amplifier and an intermediate frequency amplifier. Their characteristics are given in the table below

**Oscillators**
The important parameter for this device is the frequency stability called phase noise. It quantifies the deviation of the carrier frequency around the center frequency. If the noise is too high it can result in an improper demodulation at the mixer stage. The HF modulation is performed with a 7 GHz local oscillator multiplied by 8. The phase noise expected is –100 dB at 100 kHz.

**Mixers**
Many parameters can be set, but the most important are conversion loss and noise figure. The typical values we got are 7 dB for the conversion loss and 7 dB for the noise figure. The conversion loss must be included in the link budget and it is the choice of the designer to compensate it.

**Filters:** There are two types of filters used in this proposed design

- **Butterworth filter**
- **Chebyshev filter**

**Butterworth filter**
The butterworth here is a bandpass filter for image rejection. Maximally flat response, i.e., no passband ripple and roll-off of minus 20db per pole. The Butterworth filters will be able achieve its flatness of transition region from passband to stopband with average transient characteristics.

**Chebyshev filter**
Chebyshev filters here also a low pass filter and a High pass filter which will have a narrower transition region between the passband and the stopband. The sharp transition between the passband and the stopband of a chebyshev filter produces smaller absolute errors and faster execution speeds than a Butterworth filter. The poles of chebyshev filter lies on an ellipse.
Design Specification

<table>
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<tr>
<th>Component Name</th>
<th>Gain (dB)</th>
<th>NF (dB)</th>
<th>1(dB) compression</th>
<th>Image rejection</th>
<th>Centre frequency</th>
</tr>
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<tbody>
<tr>
<td>LNA</td>
<td>17</td>
<td>5±</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>IF AMP</td>
<td>23</td>
<td>2.7</td>
<td>17</td>
<td>-</td>
<td>2.4 GHz</td>
</tr>
<tr>
<td>MIXER</td>
<td>(-7,0)</td>
<td>7</td>
<td>-</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>BPF</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>54.4 GHz</td>
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<tr>
<td>LPF</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2±</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>3±</td>
<td>-</td>
</tr>
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</table>

Table 1.1 The table shows the design specification

Baseband Amplifier Circuit Design

Once the input signal has been demodulated, it is a train of analog pulses representing binary data. This waveform requires amplification before it can be digitized. This amplifier designed to serve this purpose. A large gain is required and a low supply voltage is desired from a power consumption perspective, therefore a multi-stage configuration is used. Since this circuit operates at baseband (below ~3 GHz) any inter-stage AC coupling capacitors will have to be large in area as the modulation scheme is not totally DC-free, and are avoided because parasitic capacitance to ground causes prohibitive bandwidth loss. Therefore since DC coupling will be used, differential architecture is used to mitigate DC offset issues.

The first stage of the amplifier is a single to differential ended converter implemented by AC grounding one input terminal of a differential amplifier. The PMOS load is biased through resistors at the output which provide common mode feedback to the output bias and can be adjusted to tune gain versus bandwidth. The second stage is a differential to single ended circuit with a PMOS current-mirror load and a parallel RC gain peaking network at the source of the input devices.
Quadrature Amplitude Modulation (QAM)

It is both an analog and a digital modulation scheme. It conveys two analog message signals, or two digital bit streams, by changing (modulating) the amplitudes of two carrier waves, using the amplitude-shift keying (ASK) digital modulation scheme or amplitude modulation (AM) analog modulation scheme. The two carrier waves, usually sinusoids, are out of phase with each other by 90° and are thus called quadrature carriers or quadrature components.

Circuit Simulation

In its simplest form ADS has the same functionality has other SPICE programs like PSPICE.

DC Analysis:
The first step in any circuit simulation is the determination of the bias point. This simulation performs this. It takes into account the non-linear behavior of the transistors and other circuit elements.

AC Analysis:
This analysis performs essentially a small signal analysis of the Circuit. A DC analysis is performed to determine the quiescent point. At this bias point the transistors and other non-linear circuit elements are linearized. In other words the transistors are replaced by their equivalent circuits which are made from resistors, capacitors, inductors and voltage and current sources. This type of analysis is only appropriate for small signals.

S-Parameter Analysis:
This is essentially the microwave equivalent of AC analysis and the same comments apply. This analysis will be frequently used in the project and microwave circuit design.

Transient Analysis:
AC and S-parameter analysis linearize the circuit and operate in the
frequency domain. Transient analysis predicts the performance of the circuit in the time domain. It therefore includes all the non-linear properties of the components. Be warned this simulation can take significant amount of time and generate large amounts of data.

**Harmonic Balance (HB)**
When designing a circuit with non-linear elements, usually we are only interested in the interaction of a couple of frequencies. This analysis takes into account the non-linear elements of the circuit and restricts the analysis to several important frequencies. This is usually faster than doing a complete transient analysis and then extracting the required information from the temporal signal by Fourier transform techniques. This is ideal for obtaining an estimate for the IMD3 products by simulating two tonetest measurements.

**Simulation Systems and Results**

**Advance Design System**
An ADS is a sophisticated circuit simulator and can take a significant amount of time to learn all the complex features. For the H6CTCE/H64RFL(P) courses you do not need to know about these features.

**Receiver**

**Receiver Front End**
In receive side, an isotropic antenna, is connected into a band-pass filter (57.4GHz). The RF filtered signal is down-converted to an IF signal centred at 2.4GHz and fed into a band-pass filter with a bandwidth of 2GHz. A low noise amplifier (LNA) with a gain of 21dB is used to achieve sufficient gain. A simple differential demodulation enables the coded signal to be demodulated and decoded. The receiver is clearly demonstrated in figure 8.1.
Figure 1.3 Receiver front end diagram

Receiver Harmonic Balance

Figure 1.4a LNA Output  Figure 1.4b RF input

Figure 1.4c LNA Output  Figure 1.4d Band Pass Filter
Budget Analysis

Figure 1.5 Budget Analysis Diagram

<table>
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<tr>
<th>Measure_Name</th>
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<th>MIX2</th>
<th>AMP2</th>
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<tr>
<td>-57.143</td>
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<td>-89.143</td>
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**NOTE:** All values are in dB.
The unlicensed band of 60GHz can support data rates of 1Gbps, with a millimeter range. This is suitable for high data rate transfer. As shown in the figure 10, the BER is calculated at 1Gbps, and the SNR at input of the demodulator, for QAM is 1.55dB as calculated from equation.

\[ \text{Sensitivity} = -17 + \text{NF} + 10 \log_{10} \text{BW} + \text{SNR} \]

NF = 8.97dB, BW = 7GHz

NF - noise figure, BW - bandwidth, SNR - Signal to Noise Ratio,
Sensitivity - \((P_{RX}) = -65.03\text{Bm}\)

\[
SNR = \left(\frac{E_b}{N_0}\right)_{dB} + \left(\frac{R}{BW}\right)_{dB} = 1.55
\]

Where \(E_b\) is the energy required for the bit of the information, \(N_0\) is the thermal noise on 1 Hz of the bandwidth, \(R\) is the system data rate and \(BT\) is system bandwidth.

Figure 1.7 \(E_b/N_0\) Vs Ber

<table>
<thead>
<tr>
<th>Index</th>
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<tr>
<td>EbN0=0.000</td>
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Conclusion

The radio Receiver design at 60GHz has been designed and simulated, with QAM modulation using Agilent ADS. The system must receive an input from a transmitter. A data rate of 1 Gbps has been achieved. The receiver sensitivity of - 63.16 dBm is obtained at a BER of 10³. The performance was confirmed with respect to measurements. The model is based on data obtained from a system level simulation that is used during design.

This low level simulation employs models of high order and complexity. The modeling methodology uses specific data to parameterize the model structure. However, this reduced-order model is capable of approximating a high degree on nonlinearity by the network. The proposed technique is applicable to state-of-the-art heterodyne, whose behavior concerning demodulation, noise figure and BER is faithfully reproduced by the presented model. Comparison of the outputs of the proposed model and simulations show excellent agreement in its operation. The field of application of such accurate model are simulations where the complexity of an extracted circuit model, the design have both accuracy and flexibility to integrate to different network.

This project Works on the system level and got the desired project output the conclusion is related with my work. Taking these results I will proceed for the circuit level design and the prototype design. The natural extension of this work is the full integration of all receiver components into a complete system. In this regard there is work beyond the scope of this paper to be performed in millimeter wave antenna design, chip packaging, and physical layer interfacing with the higher levels of the communications protocol stack. In addition, there are improvements to the designs of the individual blocks that would benefit the system as a whole, the first being an increase in the overall gain of the receiver. Alternative topologies and improved device layouts are the first place to look for these improvements.
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Neoliberalism, Global Justice and Sustainable Development

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ABSTRACT

There is an implication of the spread of neoliberal development in the developing world for concerns about global justice and sustainable development. The logic of the market which is defined by increasing expansion of production, consumption and the maximization of profit would only promote international injustice and impede the realization of sustainable development. Conversely, sustainable development would require a global cooperative arrangement in which the North will have to transfer resources, including environmentally-friendly technologies, to the South. In return the south would have to take effective measures to curb it unsustainable population growth. In short, international justice and sustainable development require global cooperation to regulate global market forces and not laissez faire.

Introduction

That the world is currently embroiled in a grave environmental crisis remains a contested assertion by only a handful of cornupians like Julian Simon who argued that our environmental challenges could be fixed by the creative deployment of technology (1981). What is not in contention, however, is that if current rate and pattern of reproduction, production and consumption continue into the future, the world faces the prospect of
an imminent ecological collapse. Some indications of this possible ecological disaster are already with us: an increasingly warming world, ozone layer depletion, massive deforestation, and the spread of acid and other forms of pollution.

Partly because of these grave environmental challenges, the growing awareness of the finitude of natural resources and a better understanding of anthropogenic impact on the global environment, there was a major attempt at the conceptual level to integrate concerns about environment and development, a move that eventually culminated in the articulation of the idea of sustainable development. As an ideal “sustainable development” was so attractive that it quickly found its way into the rhetoric and politics of national governments, international organizations and non-governmental associations. Following its articulation by the Bruntland report of 1987 published in the book, Our Common Future, there has a series of conferences and a number of negotiated conventions dealing with the myriads of environmental issues thrown up by industrial development. These include the United Nations Conference on Environment and Development, otherwise known as the Earth Summit of 1992, and The 2002 World Summit on Sustainable Development in Johannesburg, South Africa.

If the juxtaposition of the ideas “sustainability and “development” carried with it the radical potential of redirecting the character of development by emphasizing environmental considerations, a counter-revolution took place in the development community as neoliberalism or the market ideology, following the collapse of centrally planned economies in Eastern Europe, displaced the notion of state-led development and became the dominant model for economic development around the world. Advocates of neoliberalism make bold claims about the benefits of adopting their economic template. They contend that encouraging freer trade at all levels and eliminating governmental regulation of the market will yield high levels of economic growth throughout the world, thus, enhancing the living conditions for all and alleviating global poverty. Critics of neoliberalism however remain unconvinced. Instead they draw attention to the linkages between free market capitalism and realities “such as widespread hunger and poverty, massive ecological degradation and increasing social
conflicts (Harvey, 2005; Fotopoulos, 1997; Sniegocki, 2008).

This paper seeks to demonstrate the implication of the spread of neoliberal development in the developing world for concerns about international justice and sustainable development. Specifically, it argues that the logic of the market which is defined by increasing expansion of production, consumption and the maximization of profit would only promote international injustice and impede the realization of sustainable development. Conversely, it concludes that sustainable development would require a global cooperative arrangement in which the North will have to transfer resources, including environmentally-friendly technologies, to the South. In return the south would have to take effective measures to curb its unsustainable population growth. In a nutshell, international justice and sustainable development require global cooperation to regulate global market forces and not laissez faire.

To attain the objective of this work, the paper is structured in three parts. The first addresses conceptual matters, the second analyses how the logic of the free market system would impede international justice and undermine sustainable development. And the third argues that international justice and sustainable development require international cooperation as well the displacement of the market as the central organizing principle for socioeconomic arrangements around the world.

**Conceptual Issues**

The title of this paper features a collection of essentially contested concepts: “neoliberalism”, “international justice” and “sustainable development”. To facilitate the comprehension of the succeeding discussion, it is expedient that we unpack the meaning of these concepts with a special emphasis of how they are deployed in this article.

Neoliberalism has been variously defined as an economic philosophy, as an ideology, as a project of the international capitalist class etc., thus Plehwe et al (2006: 2) laments that any effort at a comprehensive definition of the concept is frustrated by the plurality of views that exist within the group of thinkers who espouse neoliberalism. The difficulty of defining neoliberalism is further compounded by the
diverse interpretation that critics bring to the conceptualization of the idea. Hahn (2008), for instance, interpret neoliberalism as an hegemonic project, which concentrates power and wealth in local and trans-national elite groups around the world while many liberals sees it an as an economic philosophy that is best suited to the creation of prosperity and the advancement of human welfare in contemporary societies. According to Harvey (2007: 22) Neoliberalism is in the first instance a theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade. Smith et al (2008:1) provide a slightly similar definition: Neoliberalism, is set of ideas and practices centered on an increased role for the free market, flexibility in labour markets and a reconfiguration of state welfare activities, while Kotz (2002:65) designates neoliberalism as a body of economic theory and policy stance which claims that “largely unregulated capitalist system (“a free market economy”) not only embodies the ideal of free individual choice but also achieves optimum economic performance with respect to efficiency, economic growth, technical progress and distributional justice”

In the light of the above definitions, it is clear that neoliberalism is essentially a political economic philosophy which posits that optimal economic system is achieved by given free rein to market participants, privatization, free trade and the shrinking of government intervention in the economy (Osimiri, 2013). A closer examination of the various conception of neoliberalism brings the following points to the fore: first, that neoliberalism promotes a global economic order in which market forces reigns supreme, what Salih (2001) describes as neoliberal globalization. Secondly, the emphasis on liberalization and free trade imply the removal of all government imposed constraint on movement between countries in other to create an open borderless world economy which incorporate both the advanced industrialized countries of the world and the developing nations of the third world. A third and final feature is the neoliberal manifest opposition to the interventionist state. According to neoliberals, the dismal economic circumstances of third world countries are rooted in a crisis of governance which is manifested
in the failure of African states to effectively manage their respective economies (Faulks, 1999). Thus neoliberals seek to dismantle the interventionist state and replace it with a minimalist state that will guarantee the interest of capital in their respective jurisdictions.

The second major key concept to be explicated here is international justice. Justice is, of course, the paradigm case of an essentially contested concept. With an history straddling the long expanse between ancient Greece and the contemporary era, justice has been variously defined as internal harmony (Plato), as reciprocity, as mutual advantage (Gauthier, 1986), as fairness of institution (Rawls, 1999) and recently as recognition (Honneth, 2004). Giving the diverse and divergent conceptualization of justice it would be impossible for this paper to provide a comprehensive analysis of the meaning of justice. What is clear, however, is that there is a general agreement that justice relates to idea of “giving to each one his due” as expressed in the Latin phrase *suum cique tribuere*. (Barry and Matravers, 1998:141). If we adopt the above as our working definition, domestic justice would require that the principle of “due allocation of entitlement” be applied within territorially bounded communities such as nations-states, whereas global justice will demand that the same principle be applied trans-nationally to cover the entire world. In the words of Soniewicka (2008:46) global justice refers to “… justice at the level of individuals but extended to the world at large irrespective of state borders”.

These demands according to him could be divided into four major categories which distributive justice, transitional justice, political justice and corrective justice. There are of course a number of thinkers who rejects the idea of global distributive justice such Walzer (1983), Miller (1995) and Nagel (1995). For lack of space, this essay will not engage these popular objectors to global justice; it simply assumes that concerns about global distributive justice are genuine in the light of the vast material disparities between the North and the South and the disproportionate consumption of environmental resources by advanced industrial capitalist countries.

The third key concept that stands prominent in our title is sustainable development. Just like all the other concepts, sustainable development is a “contested discursive field…” (Becker et al, 1999:1).
Thus, “the only consensus on sustainability appears to be that there is no shared understanding” (Becker et al, 1999:4). Yet despite the diverse interpretation of sustainability, the phrase sustainable development is generally employed to denote a commitment to quality of life, the conservation of the environment and a sense of obligation to future generation. This much can garnered from what may be dubbed the official definition of the concept developed by the Brundtland report of the World Commission on Environment and Development (WCED) entitled Our Common Future (1987). According to that report, sustainable development refers to the form of “development that that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987:8). Choucri (1999:143) slants this definition slightly when he says sustainable development means meeting the needs and demands of human population without undermining the resilience of life supporting properties.

Since the introduction of sustainable development by the Brundtland commission, there has been an explosion of literature on the subject with the result that the concept gathers new nuances as its interpretation proliferates. Thus according to Haque (1999:200) sustainable development has been variously interpreted as a:

Pattern of transformation that optimizes socioeconomic benefits in the present without jeopardizing the potential for similar benefits in the future; as a process of development that emphasizes intergenerational, interspecies, and intergroup equity; as an economic development that is complementary to environment and society; as an improvement in current living standards without jeopardizing future living conditions; and as a process of ensuring environmental services on a very long-term basis.

Perhaps the lesson from these diverse interpretations is that sustainable development is a multidimensional concept simultaneously pointing at the issues of justice, environmental integrity and human development
that must inform development discourse and practice. The attempt to capture these issues has led to the disaggregation of sustainability into four major areas by Haque (1999):

- **Environmental sustainability** (requiring development to be based on biotic capacity and minimal nonrenewable resources)
- **Economic sustainability** : implying the impossibility of never-ending economic achievements based on natural resources and the need for incorporating environmental costs into consumer prices.
- **Social sustainability** (highlighting the need for citizens' participation in environmental governance and the need equity. This dimension of sustainability emphasis the importance of justice issues in the sustainability discourse.
- **Cultural sustainability** (emphasizing the changes based on core cultural values and the acceptance of cultural differences).

**Neoliberalism, Global justice and Sustainable development**

Having defined the key concepts of this discourse we may now proceed to the question of the compatibility of the spread of neoliberal economics with the twin goals of global justice and sustainable development. It is, of course, the case that issues of Justice at some points intersects in complex ways with the issues of the sustainable development. Indeed the notion social sustainability suggests that question of distributive justice and equity are integral the idea of sustainable development. For the purpose of analytical clarity however the paper will separate the examination of the account of the implication of neoliberal economics for global justice on the one hand from its implication for environmental integrity on the other, while indicating at intervals where global justice issues affect sustainable development.

**Neoliberalism and Global Justice**

There a variety ways in which neoliberalism or a commitment to free market fundamentalism contributes to the incidence, perpetuation and
the deepening of global injustices. There are three ways in which the unfettered operation of market forces contributes to global injustice: the worsening of poverty and inequality; the uncompensated exclusion of poor nation from the use of the world natural resources and the incidence of environmental injustices.

Neoliberalism, Poverty and Inequality

One of the main promises of neoliberalism is that rolling back the state to unleash the dynamism of market forces would lead to overall prosperity, the amelioration of poverty and, as Kots claims above, the achievement of distributive justice. The realities after about three decades of the spread of economic liberalization across the world particularly within the third world have been anything but encouraging. Statistical data for instance shows that typical neoliberal prescription package, ie, currency devaluation, deregulation of prices and wages, removal of subsidies on basic necessities, trade liberalization, and privatization of state-owned enterprises, etc (Jochnick, 2001:167) imposed on developing countries and highly indebted countries in the wake of the economic crisis of the 80s by IMF/World Bank has led to the further pauperization of poor and the expansion of inequalities within and between nations.

Harrison (2010) for instance affirms that during the 1980s, average incomes in sub-Saharan Africa fell by about 20 per cent, leaving the average African poorer than she was in 1970. According to him, over a broadly similar period, average GDP in Africa grew by less than 1 per cent leaving over 50 per cent of the population on less than a dollar a day, while the between 1981 and 2001, the number of poor, those below the international poverty line doubled, reaching 313 million (Round 2007, Table 3). Interestingly these deleterious consequences of the imposition of neoliberal policies is not limited Africa. According to Socialism Today (2006) Neoliberal policies have been catastrophic for the masses of Latin America as wages and living standards reduced dramatically, leaving a staggering 41% to live on less that $2 per day and another 18% to barely struggle to survive on less than $1 a day (www.socialism today.org). Thus McChesney (1999:8) concludes that the economic consequences of neoliberal policies have been the same
just about everywhere:

A massive increase in social and economic inequality, a marked increase in severe deprivation for the poorest nations and peoples of the world, a disastrous global environment, an unstable global economy and an unprecedented bonanza for the wealthy.

But how do Neoliberal prescriptions exacerbate poverty and accentuate inequality. Thomas Pogge, a leading authority on global justice has argued extensively that the institutions of the global economic order are responsible for such negative outcomes. By institutions, Pogge was referring not to organized collective agent like the IMF or the WTO. Instead, he is alluding to the “rules of the game” or guiding principles which govern interactions among individuals and collective agents as well as access to material resources (2008:37). At other times, Pogge employs the phrase “institutional order” or “basic structure” to describe the rules that underlies the basic the global economic order. Given its dominance in the last three decades, there is no doubt that neoliberal prescriptions form the core of the global institutional order. According to Pogge, the global institutional order is skewed in favour of the affluent and is imposed by the same on the global poor to reproduce and perpetuate global poverty. In his words:

… the citizens and the government of affluent countries a- whether intentionally or not- are imposing a global institutional order that foreseeably and avoidably reproduces severe and widespread poverty. The worse off are not merely poor and often starve but are being impoverished and starved under the shared institutional order which inescapably shape their lives (Pogge, 2008:207).

Aside from being at the core of an unjust global institutional order another a major way neoliberalism perpetrate injustice at the Global level is by creating a conducive condition for the uncompensated exclusion of
the poor from the use of world's natural resources (Pogge, 2008:207). In other words the affluent lifestyle of advanced industrial countries of the world requires the acquisition and consumption of a disproportionate share of the world's resources. Yet, the poor are rarely compensated for their systematic exclusion from access to a fair share of these resources. A UNDP report indicate that in 1998 the richest 20 per cent of the world's population accounted for 86 per cent of total private consumption and consumed 58 per cent of the world's energy. In the same vein, Per capita carbon dioxide emissions in the OECD countries average 12.4 tonnes, while in the lowest-income countries the average is put at 1.0 tonnes per capita (Elliot, 2004:139). In the light of the scarcity or finitude of these environmental resources the disproportionate expropriation of the world's environmental resources, particularly those that are tagged as non-renewable, is unjust since the stock that is left for the rest is thereby rapidly diminished.

Ironically libertarians like Robert Nozick are wont to defend the present inequitable expropriation of global resources with the reference to John Lockes'(1988) theory of property rights which state that when once you mix your labour with a resource in its natural state, you have improved the quality of such a resource and it becomes your property. Locke, however, puts a moral constraint on the unilateral appropriations by invoking what is generally known as the Lockean proviso which permits any amount of appropriation as long as there is “enough and as good” left in common for others. The meaning and practical implication of leaving “enough and as good” is certainly disputed over the degree of freedom that individuals have in appropriating previously “unowned” part of nature. However that debate is resolved, what is clear is that there Locke puts a restraint on the appropriation of the commons. It is in the violation of this proviso that the affluent societies of the west perpetrate an injustice against the poor nations of the third world. To correct this imbalance in the consumption of world resource, Pogge (2008) had proposed a Global Resource Dividend tax on the consumption of natural resource with aim of redistributing the funds therefrom to alleviate global poverty.

If uncompensated exclusion from natural resources is one side of environmental injustice, the other side is the unfair distribution of
environmental harm. It is common knowledge that the poor nations are more vulnerable to the impact of environment degradation. Thus while the industrialized capitalist countries have generated economic growth, ie, benefited immensely from their massive consumption of environmental resources, the burdens of their growth is largely borne by developing countries. It has been indicated for instance, that in spite of the differentiated contribution to global warming, developing nation, who have contributed the least to this problem would be worst hit. Elliot (2004:139) makes a similar point:

Those who are most immediately affected by global environmental decline are those who have contributed least to the problem and who are now ecologically as well as economically and politically marginalized (including the poor, women and indigenous peoples). Shiva puts it bluntly: 'the natural resources of the poor are systematically taken over by the rich and the pollution of the rich is systematically dumped on the poor.'

From the discussion in this subsection we have highlighted some ways in which the neoliberal capitalist order promote global injustice, in the next we will focus on how laissez faire capitalism undermine sustainable development. These includes the undue emphasis on economic growth, the impoverishment of the poor, and the attempt to neoliberalise environmental management.

Undue Emphasis on Economic Growth
One of the fundamental assumptions of neoliberalism is the need to eliminate governmental and other restrictions on economic activities in order to allow the unregulated and continuous growth of the world economies under the ideology of free market capitalism. The problem however is that the logic of worldwide economic growth is incompatible with the now incontrovertible fact that there are ecological limits to economic growth. George Monbiot (2002, cited in Arraghi, 2009:113) captures the this point incisively when he says modern capitalism is not
mathematically possible, let alone biologically viable. As far back as 1974, an MIT study, *The Limits to Growth*, as well as its 1992 sequel *Beyond Limits* concludes that the consumption of environmental resources is growing exponentially and that we are perilously close to overshooting the earth's carrying capacity. By emphasising unconstrained economic growth, neoliberal economics ignores this warning and leaves man racing towards an ecological catastrophe.

Just as unlimited economic growth threatens to destroy the biological support systems of the earth, the drive for maximum profit on the part of big corporations, which have invaded every corner of the world, eclipse any concern for environmental preservation as they employ their influence to dismantle or decrease environmental regulation or enforcement. The fierce competition, the struggle for resources and dominance inherent in capitalism, which neoliberal globalisation has taken to higher level, can only undermine the objectives of conservation, sustainability and species survival (Low, 1999:2).

Another vital nexus between the neoliberal model of development and the environmental destruction is the perpetuation of poverty. As already indicated above neoliberal policies only serves to deepen and perpetuate existing poverty. Poverty however has been identified as one major contributor to environmental degradation. This much was clear in the Bruntland report:

Poverty is a major source of environmental degradation which not only affects a large number of people in the developing countries but also undermines the sustainable development of the entire community of nations- both developing and industrialised (WCED, 1987:364).

The precise connection between poverty and environmental degradation is clear in the literature on development and environment. Mamdani (1995) for instance, has demonstrated that as part of their coping mechanism, poor households tends to have large families. He therefore submits that “people are not poor because they are many, they are many
because they are poor”. In effect, poverty and the insecurity that goes with it, is a major factor in the explanation rapid population expansion taking place in developing nations around world, a phenomenon which ecologist argue can only serve to exacerbate current global environmental problems. Beyond burgeoning populations, hungry and poor people often destroy their immediate environment in their desperate bid to scavenge anything from nature to aid their survival. As the World Bank (1992) puts it, in order to meet their short terms needs poor people mine the natural capital by excessive cutting of trees for firewood and to replace soil nutrient.

The third avenue by which neoliberalism impedes the attainment of sustainable development is through the execution of a grand plan to subordinate ecological concerns to the economic pursuits of multinational corporations and International financial institutions like the world bank. As neoliberal politics roll back the state from center stage, the net effect of the policy is the weakening of the state and the regulatory mechanism for moderating the activities within their territories. The goal is to effect the shift to a neo-corporatist regulatory framework involving non-binding standards such as the idea of corporate social responsibility (See McCarthy and Puldham, 2004). In addition to neutralizing popular control, the big corporations and their allies in government and international organizations have perfected the art of embracing sustainable development at the rhetorical level, even as they negotiate deals for the commodification of nature. The biotechnological revolution has now made it possible for aspect of nature to be patented by big corporations, while industrialized nations now wants to pay for carbon permits to pollute, what Goodin calls buying “environmental indulgencies” (1994: 574).

Having outlined how neoliberal assumption and practices perpetuates global injustice and undermines the attainment of sustainable development, the crucial question at this point is how do we make the world a more just and environmentally sustainable place, giving the glaring conflict of interests and the asymmetry of power between the North and the South? This question is in need of a little elaboration. If it is the case for instance that the present unjust neoliberal global economic further strengthens the hegemony of the advanced
capitalist economies of the North and deepens the impoverishment of the poor economies of the South, will the North with all her political clout and influence willingly allow a dismantling of the neoliberal economic order in favour of an economic system that privileges environmental integrity and international equity? Obviously this is a remote possibility; the privileged will always defend the economic arrangements that serve as the basis of their privileges. In essence, given the advantages that the neoliberal order confers on advance capitalist countries and multinational corporations, they would resist any fundamental restructuring of the neoliberal order. There is however, one important possibility that may focus the attention of industrialised countries of the North on the issues of environmental sustainability and equity: should developing nations also develop industrially like China and India embrace the resource-expensive lifestyle in the North, the toll on the environment will unbearably high, and might hasten the ecological catastrophe that has often been predicted by neo-Malthusians. Obviously it in the interest of all nations, North and South, that we do not destroy the biophysical support systems of our planet. It is not possible, however, for a single country to guarantee this; only in the context of global cooperative arrangement can we develop effective solutions to the environmental threats we face. Principle 7 of Rio Declaration underscores the importance of a multi-lateral arrangement in dealing with environmental problems: “States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the earth's ecosystem”

In a multilateral arrangement to save the environment and by extension secure our existence, what ought to be responsibility of developed and developing nations respectively? Any holistic global arrangement aimed at actualizing environmental sustainability must begin by identifying the underlying causes of environmental despoliation, and from the analysis in this paper that neoliberal emphasis on the expansion of production and consumption and profit maximization contribute in no small measure to global environmental degradation. It should also be added that the population explosion in the developing world exacerbates the despoliation of the environment. Thus, the developing countries must institute appropriate measures to reduce
their galloping population growth and resolve not to embrace the environmentally destructive form of modernity that is epitomized by the industrial giants of the North. In return, the North as matter of justice, and not charity, must largely bear the cost of reversing global environmental damage and restoring the world ecosystem as well compensate the poor countries for their disproportionate consumption of environmental resources. Specifically, the unjust international economic order ought to be restructured to ensure that “trade, capital and technological flows that are more equitable and better synchronized to environmental imperatives” (WCED, 1987:365). In short, for the sake of sustainability, the North needs to transfer resources including environmentally-friendly technologies to the South even as they assist in eradicating worldwide poverty by creating a more just international economic system that enhances opportunities for all.

Conclusion

This paper has attempted to demonstrate the connections between unregulated capitalist system, global injustice and environmental degradation. It highlighted specific ways in which the neoliberal economic model deepens global poverty and inequality on the one hand and how it undermine sustainable development on the other. Given that poverty and unrestrained economic growth are implicated as significant variables in the destruction of the world's environment, a genuine concern for environmental sustainability necessarily requires the restructuring of the global system away from laisses' faire economics, which is the ultimate consequence of economic neoliberalism. The scanty or no regulation regime proposed by the neoliberal capitalism can only resulted in what Hardin (1968) describes as the logic of “the tragedy of the commons” where the unregulated use commonly owned resources are ultimately destroyed due to overuse. With particular reference to the global atmosphere, this logic has already resulted in negative global climatic change in the form of global warming and the erosion of the ozone layer, before the global community woke up to the need to reverse this problem through a multilateral arrangement. Unless the North and the South, come to the realisation that sustainability is a long term
interest, economic practices and resource exploitation based on short-term considerations may well destroy the global ecosystem and make the world increasingly inhabitable.
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Social Media Marketing: Its Contributions to Business Growth and Sustainability: A Study of Sowbaghya PVT Ltd, T-Nagar, Chennai, India

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ABSTRACT

The 21st century has seen a shift in the way businesses market their products and services. This is partly due to an increase in the rate of globalisation - companies are now forced to compete locally and internationally. Competition in most industries and markets has certainly increased forcing significant changes in the ways businesses operate. Today, customers have become more knowledgeable and choosy in terms of their needs and wants. As today's business world is driven by customer demand, success in business is dependent on strong customer relationship building to satisfy customer needs and provide such competitive advantage for the business. In order to meet and the needs and expectations of customers and deliver satisfaction in today's markets characterized by high competition, firms need to enhance their interactions with the customer, build a lasting relationship with them and develop promotional techniques through social media networks. This makes a contribution towards the business' growth strategy. The findings from the study indicate that, social media platforms used in promoting business activities and building customer relationship has a positive impact on a business growth and sustainability as it results in high market shares and improved financial performance.
Introduction

Social networking websites has influenced businesses way of marketing. It has brought about several new elements in the field of modern marketing. Today, social media networks have made customers more accessible, it has emerged with a completely new set of communication tools that make the process of exchanging information much easier and faster. This has compelled most industries and markets to rethink how they are communicating with their customers and potential customers.

Social media has had and is continuing to have a huge influence on business, marketing and on how businesses engage with their target market. The use of social media to share and engage with others continues to grow at an astounding rate, so it would be wise for any business to develop and implement a sustainable social media strategy in order to successfully take advantage of this rapidly changing environment.

Social media websites such as Facebook, Watsapp, Youtube, Twitter, Linkedin and Pinterest represent a huge opportunity for businesses to grab the attention of customers while simultaneously building a brand image. There are plenty of tactics that businesses can employ to do this including the creation of brand profiles on social networks such as Facebook fan pages and creative advertising via branded podcasts and applications, also known as apps.

Social networking websites allow individuals to interact with one another and build relationships. When companies join these social channels, consumers can interact with them and they can communicate with consumers directly. That interaction feels more personal to users than traditional methods of strictly outbound marketing and advertising.

Moreover, social media marketing tools offer businesses with greater market accessibility and customer relationship management strategies which in turn have a significant impact on the growth of the business. Additionally, geographical barriers can be broken down by the use of social media tools. Social media allows businesses to communicate speedily and cheaply with customers as well as allow them to construct a database that can be used to generate business leads that may translate to increased sales and thus grow the business.
Most renowned and seasoned authors in literature have spoken on the influence of social media marketing tools on business growth. With a common voice, these numerous studies suggest that there is a direct relationship between social media marketing and business growth and sustainability in today's competitive market as a result of increased sales.

Social networks allow individuals to connect with one another. It is important for entrepreneurs and marketer to grasp the benefits of social media marketing tools and its long term impact on the organisation.

According to Kotler and Armstrong (2011), social media marketing has made consumers more accessible, it has emerged with a completely new set of communication tools that make the process of exchanging information much easier and faster coupled with useful feedback that help the marketers improve their products to suit the needs of their customers.

Gary (2013) also added his voice that, this important feedback can assist in advancing their marketing efforts, and the general brand values their company projects. The use of social media as a marketing tool allows companies to mingle with fellow professionals in the field, conduct research, connect with the community and get business opportunities.

As of January 2012, there were more than 800 million active Facebook users, with over 250 million of them logging in everyday. In addition, the average Facebook user has 130 friends and likes 80 pages but this figure is expected to expand with time. Today, many businesses are now turning to social networks as a worthwhile communication tool and, if used adequately, they can significantly improve their online presence, in the form of effective promotion (Mediapost.com, 2012).

To achieve success with the online marketing, the marketers need to have a presence in the environment that their customers inhabit. Moreover, Mark Zukerberg, co-founder of Facebook supports this by saying that advertising is fast changing and businesses need to understand the usage of Internet technologies in order to remain relevant (Lisa, 2014).

Suganthalakshmi (2012) supported that, businesses with online presence have access to international markets and therefore tend to
increase their market share. New customers had grown their sales hence increased their profits. The respondents noted that the customers are able to market products indirectly as they recommend products to their friends. They also review and encourage usage of good products. The respondents also noted that social media have made communication cheaper and convenient both for the business and customers.

In his book 'Social media marketing and its role in marketing', Neti (2011) goes further to say that the relationships formed via social media marketing platforms can boost sales and generate opportunities to come up with new products and services. He further argued that, social media allows an enterprise to connect with both existing and potential customers, engage with them and reinforce a sense of community around the business' offerings. Social networking can be an excellent way to acquire new customers and retain existing ones.

Based on the review of literature, the following social media marketing tools have been chosen for this study:

- Facebook
- Youtube
- Watsapp
- Linkedin
- Twitter
- Blogs
- Instagram

**Hypothesis for the Study**

In exploring the relationship between social media marketing and business growth, the study addressed the following hypotheses:

- **H₀**: Social media marketing platforms have no significant impact on business growth and sustainability.

- **H₁**: Social media marketing platforms have significant impact on business growth and sustainability.
Methodology

The present study utilizes the exploratory research methodology to explore the extent to which social media marketing has an impact on business growth and establish their relationship. The population for this study were the management and staff from the various functional departments of Sowbaghya Pvt. Ltd, T Nagar, Chennai, India. Simple random sampling method was adopted to select the total sample size of 60 respondents consisting of 48 staff and 12 management of the company. Both the primary and secondary data collection methods were considered. However, primary data was collected from the respondents with the help of structured opened and closed-ended questionnaires. Primary data was complemented with secondary data sources such as publications on the topic from journals, magazines, and internet. The responses of the measurement were scored using a 5-point Likert scale. The measurement items of the variables were created based on the literature review. Cronbach's alpha coefficient method, Regression, t-test and chi-square analyzes were used to establish the relationships that exist between the hypotheses. Analyses of data and testing of hypotheses were performed using SPSS version 17. The analyses have been in conformity with the objectives and the hypotheses of the study. The data collection period for the study was undertaken from August 2015 to December, 2015.

Results and Discussion

Reliability Statistics

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.987</td>
<td>60</td>
</tr>
</tbody>
</table>

Cronbach's alpha was calculated to measure the reliability of the questionnaire and the results obtained. The value of Cronbach's alpha is 0.987 which is very high, thus showing the higher reliability of the instrument used in the study. This shows the data is satisfactory because they meet the minimum acceptable level of 0.7.
Table 1: Demographic characteristics of respondents (N=60)

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Description</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>38</td>
<td>63.0</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>22</td>
<td>37.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>60</td>
<td>100.0</td>
</tr>
<tr>
<td>Age</td>
<td>18-25</td>
<td>10</td>
<td>16.0</td>
</tr>
<tr>
<td></td>
<td>26-33</td>
<td>14</td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td>34-41</td>
<td>14</td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td>42-49</td>
<td>14</td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td>50 years and above</td>
<td>8</td>
<td>13.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>60</td>
<td>100.0</td>
</tr>
<tr>
<td>Qualification</td>
<td>Graduate</td>
<td>22</td>
<td>37.0</td>
</tr>
<tr>
<td></td>
<td>Postgraduate</td>
<td>23</td>
<td>38.3</td>
</tr>
<tr>
<td></td>
<td>Professional</td>
<td>8</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>7</td>
<td>11.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>60</td>
<td>100.0</td>
</tr>
<tr>
<td>Functional Area</td>
<td>Customer Service</td>
<td>18</td>
<td>29.6</td>
</tr>
<tr>
<td></td>
<td>Finance</td>
<td>7</td>
<td>11.1</td>
</tr>
<tr>
<td></td>
<td>Human Resource</td>
<td>2</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>Sales and Marketing</td>
<td>23</td>
<td>39.5</td>
</tr>
<tr>
<td></td>
<td>Production and Quality</td>
<td>10</td>
<td>16.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>60</td>
<td>100.0</td>
</tr>
<tr>
<td>Years of Experience</td>
<td>Less than year</td>
<td>8</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td>1 – 5 years</td>
<td>13</td>
<td>21.0</td>
</tr>
<tr>
<td></td>
<td>5 – 9 years</td>
<td>16</td>
<td>25.9</td>
</tr>
<tr>
<td></td>
<td>10 years and above</td>
<td>23</td>
<td>39.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>60</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Field Data

The table above shows majority of the respondents (63.0%) are Males and can be found in the Age category of 26-49 years. Further, most of them (38.3%) are Postgraduates (Masters/PhD) holders in terms of Educational Qualification and are working in the sales and marketing sector.
department of the business. (39.5%). Lastly, in terms of their Years of working Experience with the business, (39.5%) have spent ten years and above. This is partly due to the fact that the firm happens to be a family business.

The relationship between Social Media Marketing and Business growth

Table 2: Model Summary of Social media marketing tools vs. Business growth

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.952a</td>
<td>.907</td>
<td>.890</td>
<td>.58590</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Facebook, Youtube, Watsapp, Linkedin, Twitter, Blogs, Instagram

ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>166,769</td>
<td>9</td>
<td>18.530</td>
<td>53.979</td>
<td>.000a</td>
</tr>
<tr>
<td>Residual</td>
<td>17.164</td>
<td>50</td>
<td>.343</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>183,933</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Facebook, Youtube, Watsapp, Linkedin, Twitter, Blogs, Instagram
b. Dependent Variable: Business growth indicators

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>.033</td>
</tr>
<tr>
<td></td>
<td>Facebook</td>
<td>.728</td>
</tr>
<tr>
<td></td>
<td>Youtube</td>
<td>-.671</td>
</tr>
</tbody>
</table>

- 69 -
a. Dependent Variable: Business growth indicators

The Regression coefficient 'R' = 0.952 or 95.2% which means that correlation between the dependent variable and the independent variables is positive. The coefficient of determination 'R²' = 0.907 indicating that 90.7% of variation in dependent variable is explained by independent variables. The F-test value of 53.979 is significant because the significance level is = .000 which is less than 0.05.

Hence, null hypotheses will be rejected and alternative hypotheses will be accepted that Social media marketing is positively correlated with business growth. This also indicates that the correlation between dependent variable and independent variables is statistically significant and the regression model is valid. As shown in the above stepwise regression summary table, it is clear that all the seven social media marketing tools are positively related with business growth. Hence, the researcher rejects the null hypothesis and concludes that there is sufficient evidence, at the 5% level of significance, that there is a strong positive relationship between social media marketing and business growth.

Table 3: Chi-square test results of Social media marketing tools vs. Business growth

<table>
<thead>
<tr>
<th>Research Hypotheses</th>
<th>Chi-Square Value</th>
<th>Df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facebook</td>
<td>666.185*</td>
<td>16</td>
<td>.000</td>
<td>Supported</td>
</tr>
<tr>
<td>Youtube</td>
<td>424.286*</td>
<td>16</td>
<td>.000</td>
<td>Supported</td>
</tr>
<tr>
<td>Watsapp</td>
<td>110.015*</td>
<td>16</td>
<td>.000</td>
<td>Supported</td>
</tr>
<tr>
<td>Linkedin</td>
<td>71.707*</td>
<td>16</td>
<td>.000</td>
<td>Supported</td>
</tr>
</tbody>
</table>
From the table, the results of Chi-square tests for all the hypotheses are in significant level. The chi-square values are greater than 0.05 significant levels. Therefore, the null hypothesis is rejected and alternative hypothesis is accepted at 5% significant level. This shows a positive association between the social media marketing tools and business growth.

**Indicators of Business Growth**

From the review of literature, some major factors influencing business growth were selected and respondents were asked to indicate those factors which affect the business most. The following shows their responses:

<table>
<thead>
<tr>
<th><strong>Business growth indicators</strong></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in Profits</td>
<td>1.7000</td>
<td>0.88872</td>
<td>60</td>
</tr>
<tr>
<td>Increase in Sales</td>
<td>1.8833</td>
<td>1.00998</td>
<td>60</td>
</tr>
<tr>
<td>Customer Acquisition</td>
<td>2.3667</td>
<td>1.32725</td>
<td>60</td>
</tr>
<tr>
<td>Customer Retention</td>
<td>1.7333</td>
<td>0.89947</td>
<td>60</td>
</tr>
<tr>
<td>High Market Share</td>
<td>1.8333</td>
<td>1.07619</td>
<td>60</td>
</tr>
<tr>
<td>Customer Focus and Satisfaction</td>
<td>2.5167</td>
<td>1.29525</td>
<td>60</td>
</tr>
</tbody>
</table>

*Source: Field Data*

The table above represents key business growth indicators. The highest ranked indicator is Customer Focus and Satisfaction with the mean of 2.5167 and standard deviation of 1.29525. Next is Customer acquisition with a mean of 2.3667 and standard deviation of 1.32725. Third is Increase in Sales with a mean of 1.8833 and standard deviation of 1.00998.

The rest are High market share, with a mean of 1.8333 standard deviation of 1.07619. Customer retention with a mean of 1.7333 and
standard deviation 0.89947, and finally Increase in Profits with a mean of 1.7000 and standard deviation of 0.88872.

The ranking responds demonstrates that, marketing performance is not necessarily the maximization of profitable sales volume, but profits through the satisfaction of customers. The consumer is the pivot point and all marketing activities operate around this central point to ensure business success.

### T-test

**Paired Samples Test**

<table>
<thead>
<tr>
<th>Pair 1</th>
<th>Social media marketing tools and Business growth and sustainability.</th>
<th>t (1)</th>
<th>df</th>
<th>Sig.(2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>18.065</td>
<td>59</td>
<td>.000</td>
</tr>
</tbody>
</table>

The tables above represent t-test on the dependent and independent variables. The paired sample test shows a t value of 18.065, a degree of freedom of 59 and a significant value of 0.000. since the significant vant is less than 0.05, the null hypothesis of the study is rejected and the alternative hypotheses accepted that there is a strong correlation between Social media marketing and Business growth.

**Findings, Conclusion and Recommendations**

It was found that through social media marketing, businesses are able to enhance their customer base; in the case of Sowbaghya PVT Ltd, new customers have grown their sales hence increased their profits. The respondents noted that the existing customers are able to market products indirectly as they recommend products to their friends. In addition, the management and staff of the business also noted that social media has made communication cheaper and convenient both for the business and customers.

Moreover, one of the most important findings that the researcher came across while undertaking this study was the fact that the general concept of being ethical while marketing on social network sites includes the responsibility of the business to be honest with the intentions of its
campaign, avoid false advertising, be aware of user privacy conditions; thus, not using consumers' private information for selfish gains, respect the dignity of persons in the shared online community, and claim responsibility of any mistakes or mishaps that are results of the business' marketing campaign. Moreover, while it is ethical to use social networking websites to spread a message to people who are genuinely interested, many people game the system with auto-friend adding programs and spam messages and bulletins. The good news however is that, as a result of increase in technology, social networking websites are becoming wise to these practices, however, and are effectively weeding out and banning offenders.

To conclude, this study clearly identified a positive relationship between the social media marketing tools and the growth of businesses as a result of social networks increasingly catching people's attention today.

The study recommends that business managers and upcoming entrepreneurs should be keen on the current trends and impact of social media websites and design marketing mix strategies to appeal to the preferences of the market segments which would lead to increase in sales and result in business growth and sustainability in the marketplace.
References


Schivinski, Bruno and Dąbrowski, D (2013) The Impact of Brand Communication on Brand Equity Dimensions and Brand Purchase
Religion and Culture: A Study of Amuzu People in Aboh Mbaise Lga of Imo State of Nigeria

CHIBUZO IKECHI NWANGUMA

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ABSTRACT

This study is a historical survey of a people group in the southeastern region of Nigeria. It spans through the cultural and religious life of the traditional man in the region before the advent of Western culture on the continent of Africa. Given the nature of the study, the use of historical analytical method was found most appropriate in the course of the study. Again, most of the materials used for proper elucidation of facts were primarily sourced through the means of oral interviews with indigenes of Aboh Mbaise Lga of Imo State. The assistance of geography was also solicited and such afforded some maps which adequately describe the place for any strange reader. The outcome shows that the people like others elsewhere on the continent had their cultural heritage which very few of them still maintain while several others have dumped such hence most verbs in the work were predominantly in the past tense.

Introduction

Few minutes after a lesson on the early Christian Missionaries activities in Nigeria, a student visited the office my office with what one may tag a personal question, “sir you talked so much about the early missionaries activities in many areas in Nigeria but nothing was said about my place,
why?” Noticing the curiosity and aggression on the countenance of the student, the question to him was which part of Nigeria is yours? From his answer, it became clear that though researchers may not cover all regions and places, everyone will want people to know about his place. This encounter is basically the main force that inspired this writing on culture and religion of one of the interior regions among the Igbos of Nigeria.

Religion and culture link and relate with each other in several ways. This could be more because both are all about the human person. Both deal with people's belief system as well as the way they perceive life generally. As one talks about people's culture, he invariably talks about their religion in one way or the other. The assertion therefore, that culture is the lifestyle of any people; whether an individual, an organization, or a nation is a statement of fact. The culture of one is a true reflection of the person. Thus, a people without culture are a lifeless people (Maduka, 1990). This discourse therefore endeavours to examine the culture of Amuzu people in Aboh Mbaise LGA of Imo state, Nigeria. In doing this, the geography, origin of the people and other aspects of their traditional life are duly addressed.

The Geography of Amuzu

Amuzu lies South of Aboh Mbaise. It bounds on the east with Ngwa-Abia state by the Imo River, on the west by Lorji, on the North by Ezinihitte and on the South by Ogbor Uvuru. It is about 25 kilometers square with a moderate population. Originally, owing to the heavy rain fall due to its nearness to the Atlantic Ocean, its vegetation was that of a tick rain forest. This natural vegetation has of late been destroyed by man for settlement and agricultural purposes. Right now, we have bush in uncultivated areas and a few scattered traces of forests, especially, where there are shrines (Onwuka, 2008). Like in most parts of Imo State, the topography of Azuzu is that of plane ground.
AIR PORT SITE
Courtesy of Josiah Onwuka, Senior Geography Teacher at Comprehensive Secondary School Amuzu, Aboh Mbaise LGA as well as an accomplished geographer in Imo State Secondary School System, who is also an indigene of Amuzu
History of Amuzu

The history of Amuzu, like any other part of Igbo people, is quite difficult to trace. There seem to be differences in views as to the beginning of the people. The reason for this could be traced to the time lag between now and the very beginning and the fact that most people could not leave historical facts for the coming generations. Nevertheless, one uniform fact of the origin of the people is the eldership of Umugberim. All Amuzu people believe that “Gbarim” is the eldest son of Uzu.

According to Eze G.I. Elugberaonu (2007), the Uzu I of Amuzu, they journeyed from Arondizuogu through Awka. This can be attested to by the similarities between Awka and Amuzu in culture, especially, as blacksmith. According to the Eze, they were many. They journeyed from Awka and settled first at Amauzi in Ahiazu Mbaise Local Government Area formerly call Amaushe (a place to settle down for short while and rest).

In search of water, Eze Elugberaonu said that the people left Amuzi and travelled towards the river. They settled at the valley called “Ovoro valley” where they call “Orie Uvuru” today and there they expected water. This was where the people had their initial settlement. Uvuru was the elder brother, according to Emma Onweremadu (2007). He, Uvuru was asked to offer male and female by the water deity or Chukwu himself in order to have water settle at the valley, but owing to the fact that he could not understand the mind of Chukwu he failed and so the water would not settle in the place.

Mazi Stanley Ahunanya (one of the then main opinion leaders of the land) said that Nrii was the fellow who understood the message and so offered the male lizard and female lizard to the gods hence the settlement of the river at Nrii (2007). The secret behind Nrii’s understanding of the mind of the deity could be traced to the truth that Nri is of the priestly sect of the Ibos, according to Igbo ethnographic history (Afoigbo, 1981). The size and nature of this work does not allow for further comment on this, but suffice the reader to understand that if others migrated from Awka, the Nri’s would have sent one or two of theirs to follow those on course as to preserve the culture of Igbo people.

However, the story has it that when the water left the valley a part
among which were the Uzu left. They settled under an umbrella tree called (Abubu-udele). They were then instructed to scatter in order to settle around the umbrella tree. The first to find where to settle was Erim now called Umugberim, Lolo followed suit. The children of Lolo are today called Umulolo, then Umunehi, Umuebee, Umuogu, Odaa-naObo, Umubazo, then, according to the Eze Umuebi had to trace their brothers down to the place, Umuogu also joined from across the river. Nriukwu settled along the Imo River after certifying the gods by offering male and female lizards in order to have water settle in the place. These make the nine villages of Amuzu and how they settled.

Eze Elugwaraonu and very many other Amuzu people including Stanley Ahunanya, C.C. Anorue and Emma Onwueremadu believe that the Isiala Ngwa people were part of Amuzu. They had crossed before the settlement of the Imo River hence the name (Ngwa, the fast ones or the favoured ones “Ngwam”).

**Economic and Educational System**

Before advert of the Europeans, the educational system of the Amuzu people was traditional which the modern man calls informal education. Adults of Amuzu people, especially, men and family heads, always gathered the young ones most often at night during moon-shine and revealed most historical facts and truths about life to them. The method that was chiefly used was story telling. Some moral educations or instructions were received through songs and proverbial stories.

Vocational training were offered by the method one may today call 'on the job training.' The young Amuzu boy always observed his father 'smithing,' cutting and cultivating yams, tapping palm wine, pounding palm nut, weaving baskets, fishing etc. The child would in turn follow suit by way of imitations.

The young girls in the same token observed their mother cooking, taking care of the little ones, cultivating cocoa-yams, three-leaf-yams, and processing palm-oil in the palm oil boat as a future mother. Those youths who wanted to be skilled people went for more professional training like mid-wifery, herbalism, basket and mat weaving, black smithing etc. Musics like “Eshe' and “Ukom” were
profession and so required professional training. Learners learned by observation and imitation.

There were few cases when use of marks and signs on the walls or any object to mark distinction and level of knowledge (Onweremadu, 2007). Before the coming of the white man, the Amuzu people were majorly peasant farmers. Their chief products were yams, maize, cocoyam, palm produce and varieties of vegetables (Ahunanya, 2007). They also grew fruit trees like pears and oil been (Ugba) which one sparingly see in existence today. In addition to peasant farming was fishing. Almost all adult men in the river areas of Amuzu were involved in fishing but there were few specialized fisher-men. There were skilled canoes they used to cross people from Nrii to Ngwa. The Umugberim in particular were almost all blacksmiths. The traditional mid-wifery still endures till today.

Social Pattern

This section is concerned with the salient issues in the world view of the Amuzu people. These include their mode of behavior, moral values and norms, value system, belief system and sports.

Mode of Behaviour
Based on the testimony of late Nze Josiah Nwanguma Aghalanya, and the researcher's personal observation as an insider in conjunction with his knowledge of psychology, Amuzu people are averagely melancholy-choleric. Being melancholies, they are reserved and meticulous over issues of life. Their conversations are always more in verses than prose. They are friendly and teachable. Nevertheless, their choleric nature makes them quite outspoken and even warlike; hence the presence of the war deity (Agbara-ogu) as explains Oweremadu. They are courageous and energetic.

Moral Values and Norms
It is a serious offence for a young person to insult an elder Amuzu person. The Old Testament Biblical view of the elder-child relationship is similar in all respects with that of Amuzu. It is unethical for a younger person to
call the elder by the very name especially first name without prefixing “Dee” for elder man and “Daa” for an elder woman. The elder-child respect was paramount among the people. The verbs are put in the past because most of these values are either lacking today or faintly noticed.

Stealing, killing (especially of kin) false-witnessing (ikwu chaachaa), killing of totemic animals (animals believed to have close connections with family groups), incest, sexual intercourse in the bush. These are all punishable offenses according to their respective punitive measures attached to each of them.

Value System

The Amuzu people place their values on hard work and possession of material wealth. The worth of a man before the advent of the white man was measured by the quantity of yams he had in his barn. A successful male farmer used to have the title of Ezeji (Yam Chief). This was the most popular title then. The successful female farmer, on the other hand, was crowned the title of Eze Nwanyi ede (Cocoyam Queen).

Good wrestlers were also highly esteemed. Most of them married freely. They were metaphorically called “the Cat” because no one could defeat them in wrestling matches. Of course, an unmarried adult man was never respected in the society. This value system still lingers up to today, the difference being monogamy and polygamy. The old-bachelor was always called Okemayi (wine server). This name was given to him because, in the tradition of the Amuzu people, only the junior ones serve things in the public and unmarried people were and are believed to be junior in terms of certain life's experiences. Putting it in JA Onwuka's word “the people place their values in achievement – the ability to grow up a strong man, marry as many wives as possible, and have a large barn of yams because their occupation is chiefly agriculture – the cultivation of yams, coco-yams, etc. Both then and now, anyone who lacks in material wealth and the prospect to achieve something worthwhile in life is considered a misfit, and to some extent relegated in the society.

Sports

By their very nature, as we saw in the “Mode of Behaviour” above, they
were very energetic and felt that they should dissipate such in their recreational activities. Among their recreational activities was traditional wrestling. There used to be inter-kindred wrestling matches and that of inter-village. There used to be friendly wrestling during moon-shine. Burial ceremony of an accomplished Amuzu man was not satisfactory without wrestling.

Dancing was a sort of sports in Amuzu. Such dances as *Ekpo*, *Ikoro*, and *Nkwa Otile* (rump dance) had features characteristic of our modern sports. They were danced during festivals and unique occasions. Others were swimming, canoe paddling and tree climbing (especially palm tree). These were both competitive and observed during festival periods (Onweremadu, 2007).

**Social Structure**

It was either a social structure or an administrative system. Emma Onweremadu, a social scientist and a politician, sees it as communalism in nature where there was an inevitable inter-relationship between brother and brother. This in the universal terminology could be termed “be your brother's keeper syndrome.” Onweremadu further identifies three major classes and overall super structure namely: the elders, *Umu Opara* (the first sons), and youths. The elders were the custodians of the culture and the judiciary. *Umuopara* joined them to be the legislative group because they were believed to be more intellectually alert and pure while the youths were dynamic group that could be used to implement the laws. The social structure or political system of the people before the advent of the Europeans was better explained by Anoruo in his *CMS Mission in Oko-ovoro 1910 To the Present Day*. In his words:

> The head of the extended family was recognized as the head of the kindred, and the head of the senior kindred as the head of the town. The head of the kindred, or town had privileges and authorities similar to those of the family head in his respective area of influence. But this authority was even more restricted as all orders were given by the entire town council *Amaala*. The position of the head of the town council was merely that of the first among equals. The council was attended by all elders; but young men could be present also. Anyone could speak and
the more intelligent generally exercised most influence on the decisions made irrespective of age or rank. The functions of the council were mainly administrative, legislative and judicial (1981:6).

The council in Anoruo's work is identical to Onweremadu's super structure from where other institutions stem the difference being simply semantic. Based on the research, the *Umu-opara* thing is a new comer in Amuzu just like the age grade syndromes. According to most of the elders the researcher interviewed, these are not up to thirty good years in Amuzu. This justifies the view that culture naturally and inherently dynamic.

*Osu Caste System in Amuzu*

An *osu* used to be a strictly social outcast in Amuzu. He was as isolated as those who committed *nso-ala* (abomination) in the society. Odimba reveals about two main ways one could become an *osu* in Amuzu. In the first place, one who swore an oath before a juju and dies within one year was believed to have been killed by that juju. The children had some rites to perform to purify the family. If they failed to do so, they were regarded as *Umu-osu* (children of the juju or the *osos*). This belief is still held by the people but not as much as it used to be before the inroad of Christianity in the land.

Again, a man could be offered to a juju. He might not be killed, but his children and entire lineage would be regarded as *umu-osu* (Odimba, 2006). A man who found life very difficult could also offer himself to a deity whose “osu” he would become. In turn, the deity would bless the fellow and his posterity.

An *osu* never held a position of regard in Amuzu. He could not be given any title in the community. He also could not marry from a non *osu* formally known as *di-ala* and vice versa. Theirs was a life of isolation and disregard. Although an *osu* is still an *osu* in Amuzu, but his relationship with the *di-alas* in the society is by far better today than about hundred years ago.
Belief System: Their Religious Life

The traditional religion of the people starts with their belief in, and worship of Chi-Ukwu (the Great God). Belief in the Supremacy of Chineke (the Creator God) as the Most transcendental and powerful and generally agnostic is paramount among the people (Onweremadu, 2008). But to them since God cannot be seen or known they had the mediator gods and goddesses that link them to Chukwu, the Most High God. They believe that all those deities have different functions in their lives. So, they consult each when the need arises. Anorue in his CMS in Oke Ovoro puts this clearer:

Apart from their strong and unflinching belief in the Supreme Being, they also believe in multiplicity of minor divinities and spirits, they Mother Earth, and Ancestors. They elevated position of the Great Chi has led to a complex system of mediation. They believe that the Supreme Being had brought into existence a pantheon of divinities that are his offspring and ministers act between him and his people. At the Apex of this pantheon is the Supreme Being who is regarded as the Creator, the General Supervisor, the Controller, and the Ruler of man and other created things. He provides all our needs which they believe he does through the intermediaries – the minor divinities, the Mother Earth, and the Ancestors (1981:11).

He further outlined the divinities and their functions. They include “the Mother Earth” which is the guardian and supervisor of morality, in charge of productivity and fertility. Others are Ahiajoku, the patron divinity of farmers: Agwu, the patron divinity of the medicine men who grants the power of healing; Amadioha, the thunder divinity who represents the righteous wrath of Chukwu, Ofo, the elders emblem of authority, is venerated as the judge of morality. Others, according to him, were Nnemiri which causes obesity, chi; the personality god of everyone is the fashioner of individualism, that the individuals’ destinies. In certain
perspectives, he termed the individual's destiny decider. One is believed not to be able to be raised beyond his chi.

Sacrifices were offered to Ala (the earth goddess) at the beginning of every farm season for bumper harvest. All the customs, traditions, and other aspects of the social and community life are sanctioned by the earth goddess. Things prohibited in the society constitute an offence against her. For instance, incest, stealing, homicide, murder etc. are considered offenses and abominations nso ala. When such occur, it is the responsibility of the people (the society) concerned to make necessary sacrifices of atonement and restitution in order to placate the land. Failure to do so always resulted to poor harvest.

Unlike the Christian belief in heaven, (life with God and the blessed angels in great beyond) the traditional Amuzu people believe that their dead fathers and loved ones exist somewhere in the spirit world interceding for them and thereby playing the role of spiritual watch-dogs over the living. In order to keep them happy, and guarantee their continued support for the living, Anoruo says that “the people saw it as an obligation to give them their share of family good and drink” (1981:17). This is why the pouring of libation or offerings of certain food items, drinks, and animal victims to the ancestors as their own share of foods taken here by the living.

In doing this, the Amuzu man believes that he is keeping a constant fellowship with his ancestors on the appeal for spiritual assistance and intercession which is characteristic of the traditional annual festival. The spirits of the ancestors and dead kin are believed never to be far from their very kinsfolk but near and ever ready to play the active role in all matters relating to the welfare of their families and communities.

The belief in the spirit of the ancestors is so strong that once a family, meal is brought, a few lumps (mostly, four lumps according to the number of the four market days) are thrown out to the ancestors to eat. The family head pours out the first drop of wine with some words: Ndi Iche lekwenu manyi (Our ancestors, this is wine). Still on their belief system is the belief that he who was not given a worthy burial becomes earth-bound and may not reach the spirit world and therefore not intercede for his children still in the world. The Spirit of the dead who are
earth-bound is also believed to be wondering around his family home and keep on tormenting his family until adequate sacrifices are made to send him to the spirit world.

There is also the belief that life force cannot be destroyed. This ushers the discussion on the people's belief system to their belief in reincarnation. The traditional Amuzu people like their other African counterparts believe that people die and return to life in new born babies. Hence the names: Nnanna (grandfather), Nnenna (father's mother), Nnenna (mother's mother). “Some elders”, says Anoruo, “have proved this by showing some marks which the person bore in his first life.” Thus when a child is born the elders go to the diviner to find out which ancestor reincarnated (1981:21).

Rather than heaven, the resting place for the saints, or hell, the place of torment for the unrighteous, the traditional Amuzu people believe that what one does determines the position posterity will give to him and the type of society in which his children will live. Bad people in their first cycle will reincarnate to suffer. The parents of such tirelessly offer sacrifices to the gods in placation and propitiation as to normalize life for him.

Rites of Passage

Before anything is said in this section, it will be important to state that like any discourse on the African society, the section fits rightly into any of the two discussed above, that is, either religious or social especially social pattern. It is just that its peculiar nature, especially in context of this work, forced this writer to treat it separately. The main aim is to disclose the rites of passage among the people the study is all about. This has to do with those rituals that mark the transition of an individual from one important status or stage to another. There are about three rites of passage in Amuzu. These include the birth rites, the marriage rites, and the funeral rites.

Birth Rites

In Amuzu and Mbaise as a whole, a woman whose pregnancy is new is disallowed to do any hard work. She is also forbidden to look at
masquerades or ugly images and pictures in order not to expose the unborn child to poor or ugly formation. Again, she is forbidden to mock a deformed person for fear of retributive judgement on her which may eventually fall on the innocent unborn child (Onyenso, 2007). This is what Heibert may call “separation rites” (1990:160).

As the pregnancy gets more mature, the older women begin to educate her on the type of food to eat as to make sure the child does not get bigger than normal before birth. Advices are also given to her on what the child will need after birth. Finally, when the child is born, name is given to it. Eze Elugwaraonu says that the traditional Amuzu man fills a vessel with water on the day the child is born. On the eight day the child will be brought to the father by the mother and place it on the father's palms in the very early in the morning (naming ceremony in the traditional way in Amuzu is always very in the morning especially 7 a.m).

The husband will in turn present the child to the Amala or Umunna (kins men) whom he must invite for the occasion. Native salad and “ose” (native sauce prepared raw with oil, pepper, onions and lime stone) will be presented to the amala. Other things might be offered to the Umunna who have come to name the child (Elugwaraonu, 2008). Then the father whispers the name of the child to the family head who will in turn whisper it to the head of the extended family head after which the child will be named.

Marriage Rites
Marriage is believed to be the most elaborate transition rite. A lot of people have said why this is so. Perhaps, the reason could be more because marriage is one among the three important days of a man that he celebrates himself. Odimba's narration explains marriage in Amuzu which is typical of all Mbaise:

In days of old, marriage could be contracted right from the birth of a girl. What prompted such early marriages was the relationship or mutual understanding between two families. Mr. “A” could be a friend of Mr. “B”. If either of them was blessed with the birth of a baby girl,
the other can drop some cowries or one manila in the water bowl of the baby and she automatically becomes his intended wife. He could start paying the bride price even from that day and can take the girl at any age no matter how young. There was no chance for the girl to make her choice then and more often than not, she would marry a man older than her father. The man went to the girl's family with his relations with some calabashes of wine. His father-in-law would invite his own people. After feasting then on food and some wine, negotiations would begin. The two families would gather and thus the sole arbiters in the negotiation (Odimba, 2007).

This narration reveals the marital rites of the people before the imposition of foreign culture on them. This marital rite has taken a different shape today. Odimba speaks further that, "These days, marriages begin from the bride and bridegroom who must agree to marry each other before the girl's parents are intimated of their proposal. The man kicks off with going to the parent-in-law with a jar of wine, a carton of beer, a bottle of whisky and some kola nuts."

If the girl agrees in the presence of all present to marry the man, she would be given a cup of wine to drink with the husband to be. This marks the first solemnization of their marriage. Negotiation and payment of the bride-price can be made in parts or in full. The process to undergo includes (1) Nvuzu manyi, (2) Ihie Amala, (3) Alumm, (4) Ivu Efere and (5) Igba Nkwu. After the completion of these processes, she becomes his legal wife and is taken by the husband if or not they have had a church marriage depending on religious belief of both (Odimba, 2007).

The foregoing explains modern marriage rites in Amuzu. The processes take place in a day or one each day. It is considered an anathema to go for marriage deliberation on Eke or Orie market days. All discussions are made either on Nkwo or Afọ market days, but the most acceptable day is Afọ market day.
Funeral Rites

Before the advent of Christianity, (and even now) death among the people has many things attached to its occurrence. For instance, if a man died, the elders would first go to an oracle to make sure of the circumstances culminating in such death. If the oracle pronounced him or her a wizard or witch, the corpse would not be buried. It was dumped in the forest (called bad forest) and left there to decompose. If the oracle declared him or her free of such vices, the family of the deceased would jubilate and in the case of accomplished males the entire villages were made to know by the burning of canon shunts which was followed by crying and yelling of his entire family (Odimba).

It is important to note that this rite is still on among the traditional Amuzu people. No one has to cry before the canon shut. If anyone should cry before the cannon shut, the villager would demand a penalty of one goat, and until this was done, nobody would go there. If a polygamist died, all the wives were made to sit together on a mat. They could not go to sleep on their beds as all of them must sleep on that mat. If one of them wanted to go to the toilet, all would accompany her. Some women who had lost their husband had to cook the food they would eat.

In the morning, they (the new widows) would cry and yell loud for all to hear. This lasts for about 5 or more minutes. The “Eshe” drummers must be invited and they would stay till the corpse was buried. If the man per-chance was a juju priest, he could not be buried until some juju priests were called in to extract him from the shackles of his juju. A lot of animals were slaughtered for different rites:

- One dog known as *Nkita-ukwu-na-ije*. This was performed solely by the elders who have traveled too far places on foot.
- *Eghu obi*, one male goat was slaughtered in the night by only a cross section of responsible elders who alone ate the meat. The blood was sprayed on the coffin and put on the coffin. This was to make sure he would keep secrets when he would reincarnate,
- *Evule ndu*, the first son killed a ram with kicking it with fists and bouncing it on the ground.
- *Iwa-ji*, responsible elders again preformed this. A yam was cut into four parts, lengthwise and cultivated. Ropes were tied onto
four sticks. A cock was killed with the blood sprayed on the spot. This was to make sure he became a successful farmer when he comes again.

- *Nkita Anya*, a strong man handles a big male dog with frenzy dance and fun-fare to the drumming of the *Eshe* music amidst the crowd, throws the dog to the ground and the crowd kills the dog with cudgels, sword or what have you. This was to make sure he would not be a coward in the next life.

After all these rites which took more than four market days, there are four market days in Ibo namely: *Nkwo, Eke, Orie and Afọ*, the burial then took place. All the wives would be made to bring a hen each for “Ala-Oru.” An elderly man would take the hens in turns beginning from the eldest wife. He would pull off the head and the wife would rub it all over her body reciting some incantations, praying not to suffer early loss of her husband in her next life. The coffin would have been laid to rest. Canon shots would be fired and the crowd feasted. The completion of all rites took about four days. It is necessary to note that a man was and is buried only on an Orie market day while women were buried on either Afọ or Nkwo market day. The rites of passage for women differed a lot. The dance was never *Eshe* but *Ukom* and she must be.

**Conclusion**

It is interesting getting to this level of the study – doing a study of a region and culture that has been in existence for several centuries now. It is all about the Amuzu people, their geography, origin and general lifestyle including their belief system. It is certain that they are part of the African Peoples, and so their practices etc. were not far from what are familiar to others in the neighbourhood. With the exception of Christianity and modernity, such would have endured till today. Nevertheless, there are still some who still keep to most of the traditional lifestyles studied. Such are on the very minority hence the action words used in the course of the study were predominantly in the pass.
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Control of Bidirectional Converter for a Stirling Energy System (SES)

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ABSTRACT

This paper discusses a 23 kW three-phase AC bus system that is utilized together with the “Stirling Energy System (SES) Integrated Solar Dish-Stirling Module” to function as a mini-grid for off-grid locations. The system is designed to supply power to rural households. This three-phase AC bus system includes a bidirectional 4-wire PWM converter and a battery bank for energy storage. The simulations and results presented show that the system can function as a rectifier and as an inverter. The system operates as an inverter when the SES starts up and when different AC loads are connected to the AC bus. The unit functions as a rectifier when the battery bank is charged. The design was implemented successfully in a practical system and measurements revealed that the system functioned as a standalone unit.

Renewable Energy

Due to the drastic increase of electricity demand throughout the world, it is essential to have alternative energy resources to fossil fuels such as coal, natural gas and oil for the generation of electrical power. The amount of power generated by coal, natural gas and oil consumed by the world's population in one day corresponds to 500 000 days for nature to provide these natural resources (Alt, 2002). This means that energy is
consumed 500 000 times faster than nature can produce these sources. Large-scale electrification has been prevented due to the high investment and maintenance costs of expanding interconnected grids to locations where the energy demand is poor. Some of these off-grid locations have been electrified with diesel generators. Because of high fuel costs, a need to find cleaner ways to harvest energy is vital to provide these off-grid locations with power. The three most extensively available natural resources are hydro, wind and solar. The movement of water is used to generate power by hydro systems. Wind motion is utilized by wind turbines to convert kinetic energy to electrical energy. Solar radiation is the most common kind of energy that is converted to electricity by employing photovoltaic panels (PV), solar towers, channels, solar dishes, etc. Photovoltaic systems are currently the most favourable in terms of their low cost.

**Island Grids**

Supplying electricity to decentralized consumers that cannot be connected to an existing electrical grid is essential throughout the world. At present island grids exist in numerous sectors around the world (Beukes, 2002). An island grid is intended to be standalone and operable in remote areas. Different types of island grids are employed in different regions, depending on the environmental circumstances. It is more likely that wind turbines are employed as energy source in windy areas, where the sun's solar radiation is inadequate. Farms were commonly connected to a low-voltage or intermediate-voltage grid, where diesel generators are the feeding energy source. Due to the increase in the fuel price, farmers started to use hybrid systems. Renewable energy sources were implemented as an alternative to diesel generators.

Energy sources such as photovoltaic (PV) panels, wind turbine generators and solar dishes are examples of renewable energy sources. The most developed system is the PV system. Wind turbine generators are more feasible for higher power ratings than PV. This would make them attractive for pumping. The solar dish concept is more feasible in the 10-50 kW range than photovoltaic panels. Other solar thermal options, such as solar tower or solar troughs, are more feasible at
higher ratings (MW) (Beukes, 2002). Lead acid batteries are the leading technologies in energy storage.

Storage Devices

Electrical energy can be stored in limited ways. One of the oldest ways to store energy has been by making use of flywheels. These flywheels operate on a simple principle of storing kinetic energy in a rotating mass (Alkagi and Sato, 2002). Another common storage device is a capacitor, where the energy is stored electrostatically. Large-scale energy storage is done by pumping water to a reservoir or dam at a higher level. The most common storage device is the battery. The versatility of batteries makes it possible to have a large variety of storage space. Sealed lead acid batteries and nickel cadmium (NiCad) batteries are superior for solar applications. A NiCad battery is 2-3 times more expensive (Guoxiao, 2001) than a lead acid battery and is mostly used in very cold environments. The lead acid battery has an excellent power-to-cost ratio and has high charge store efficiency.

Power Electronics

The flow of electric energy is processed and controlled by power electronics, which supplies accurate voltages and currents in a form optimally suited for user loads. Fig.1 represents a basic power electronic system. The power processor mainly consists of semiconductor devices that are driven from the controller. These semiconductor devices have enormous current and voltage capabilities as well as high switching speeds.

![Fig.1: Diagram of a Bidirectional Converter](image-url)
Converters

A converter is a basic module of a power electronic system, such as in Fig. 2, which converts power by signal electronics. Converters are divided into four broad categories:

- AC to AC
- DC to DC
- AC to DC
- DC to AC.

A power converter which converts DC to AC is called an inverter. A rectifier converts AC to DC. This thesis presents a design of a converter which is intended to function as an inverter as well as a rectifier. This bidirectional converter consists only of a single semiconductor module and thus rectification and inversion take place successively. Figure 1-3 shows the fundamental blocks of a bidirectional power electronic system.

![Fig. 3: Block Diagram of bidirectional converter](image)

DC Bus Topology

The DC bus topology can be observed in Fig 4. The solar dish feeds through a three-phase bidirectional converter into the DC bus, where the energy is stored in a DC battery bank. It is compulsory that the three-phase converter is bidirectional to start-up the induction machine of the SES as well as to consume the generated power of the SES. A three-phase inverter then supplies the load with power. The power is
converted twice before it is fed to the load. The first conversion stage is done from three-phase AC to DC and the second conversion stage is from DC to three-phase AC. Each conversion stage has a typical efficiency of 95%, which relates to a total typical source-load efficiency of 90.25%. The two conversion stages make the DC bus system more complex and thus more expensive. The dump load consumes the excess power generated by the SES. The most efficient position to place this dump load is at position A. Position B and C is situated on the DC bus and on the three-phase AC output respectively, where the power has to be converted at least once before the power is dissipated in the dump load.

![Fig. 4: DC Bus Topology including Dump Load](image)

**AC Bus Topology**

A number of smaller battery banks are connected in parallel instead of connecting all batteries in series. This is done to ensure continued operation if a single battery fails. A disadvantage with this low DC battery voltage is that a CUK (Mohan et al., 1995) converter (DC/DC), which steps up the voltage to a higher level, needs to be included in the design to get the required AC output voltage.

The Sunny Island® topology is shown in Figure 5.

![Fig 5: Sunny Island® Topology for a Single-Phase Unit](image)
This topology is extended to a three-phase system by adding another two of these single phase units in parallel as seen in Figure 6. The system controller is then configured to function for three units.

![Fig 6: Sunny Island® Topology for a Three-Phase Unit](image)

The design of the AC bus system for this project was based on the AC system of Sunny Island®. The main difference is that the design presented in this thesis consists of a three-phase inverter that has one system controller and consists of a single unit instead of three single units as in the Sunny Island® systems. Another big difference is that a high-voltage battery bank is utilized, thus eliminating the use of the CUK converter. Since the power rating of this system is significantly higher (25 kW), parallel high-voltage banks are typically used for energy capacity and redundancy. Figure 7 (a) shows the topology implemented in this design. The topology entails a three-phase bidirectional converter connected to a battery bank to modulate an AC grid. This 4-wire AC system provides clean power to single-phase or three-phase loads. The system also absorbs the power generated by an energy source, such as the SES. The single conversion stage has an efficiency of 95% which is better than the total efficiency of the DC bus topology, which was 90.25%.

In Figure 7 (a) the dump load is connected to the AC bus. This configuration is more efficient than the DC dump configuration seen in Figure 7 (b). The main advantage of the AC load over the DC one is that the former avoids the flow of active power current through the PWM converter. Consequently, the PWM converter rated power is lower (Marra and Pomilio, 1999). During a normal day of solar insolation the SES provides a power of ± 20 kW. About 10 kW is used to recharge the
batteries and the remaining 10 kW are dissipated into the dump load. If the dump load is in position B, as in Figure 7 (b), the power ratings of the converter have to be increased by 10 kW, since the power that is dumped needs to be converted to DC. It is thus more reasonable to employ an AC dump load.

Fig 7: Diagram of the AC Bus Topology including (a) AC Dump Load; (b) DC Dump Load

**Simulation Results**

Simulations of the system were done over a one-second period. Simulations done over a longer period of time are very time consuming and require too much computing power. Data need to be sampled every 5 us to get a reasonable result. The AC bus voltage waveforms of the system are represented in Figure 8. The voltages are 120º phase shifted and have magnitudes of 230 V RMS. The voltages are measured across the filter capacitors (C1, C2 and C3). A 5 kHz ripple is observed on the signal. The DC bus voltage corresponds to 746 V.

Fig 8: Simulation of the AC Bus Voltage Waveform
A resistive load of 4.7 Ω is connected to each phase as a Y-connection with the neutral point connected to ground. The converter functions as an inverter with a total output power of:

\[ P_{out} = \frac{3V^2LN}{R_{load}} = \frac{3 \times 230^2}{4.7} = 33.77 \text{kw} \]

A very big load of \( R_{load} = 0.7 \) Ω is connected to each phase of the inverter. This simulation was done to observe how the inverter responds to high currents. High starting currents are necessary to crank the IM at start-up. It is observed that a peak current of 470A is drawn from the inverter. Figure 9 represent the simulation output waveforms of the peak-current simulation. The phase voltages have RMS values of 230V.

![Output Waveform of the Peak-Current Simulation (20 ms)](image)

The power factor in an induction machine (over-excited) is always lagging, while the power factor in a synchronous machine (under-excited) can be varied from lagging to leading (Ozpínecci, 2002). The lagging power factor of the induction machine is shown in the phasor diagram (Figure 10), which represent the phase current and voltage, while the IM operates as a motor and as a generator. The current \( (I_A [CH4]) \) lags the voltage \( (C1.V [CH1]) \) by 60.6°. The power factor is 0.49, as shown in Figure 10. The power factor increases to 1 with an increase in IM speed, where the current lags the voltage by 90°. The diagram in Figure 10 demonstrates that a power factor 0.78 is achieved while the IM is generating power.
Figure 12 shows the simulation of the power flow in the converter. A low pass filter is inserted in the simulations to overcome the high ripple harmonics which are present on the AC and as well on the DC side of the converter. The filtering of the signals provides good results for average power values. Peak values, however, are not precise due to filtering. Figure 12 shows the power of the SES (\( P_{\text{SES}} \)), the power that is dumped into the dump load (\( P_{\text{DUMP}} \)), the power of the batteries (\( P_{\text{DC}} \)) and the combined power value (\( P_{\text{DC}} + P_{\text{DUMP}} \)). \( P_{\text{DUMP}} \) is zero until the IM functions as a generator. \( P_{\text{DC}} = P_{\text{SES}} \) until power is dumped at \( t > 0.5 \) seconds. At \( t = 0.5 \) s the IM functions as a generator and delivers power at 20 kW as seen in Figure 12.
The magnitude of the ripple as well as the magnitude of the fundamental waveform is required to calculate the voltage and current ripple. The peak to neutral voltage is $V_{PN} = 333 \text{ V}$ and the peak to neutral current is $I_{PN} = 70.85 \text{ A}$. The current waveform ($I$) had to be scaled by 4 to get a better view. It is observed in Figure 13 that the voltage ripple is 10.5 V and the current ripple corresponds to $7.8/4 = 1.95 \text{ A}$. The percentage voltage ripple is calculated as follows:
The percent voltage ripple is calculated as follows

\[ \Delta V\% = 100 - 100 \frac{V_{pn} - V_{ripple}}{V_{pN}} \]

\[ = 100 - 100 \frac{333 - 10.5}{333} \]

\[ = 3.15\% \]

And the current ripple correspond to

\[ \Delta I\% = 100 - 100 \frac{i_{pn} - i_{ripple}}{iR} \]

\[ 100 - 100 \frac{70.85 - 1.75}{70.85} \]

\[ = 2.75\% \]

**Conclusion**

The simulations verified the functionality of the system, and revealed the component ratings. The simulation results revealed that the PWM converter system operates as an inverter, when a load is connected to the AC bus and as a rectifier when the battery bank is charged. The simulations revealed that the bidirectional converter could be developed practically and that the practical results should merge with the simulations. The component ratings of Table 1 are used as the minimum requirements in the next chapter, which focuses on the design of the AC bus converter system.
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Noises' from the 'Mistaken' Womb-Man

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ABSTRACT

This paper is on women liberation. It seeks to examine the general agitations among African women theologians and argues for openness to women's issues. It employs the discursive and analytical methods to reach its conclusions. It is observed in this paper that though women may have a genuine case that requires concerted hearing from all God's people they are often ignored. The paper looks at how African womanists/feminists contend against societal and religious definitions of women. Such definitions result in socio-economic and political depersonalisation of African women. The resultant depersonalisation means that women are relegated to the periphery of both society and church. Consequently, women become the nameless, faceless individuals or groups whose toils are embezzled by males to achieve significance. The paper challenges the African church to take the problems of the African woman serious in pursuance of its role as the defender of the defenceless.

Introduction

This paper concerns women liberation. It seeks to examine the general agitations among African female theologians and argues for openness to women's issues. African feminists are unhappy about patriarachal chauvinism in religion and society since they believe God did not create women inferior to men. We will therefore ask: What is the nature of
(African) feminists' contentions and what should be the attitude of the church to these contentions? The paper employs the discursive and analytical methods to reach its conclusions. It will be observed that although women may have a genuine case that requires concerted hearing from all God's people they are nevertheless often ignored. African feminist contentions are often not given the deserving rapt attention because they are seen as mere women's noises. This paper will examine and evaluate how patriarchal chauvinism mitigates against and defines (African) women. Such definitions result in socioeconomic and political depersonalisation of women. The resultant depersonalisation means that women are relegated to the periphery of both society and church. Consequently, women become the nameless, faceless individuals or “race” whose toils are embezzled by males to achieve significance. As I will argue in this paper, the full humanity demands that all unjust systems are sanitised and turned over to the Lordship of Christ and his Father. Thus, this paper challenges the African church to take the problems of the African woman serious in pursuance of its role as the defender of the defenceless.

It is said in Akan, the language of some 45% Ghanaians that Obi ba wuo tuetue obi aso ("the death of someone's child is nuisance to another person"). Similarly, it is very easy to gloss over the agitations of women and see them as mere 'noises'. Hence, in this paper I will examine various voices coming from (African) women in their search for a liberating Christian theology. I ask that we deliberately and consciously give rapt attention to serious and important issues concerning women. Women's issues, and especially feminism, do not enjoy very serious attention from the African church and society. Often when they come up they are pushed under the carpet with the pretext that women are their own enemies or that women abuse authority when they are given the chance. It may be that some women antagonise their fellow sisters and also that some women become overly bossy but the same may be true of some men. The discussions in this paper use two OT stories to demonstrate the soteriological importance of women in religion, politics and culture. The question as to whether males are important than females underlines feminist agitations. I will dialogue with feminists on this matter. I will then follow it up with an analysis of the embezzlement of
female identities in religion and society. I will also discuss the source of feminine theology to see whether culture can replace the Bible in the theological task. Finally, I will offer reasons to justify the feminine contention, and then conclude the paper with a summary of the discussions.

**Heroines or Villains?**

Matters concerning women are often considered nonessential and a woman who advocates on women's rights and liberties is often perceived as over-assertive and vociferous. For Africans such a woman is too “manly” and a witch. This attitude is self-condemning for “on one hand, human dignity is declared for all while on the other hand, some are regarded as unable to exercise the human faculties of the mind and the intellect” (Nwagwu, 1998:91). But should women acquiesce to the patriarchal role definition assigned to them? This is the basic thesis that underlines this “noises from below”, an examination of the stereotyping and role definition of a half of humanity.

For a long time women have not enjoyed good sociocultural and theological imaging. They have been ascribed with evil, wickedness, vanity and treachery. For instance, Shakespeare's Macbeth's overnight disloyalty and murderous inclinations towards his cousin, King Duncan, are instigated by the prophecies of three witches and also his wife's unbridled desire to become the queen at all cost. Again, some women have been picked on as typical characterisation of women's vileness because of the way traditionally we have read the Bible. Good examples are Eve, Delilah, Jezebel, the witch of Endor, to mention just a few. The unfortunate thing is that we ignore the positive roles many women have played in the transformation of people's lives, including men. The crucial question is: Are we justified to condemn all women as villains? Can we not, perhaps, in a stronger breath see many women as “heroines of faith”? In the sections that follow, I will examine the contributions of two Israelite women in ensuring good life for others as a basis for doing critical appraisal of women's issues in the subsequent sections.

*The Unnamed Slave Girl who Saved a Captain*
In 2 Kings 5 is a story which by all indications speaks volumes about the importance of women in human history. Like many such stories the women actors are unnamed: neither Naaman's wife nor her Israelite maid is named. When the story commences it announces Naaman as a great and valiant soldier of the Syrian army. Throughout the narrative one is tempted to think that Naaman is the hero: he is the commander of the Syrian army through whom the Lord had wrought victory for the Syrians. He is loved and occupies a high profile position in the Syrian court. His military exploits are jealously protected and guarded by his king. Hence, the latter shows deep commitment for his health and general wellbeing. On one of his several raids he had brought home an Israelite girl to serve his wife. Normally, such slaves were docile and not required to poke their noses into the affairs of their masters, not least their personal affairs such as stigmatising diseases.

Naaman had been suffering from an incurable and abominable disease, leprosy, for some time. Perhaps his leprosy was in its developmental stages; it had not as yet attained public gossip. Yet it was a great worry to him that he contemplated about its cure. He may have tried several means and places for cure but to no avail. Then the unexpected happened one day. The poor Hebrew slave girl would not concentrate on her menial assignments; she decided to transform herself into a family counsellor. She tells her madam that her master could get cured in her home country. And true to her word Naaman gets cured of his leprosy when he travels to Samaria and meets the prophet Elisha.

The whole episode unfolds to us significant insights. It reveals that the story is about a heroine, a nameless Israelite slave but not about a powerful hero. For example, despite all his celebrity Naaman still cowered under the fear of social ostracism. Consequently, he was a hero outside but a fearful prisoner in the inside. Now Jehoram the son of Ahab, king of Israel, cannot be the hero since he was suspicious the Syrian king's sending Naaman to him was a ploy to entangle him in a war. What about Elisha, can he not be the hero? No, he performed a feat to promote his God. In all probability it is the maid who is the heroine of the story. Yet she is unnamed, faceless, mentioned in passing as if she does not matter but must be mentioned as a necessity of the occasion.

Another important fact about this story is that it offers us
ingredients for transnational politics and relations. It shows that while dominant powers and economies tend to dictate the existence of their dominated partners there are situations when they need to learn to adjust for international symbiosis. No one individual or nation is self-sufficient, requiring no help from others. Even weak economies can still provide healing support to strong economies. This means that in spite of their celebrated achievements even strong economies may suffer from very “strange diseases” that may require weak economies to redeem them. Consequently, the former must learn to overhaul their superiority complex so that they can benefit from the latter. For instance, it is no secret that most of the world's strongest nations are turning more and more secularised with little or no concern for spiritual matters. This is one area of need that the so-called poor economies of the Two-Thirds world can supply. For in spite of their material poverty they appear to be strong spiritually. Spirituality here encompasses moral rectitude; it is more than mere religious talk.

This story also offers us ingredients for doing cross-cultural theology. As the story unfolds we see Naaman adjusting his religious beliefs to accommodate the Israelite faith. To achieve this he needs to make some cultural shifts. This occurs when Naaman requests to carry some Israelite soil to his homeland to serve as an altar for the Lord. The point is that this cross-cultural theologising is the result of one faceless slave girl's desire to see her master recover from a stigmatising disease. In other words, she was the initiator of theological cross-fertilisation. This leads us to appreciate the various ways some insignificant women have become the sources for theological orientation and research. I call in mind the initiatives of many African women prophets, like Grace Mensah, whose search to bring healing and salvation produced paradigm shifts in the theological enterprise. Thus, like in earlier generations there are women who pioneer and pastor prophetic ministries. My personal research has led me to a number of these women in Ghana.

In the Church of Pentecost (COP) in Ghana, for instance, there are many such women who run prayer centres whose preoccupation is to bring physical, social, psychological and material healings/salvation to their teeming clients seekers. Outside COP many such women either run prayer/healing camps or are in charge of churches. An interesting
phenomenon of these centres/camps/churches is how these women succeed in tilting the gender equation to their favour (Quayesi-Amakye, 2013; cf. Asamoah-Gyadu, 2007:65-86). Thus, unlike the traditional church setting where women are subservient to men, in the centre/camp setting there is an effective role redefinition where men submit willingly to the leadership of women. This situation results in a theology from the underside of history in the sense that now the theological project swaps hands from men to women. The point is that it is the prophetesses and their ministries who provide the needed spiritual leadership, guidance, pecuniary, material and soteriological support to both their assistants, clients and denominations (*The Church of Pentecost* 2008). Again, together with their male counterparts they constitute the fulcrum for theological research and discourses.

Indeed, the theology from the underside is very significant in that it challenges the normative theology of the traditional ecclesiastical system. Again, it ably signifies that no longer can women continue to accept men's monopoly of the Spirit. Meanwhile it also demonstrates how far women are prepared to be fellow-workers with the Spirit of God to subvert the status quo to effect soteriological unconventionalism as bearers of the good news of Christ. This is important since many a time like the faceless Israelite slave girl many women have suffered from diminutive characterisation in the sense that their contribution to life—church, society, family—give way to male supremacy. Thus, in the Naaman story there is diminutive characterisation of deliverance when the slave girl's role gives way to free men—the king of Syria, the king of Israel, and Elisha as if she did nothing. And yet despite the narrator's attempt to force this on her there is clear indication that she resists any suppression by boldly confronting Naaman, the mighty Syrian commander, with his unspeakable problem. This is what we see in the lives and ministries of many healing prophetesses; they continually resist systemic manipulations and false characterisations and definitions. Eventually, their resistance pays off when their ministries become the solution centres for all.

Indeed, the efforts of some women to resist the status quo have been the cause of social cohesion and national unity. I refer to an incident that almost marred David's recapture of Israel's loyalty. The story
concerns how one Benjamite, Sheba, almost irrupted a revolt after the defeat of Absalom (2 Sam 20). After Absalom's defeat and death all Israel decided to return their allegiance to David. But David's tribesmen, the Judeans, provoked the rest of the tribes by claiming sole monopoly of the king. Unfortunately, the whole tribal game was initiated by David himself who queried his tribesmen why they were the last to demand for his return to Jerusalem.

When the contention became hot Sheba blew his trumpet and called the other tribes to abandon David to the Judeans. Then the scales fell off David's eyes; he saw the looming danger to his control of the nation and sent his nephew Amasa, who had been Absalom's commander in the rebellion, to quell the impending rebellion. In the meantime incensed with jealousy Joab killed Amasa his cousin (or brother in the African sense) and led the troops to besiege Abel where Sheba had fled to hide, perhaps to mobilise support for civil war. From all indications Abel was bound to suffer terrible reprisals from Joab's army until a wise woman saved the day by challenging the wisdom in destroying an innocent city which had played the traditional role of a “mother” to Israel (2 Sam 20:16-22). Her proposal to hand over Sheba's head to Joab saved David and his throne from shedding innocent blood and also effectively saved the nation from senseless civil war.

The whole story provokes a number of issues. First, it reveals the stupidity of playing the tribal card for political control. Anytime tribal sentiments are whipped they lead to national disharmony. This is even more serious when politicians or even Christian leaders become tribalistic or ethnocentric in their approach to situations. Such irresponsible behaviour is bound to implode into civil unrest or ecclesiastical dissatisfaction that can lead to factionalism. People want to belong to a unifier leadership where their individual and corporate identities are respected.

Second, few people can countenance change that can result in their demotion, more so when it is meant to promote potential enemies or rivals. Change is necessary but it must be carried out tactfully and humanely so that it does not trigger off trouble for innocent people. People's characters must be weighted before effecting changes that can adversely affect them, or else they can take drastic actions to harm
innocent lives. David was the best person to have learnt this lesson and yet he appears not to. His own anointing by Samuel while Saul reigned incited unnecessary jealousy and hatred in Saul against him. Again, he was familiar with Joab's prone towards unforgiveness; Joab murdered Abner for killing his brother Asahel and also for fear that he would lose his control and influence over David's troops to Abner (2 Sam 3:27, 30).

Horner (2008:214) counsels leaders to understand the varied ways people feel about change. Some tend to resist change because it represents the loss at some level or another. Others are willing to change. Some change resisters are “avowed” resisters just for the sake of it. Others resist because they feel threatened by the insecurity and uncertainty of doing something different. This was the problem with Joab. The leader must try to answer the following questions under such circumstances:

- What is at stake for them?
- What do they see as their greatest loss?
- Is their resistance based on what is to be changed or on how it is to be changed?

Some people love change. If for a good reason the love for change can be very helpful to the leader. There can be varied reasons why people love change: some love change for wrong reasons; they do not count the cost but run. Others are malcontents who just love change for “some greener pastures”. Others still are immature and so see change as adventure. Plausibly Amasa was one of such immature, opportunistic lovers of change. Those who are willing to change hold the two extremes in balance. Most likely David failed here and as a result suffered grief in multiple forms in the process.

The most significant insight in this story as far as this paper is concerned is that when men were fanning trouble to exterminate the nation it took a woman to give the nation peace. All the men in the story were inconsiderate of the national interest but cared about their own interests. David was interested in holding on to power even if it cost the blood of the very people he sought to rule. This is very characteristic of the political leaders in many African countries. They cling to power at all
cost and are unwilling and unprepared to countenance any dissenting opinion or challenge to their leaderships. Meanwhile like David their political careers are characterised by nepotism, tribalism, favouritism, clientelism, among others (Gifford, 1998:5-6).

Unfortunately, there are always self-seeking supporters like Joab to do their bidding. There are many Amasas who do politics of convenience; they change allegiance as and when the situation favours them. Alas, they suffer dismally for their inconsistencies and suspect loyalties. Then there are the Shebas who are always fomenting trouble with disregard for national security, cohesion and harmony. Such people have never gotten over their ethnic insecurities and complexes so that when some outsider portrays some amount of superiority complex they take offense and quickly strike back.

Unfortunately, these negative tendencies are considered manly whereas in reality they are obvious portrayal of psychological deficiencies and moral immaturity. Fortunately, there are women who decide to defy kings' senseless orders for the sake of the general good. They are willing to put their skills at the disposal of everybody who needs them. They dare to challenge the status quo to ensure that right things are done with minimal cost. Such is the case of many feminine theologians who dare to challenge accepted theological and cultural normatives so that there can be “full salvation” for all God's children—female and male alike. With tact and skill they cry over the walls of separation to ferocious attackers of human peace and pronounce the verdict that womanhood must be respected, for it is by women that human existence is made possible and sustained. Such women reject to allow troublers to disturb others with their selfish interests.

Another important insight that emerges from this narrative is the revelation about women's nature. The story presents us with the real nature of women: their sensibility, discernment and foresightedness to problems, their tactfulness to dealing with problems, their daring to confront situations that men may find difficult to confront and their compassion towards the suffering. These attributes may explain why most women play the prophet's role to their families and the larger community. Unfortunately, most men reject the prophetic roles of their wives and end up suffering untold but avoidable misfortunes.
The Housewife who killed a Champion—Judges 4

In the days when men were unwilling to confront socio-political injustices and cultural suppressions in Israel it took the singular daring of a woman to crash the oppressor's rule. I am talking about a woman, a housewife who dwelt in tent at the crossroads in Israel. She is Jael the wife of Heber the Kenite. I am unsure whether she was an Israelite or like her husband was a Kenite. Assuming she was a Kenite then we are dealing with a transnational politics where a non-Israelite acquires centre stage position in Israel's life. But more than this she is not a man but a woman of no significance. Her only pedigree is that she is a housewife who waits on her husband, household and friends of her husband, who often were antagonistic to her family's benevolent Israelite hosts.

When the story opens we meet Deborah, a prophet of Israel, instructing Barak, an Israelite man, possibly a mighty warrior, to undertake the Lord's campaign against the Canaanite Jabin. Jabin had successfully suppressed and oppressed Israel because of two basic reasons: the Lord had sold, that is handed over, Israel to him to punish for its sins and also his army had a strongman commander called Sisera. This part of the story is significant. First, it shows that God's people cannot get away with sin; God surely punishes them and he often uses human agents to do so. Often these penal tools become enemies to the sinners. Second, success is achieved through human beings who willingly offer their services for the general good. This brings to the fore issues of leadership crucial to the African situation. Often leaders think they achieve all alone without followers. But this is false; it takes loyal followership to achieve success. We see this in the Jabin/Sisera relationship.

To appreciate this story we need to allow some mental shifts to occur in us. At first sight it appears it is Deborah who is the celebrity. But a deeper scrutiny reveals that Jael is the heroine. Unlike Deborah Jael is feminine. That sounds quite absurd and controversial. But such controversy is allowable when we recognise that Deborah, by virtue of her prophethood had acquired a prestigious place in Israelite society. She had been accepted and incorporated into Israel's powerful, chauvinistic society that subjugates females to males. That is why she can send and command a man to do what she maintained was a divine imperative. Deborah contrasts Jael because she is a career woman. Like all career
women she gives voice to the unknown, nameless, faceless housewives. She writes Jael's memoirs for her and projects her into prominence. It is she who provides a shoulder for Jael to stand on for social recognition.

Often, it is easy to give high profile treatment to career women and ignore the presence of “housewives”. But who said housewives do not contribute to our wellness? The reality is that many a masculine human being has come this far because some housewife sacrificed for them. So the question is what is the worth of the housewife? The answer is many housewives are worth more than the career woman. She remains at home to attend to the hunger pangs of the family. She is never too tired to “set the table” or attend to the nitty-gritty of life. She does not complain of overworking to necessitate a house help who could entrap her husband into marital infidelity. Consequently, she kills all potential champions who threaten her marriage and family harmony.

While the career woman touts loud the general problems the real action is the exclusive preserve of the Jaels. And yet we often do not deem it correct to celebrate our Jaels but tend to see them as interpretative data for our selfish achievements. They are seen as liabilities to domestic and national interests. In fact, not many housewives are as fortunate as Jael to have their names entered into our books of remembrance. Many of them die nameless and faceless. And yet many people become great because some housewife killed a champion for them to make it possible to enjoy stress free life. Why can we be so callous to obliterate such valiant and selfless women from history? It must be noted that these unsung workers' contributions to the economy run into millions of a nation's currency, and yet housewifery, is less esteemed, being a “woman's prerogative”.

“Dear God, Are Boys Better than Girls?”

The quote above is from Faith Forster and Roger Forster. It may sound humorous but it nonetheless raises a thorny but neglected issue in Christian theological discussions, namely, feminism. This is all-important because of the traditional assumption of the maleness of God, which results in androcentrism. The argument may be reduced thus: If God is male then male is “God” (Forster and Forster, 1987:49). But
where did this thinking originate from, in the first place? Like Okure (1988:47-59) and Oduyoye (1982:193-208) Ndute (1998:100) questions this proposition of God's maleness that seeks to debar women from priesthood, since God is biblically androgynous.

Martey (1998:39; cf. Oduyoye, 1982:193-208) hits the nail right on the head when he argues that “any analysis of women's experience in contemporary Africa stops prematurely if it does not dare to tackle the broad issue of culture which encompasses the main factors of the African society's reality which influences our lives”. He believes that this analysis should involve the religious, linguistic, and ethnic dimensions of the African culture because of their tremendous impact on women in Africa. Martey again identifies two basic cultures that evidence in African societies: the male and female. He also observes that there is a systematic exclusion of women that results in female stereotyping the male species, an exclusion that gives vent to a preference for male children to female ones (Martey, 1998:41). Among other cultural violence like forced marriages, betrothal, bride wealth, puberty rites that seclude women for years, menstrual taboos and denial of certain secret societies to women female stereotyping mails does injustice to women in Africa (Martey, 1998:41; Makinde, 1998:75; Okunla, 2001:30). It is against this exclusivist background that we may appreciate African feminists' “noises” about the need for dismantling chauvinistic patriarchal oppressive elements to bring about the full humanity of all people---females and males---for an authentic “imago Dei” in Africans (Martey, 1998:46).

For a long time African women have had to live by male stereotyping, both religiously and secularly, so much so that “it is 'normal' for a woman to be docile, domestic, submissive, irrational, emotional, illogical, nurturant, soft, gentle and good with her fingers” while “it is 'normal' for a man to be aggressive, a good leader, logical, unemotional, decision-making, abstract, active, and non-domesticated” (Nwagwu, 1998:91). This kind of male stereotyping reduces women to a state of sub-humanity, “but as long as to be male is to be normal, there is no place of safety for some women” (Nwagwu, 1998:10). This is why African womanists/feminists contend that African women ought to break through this androcentricism to discover and define their personhood.
free from male domination.

To take it a step higher some African womanists/feminists even argue that femininity is not a gender issue but sexual matter. This is because there are males who are dominated and “effeminated” by “masculine” women in many spheres of life. In this world of “male normalcy” there is no room for effeminates. Consequently, some feminists insist that all human beings who in one way or other are victimised through classism, sexism, racism, and so forth, are engendered females, while their oppressors are engendered males, irrespective of their sexuality. These emasculated “females” suffer social, cultural, political, religious and economic inhibitions to self initiatives and achievements. Consequently, there is always a gender imbalance whenever one person wields power over another. Hence, a domineering husband, or wife, employer, parent, leader, pastor, teacher, and so forth, reduces his or her victims to the status of ‘females’.

Defining Power by Gender

Indeed, African womanists/feminists contend that power is central to gender issues and inequalities. They also assert that though both males and females may suffer from androcentricism it is the latter who suffer greatest due to their sexual orientation. Sexism, they insist, is ideological which unfortunately is biologically tied to discriminate against the female humanity. Some even maintain that Christian history and theology negatively link gender issues to sexism. Thus, Adekunbi (2001:103-12) boldly opines that Christianity is non-existent but rather has left a sexist god “behind”. Such stereotyping not only negatively affects women psychologically but also impedes and immobilises their use of spiritual gifts for the full benefit of all humanity. Indeed, African feminists are convinced that the realisation of full humanity of all people is tied to the “recapturing” of women's place in this patriarchal world. Hence, Adekunbi writes, “African women should claim and acknowledge their own power, to take their thinking in their hands and to create the world they want. When we as women learn to take care of ourselves in a positive way, to have self-respect and self-worth, life for all human beings, including men, will have taken a quantum leap in the right
direction” (2001:105). To the African feminist/womanist then power in Africa is religio-culturally conditioned that demands responsible reclamation and redemption by African women.

The offsetting of imbalances in gender matters as noted above cannot be ignored. Indeed, the importance of women in God's salvific purposes has been noted by Alalade (1998a) who insists that any talk without women is incomplete. And yet culture with all its “dehumanising” failings blends beautifully with women, for “without women there can be no gospel” (Alalade, 1998a: 12). Many African womanists/feminists point out the socio-political and economic contributions of women to society, and maintain that theological education should not be denied African women since they occupy such an important position in the church. They further wonder why women who have a primordial function crucial to the very survival of the society, and serve as the model and first social contact to children, should be denied of so-called “men's” exclusives. Thus, for these women the liberation of the African person is defined within the context of the African woman's liberation, which in turn is contingent on the place the church gives to its women's education. Thus, African feminists insist that the theological tasks in Africa must endeavour to change social and religious attitudes, concepts, practices, customs, policies, beliefs, among others, that demean, limit and distort womanhood. To such feminists' the fact is that the Incarnation provides the greatest proof of God's high regard and esteem of womanhood. God demonstrates his abhorrence of sexual prejudices and chauvinism when Jesus of Nazareth freely mingled with and accepted “sinner” women into his ministry (Martey, 1998:55).

Undoubtedly Okure's (1988: 47-59) call for a disapproval of biblical misapplication of patriarchy that justifies gender imbalance in the church and society should be taken seriously. So is the call to religious people, particularly Christians, to reject and oppose all “gender stratification, male entitlement and female self-abasement coupled with acquiescence that plainly cannot be exhibited in the presence of God” (Oduyoye, 2001:3). In some Ghanaian Pentecostal churches women are unconsciously conditioned to accept secondary role definitions. This manifests in the way they speak of themselves in the church's life. They
are made to see themselves as “hewers of wood and fetchers of water” for their male counterparts. Even in churches where women are allowed in the sacramental ministry they suffer a lot of setbacks in the promotion process. Some of these churches shrewdly redefine their female ministers as “lady pastors” rather than accord them the normal biblical title of “pastor”. Innocent as this appears it must be pointed out that it is a smart, parochial and diminutive redefinition of females underpinned by male superiority on one front and cowardice (the overprotectiveness of a “male domain”) on the other. While these lady pastors can appear content, they likely feel depressed from such gender biases. As Oduyoye (2001: 3) argues, any language that belittles women's worth betrays any God-talk of our claim of women's imaging of God as mere double-talk and religious gimmick.

It seems Okure's (1988: 47-59) call for a disapproval of patriarchy that stems from a misuse of biblical appeals to justify gender imbalance in the church and society, and Oduyoye's call to religious people, particularly Christians, to reject and oppose all “gender stratification, male entitlement and female self-abasement coupled with acquiescence that plainly cannot be exhibited in the presence of God” (2001:3) should be placed within the same context of what Asian women are saying.

Nadar (2001: 164) uses Ruth's role dedifferentiation to contend that women can and indeed, possess more than docile and submissive qualities. She argues, “Ruth's character is independent, autonomous, strong-willed, and even subversive” (Nadar, 2001: 164). Writing from her Pentecostal and South African Indian Christian context, Nadar sees herself committed to the single (widowed or divorced or labour migrated husbands' wives) or/and impoverished, ethnically oppressed women. These “disadvantaged” women “use the Bible collectively as a crutch on which to lean in difficult times (and who consider) the Bible a foundational religious document that dictates how social and other relations are nurtured” (Nadar, 2001: 162). She defines role dedifferentiation “as the process by which persons respond to a crisis through adding roles, including roles that would be socially inappropriate in normal times” (Nadar, 2001: 164). I will not hesitate to say that Nadar is right to bring out Ruth's resourcefulness and ability to
circumvent the law in order to provide for Naomi and herself.

On her part, Dube (2001:179-95) sees the relationship between Naomi and Ruth as representative of the international relationship between Judah and Moab, and which underscores the unequal relationship between a chauvinistic husband (Judah) and his docile wife (Moab). She notes that the relationship, despite the self-sacrificing and resourcefulness of Ruth (Moab), was not one of liberating interdependence, but of subordinates and dominators in which Moab cannot benefit equally from Judah's resources. By this Dube stretches gender inequalities to cover international relationships and consequently argues for the maintenance of healthy relations as an indispensable mediation in healing the world, and in proclaiming life and success within and outside nations. She thinks also that there is a political bias whereby the dominant powers think that weaker nations need to adopt their systems in order to be accepted. This in her view has led to neo-colonialism.

In my view this subtle and transnational narrative reveals the way nationals manipulate migrants in their new homes to achieve national aspirations. Fortunately, not all migrants are oblivious to opportunities submerged in foreign manipulations. They are smart enough to subvert their kinsman-redeemers for their own survival in strange and prejudiced environments. Apparently, this explains why Nadar “refused” to identify Ruth with seduction than her resourcefulness in taking advantage of her situation. Thus, Ruth is:

a perfect representative of oppressed Indian women who takes control of her destiny and who changes it from hopelessness to happiness. She is a survivor, not a victim of circumstance, waiting for a man to change her fate…. (Consequently) women in situations similar to Ruth's can, like Ruth, rise to the occasion and initiate actions that will change their hopeless situations into positive ones (Nadar, 2001:172).

These days it is important women become resourceful so that men will not continue to reduce them to footstools.
Lack of resourcefulness has reduced many people to servitude. In all spheres of life the resourceful are positioned to utilise the less resourceful to their advantage. Someone said that we build wealth reserves through the sweat and cheap labour of “fools”. The point is that few, if there are at all, employers recognise and value the contributions of their employees. Oftentimes, the feeling is that the employee depends upon them for survival. The Haitians have an adage that goes like this: “If work was such a good thing, the rich would have found a way of keeping it to themselves” (Dube, 2001:172). The powerful seek to justify their maintenance of their high positions to signify that work is good for the poor. But why should this be so?

**Source of Feminist Theological Task: Bible or Culture?**

Feminists are unhappy with the way the Bible is (mis)used to justify chauvinism. They think chauvinism benefits from so-called inspiration of Scripture which means that nobody has the right to question or interpret abused scriptures differently. For instance, Hurding (1987:285) views human creation three dimensionally: humans represent God in creation; humans resemble and re-present God the “Original”; and humans are God's relatives who are called into relationship with God and with one another, which is an intersexual relatedness. He ties gender inequality to divine judgement of sin in Gen. 3 which for him places feminists' case on slippery mire, unless the divine element is denied, which will mean a rebuttal of the inspiration of the Scriptures. And if inspiration is tenable it will mean the argument ends here.

Undeterred, African feminists like Dora R. Mbuwayesango and Seratwa Ntloedibe-Kuswani Gomang question the all sufficiency of the traditional claim of the Bible's inspiration. For example, Mbuwayesango (2001:67) strongly claims that missionary Christianity “colonised” the Shona deity *Mwari* by adopting it for the Israelites. Similarly, Gomang picks issue with missionary translation theory because it regards the Bible as the source text that is immutable while the receptor languages and cultures or targeted text is changeable. Inherent in this theory, she contends, is the dangerous subjugation, colonisation, and domination of women and African people. For her then the whole issue of missionary
Bible translation must be seen as an ideological and theological instrument that reduces non-biblical cultures, languages and source texts to servitude of the “source text”, the Bible, the tool in the hands of European Christianising colonisers. Thus, she boldly proclaims, “the violence of biblical translations must be revisited and exposed, and alternative theories that respect both the receptor and source languages should be proposed and applied” (Gomang 2001:80-1). In effect, these women reject the biblical text and opt for African cultures as better alternative text for Christian living and theologising.

Feminist rejection of the finality of the Bible to human problem is not peculiar to African feminists. Thus, according to Lan (1995: 290-2), the Chinese have begun to question the superiority of the Bible over non-Christian scriptures. Like Mbuwayesango and Gomang, she rejects the Bible as the only word or truth of God. Rather, there are other revelations of God in all other cultures and religions. She boldly writes:

Since I reject both the sacrality of the text and the canon as a guarantee of truth, I also do not think that the Bible provides the norm for interpretation in itself. For a long time such 'mystified' doctrine has taken away the power from women, the poor and the powerless, for it helps to sustain the notion that the 'divine presence' is located somewhere else and not in ourselves. Today, we must claim back the power to look at the Bible with our own eyes and to stress that divine immanence is within us, not something sealed off and handed down from almost two thousand years ago. Because I do not believe that the Bible is to be taken as a norm itself, I also reject that we can find one critical principle in the Bible to provide an Archimedean point for interpretation (Lan, 1995: 302).

Hence, Lan (1995) thinks that the Bible can serve as both a domineering and liberative instrument depending on who uses it. Consequently, she calls for a two-fold dialogical engagement: between Asian spirituality and biblical spirituality; between Christianity and Asian non-Christian
faiths as partners in search for truth.

But is it true that the Bible is not normative simply because some manipulate their fellow humans by it? Can we refuse to be cultural or reject our languages simply because some people abuse others by means of our cultures and languages? Certainly, we can choose to use the Bible to serve liberative purposes and thus “subvert” the abuses of the abusers. In my view, to reject the inspiration of the Bible disqualifies the theologian from being Christian and a Christian theologian. We do not have to dispute our identity because some people define us in their own way. What we must do is to examine critically the Bible to establish whether or not it allows the oppression of other people. I do not think the Bible does.

The point is that such contextualising of the Bible treads unsafely towards syncretising biblical Christianity in the process (cf. Kato, 1985:23, 25-7). Therefore any evolvement of Christian theology that “unguardedly” uses religio-cultural sources other than the Scriptures and/or qualifies those religio-cultural features as equally revealed will appear to replace the Bible with multiple different cultural values (Kato, 1985:11). I am not very sure if cultural relativism is good for the theological task. In our struggle for true humanity what we may need to consider is to accede to Hurding’s (1987:295) call for our total maturity in order to erode all barriers that impede our sexual, social, economic and political relationships. After all, our sexual differences are only biological in terms of hormone balance and reproductive capability (Hurding, 1987:292). Needless to say feminists do not think that their position is unjustifiable as long as it helps to produce some lease of hope to women.

A “Fair and Caring God” for “Free” Women

If African women suffer from identity crisis from their namelessness then there is a serious case for the African church. These women want to see themselves as free women not necessarily because they want to challenge the authority of men. Rather, they feel oppressed socioeconomically, religio-culturally and politically. They want to find assurance in the “God” of the church who they are told cares for the
oppressed and the downtrodden. In this God they hope to find solidarity as one who takes sides with all the oppressed of society. This God must be *fair* to these women. In short, they are looking up for a *fair and caring God* who is not selfish on the basis of gender but for the fact that he (or she?) prefers the oppressed who suffer from psycho-emotional, socio-economic, religio-cultural and political shame and depression. This is why there are rumbles among feminists about the place of cultural hermeneutics as a new way of theological analysis of women's situation in the church and society. Indeed, the major debate in theology today is about hermeneutics that seeks to relate to the historical context of a text to its contemporary situation devoid of abstract interpretation.

Such cultural hermeneutics or “encounters” may be done through feminist theological formulations achieved through the exploration of people's experiences (Kanyoro, 1995:21). In this case, there can be the employment of the story-telling art (Oduyoye, 1998:31). According to Olivera, the nameless haemorrhaging woman of Mark 5:21-34 represents the myriads of unidentified and “disidentified”, “forgotten”, “faceless” and “nameless” women who in search of identity, care, sexual affirmation and religious inclusion explore the Bible to encounter Jesus for themselves.

For such women spirituality becomes only meaningful when it provides a locus for inner peace and liberation in their encounter with Jesus Christ. It does not stop at a life of prayer and meditation but is authenticated by a commitment to life since “it is useless to groan over the oppression and misery of the people while those who govern do so with impunity” (Mbuy-Beya, 1994: 67). Expressed differently,

The exigencies of the gospel of love and sharing can best be experienced and articulated by those who are in need, by those who suffer, by those who are abused. It is the wounded who know the pain of wounds. The oppressed are those who best understand and are receptive to the promises of the kingdom (Matt 5:3-11; Luke 10:21). The oppressor is insensitive to the demands of justice and love (EATWOT, 1983: 199).
Essentially, feminists' quest for a hermeneutical privilege is to read from the underside of Scripture about God's liberation for women as assuring of the fullness of all humanity. We will say that the church is called to join God to bring total freedom and justice to all God's people.

Feminists like Oduyoye (1998: 6-7) do not think that the task of human liberation is not prerogative of men but involves women also. Hence, she queries: Why should men alone carry the burden of humanising the human race? Why should men carry single-handedly the burden of creating human culture? It is because of her conviction that women are co-partners with men in this liberation task that she indicts the exclusion of women from church leadership. Well, if men legislate “not permissibles” for women how do women “create” a notch for themselves in the “privileged” establishment of men? The advocacies of African feminists are that women should get on board the theological bus of the church. Thus, Oduyoye lambastes those male theologians who resist women theological education because of their fear that women “will flood the job-reservation left for men to find refuge from women's intellectual capabilities” (1998: 34). Similarly, Alalade observes that the time is ripe for “discussing issues that affect women, culturally and theologically” (1998b:8).

African womanists/feminists believe that not only are women denied of ecclesiastical leadership but they are also not expected to get involved in political leadership. The general impression among Africans is that a political woman is insubordinate or finds it difficult to submit to men's leadership. She wants to be free from male leadership and rather wants to “rule” over males! But is it wrong for a “full” human “race” to desire and demand their independence from one manipulative and domineering “race”? Why should it be thought that women must not be involved in political leadership because they are sufficiently represented by their male relatives and connections in politics? Is it because women are considered docile and immature that they should be classed with children in so-called women and children ministry? In any case, are women “child-men” who need to be represented by “adult-men” for special treatment and attention?

Again, why all the touting about women's representation in parliament? Is it not a subtle disclosure of the African basic assumption
that the House is not a place for women and their going there is something abnormal, and which demands a debate? The general attitude towards “manly” vociferous women politicians is that they are “untrimmed” and “untameable”. Though we often hide behind their political leanings to castigate them, somehow underneath the vicious attack is the belief that they are women and should not talk “too much” but leave such “important” and “sensitive” matters to men. Given the chronic political upheavals in Africa why should women keep quiet when they are much aware that they together with children are the greatest victims of displacement, poverty and diseases during such mishaps? (Kpanie, 2000: 92-8) Is it not for the sakes of such that Kudadjie is unhappy with the church's long-standing “Good Samaritan” tradition of waiting to bring “relief when the harm has already been done”? (Kudadjie, 2000:3) No wonder Akumiah (2000:7) draws the church's attention to Scripture's enjoinder to share in solidarity, to be concerned neighbours, to other people — “to the church together”.

Today, the African church cannot pretend to be oblivious to the African woman's problems. African feminists/womanists' insistence on reading the Bible from the underside, from women's perspective, should not be seen as an unnecessary clamour from some discontent females. The church must carefully listen to the women and appreciate that women are co-pilgrims with men along the same Way of salvation. It must become the voice of women in the social spaces to demand for socio-cultural, economic and political liberation for women. Actions, inactions, tendencies and behaviours, overt or covert, that potentially inhibit women's rise and prominence in ecclesial and public spaces should be avoided and reproved. It is the church's ordained duty to speak for and promote the development of all its members to full humanity.

Consequently, the church must ensure that anything that inhibits women's full development in society is spoken against and removed. First, parents should be encouraged and demanded to educate their girl children to the highest levels. Second, girls should be encouraged to pursue education to the highest. Third, society should be educated to appreciate the role of women in national development. Fourth, the church must speak against obnoxious cultures and traditions that depersonalise the African woman and demand that a just and equitable
system is made available to both women and men. Fifth, the church must demand from African governments the eschewal of selfish tendencies that have the potential of impoverishing and displacing the African woman. This means that governments should avoid electoral frauds that can result in civil unrest and wars since under such circumstances it is women (and children) who suffer most. Finally, the church must demand governments to include women on their human developmental agenda. I will summarise the discussions below.

Conclusion

This paper has examined and evaluated the situation of being a woman. The question I sought to answer was: What is the nature of (African) feminists' contentions and what should be the attitude of the church to these contentions? I used the discursive and analytical methods to arrive at my conclusions. With stories from the OT as points of departure I demonstrated the socio-theological-political significance of women in human history. The fact still remains that the church needs to make room for such “disturbances” because they will help to make the world better for living. All these happenings are significant. They are “loud noises” that demand that the church re-examines its theology without bias to ensure that Christ's salvation becomes meaningful to all God's children--females and males. Women's issues cut across a whole range of questions: identity, power, liberation, equality, social equilibrium and definition, among many others. These are seen in religion, politics, social and economic spheres. The culprits are often “males”. The imbalances in the human family are a problem that the church must deliberately choose to correct so that all God's children can live together as true representatives of the imago Dei. This means the church must begin to develop an all embracing definition for what we mean by sin.
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Wheelchair Seat Cushions Selection for Spinal Cord Injury Patients

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ABSTRACT

Selection of Wheelchair seat Cushion for people with spinal cord injury and cerebral palsy is important. Some of them spend their whole life time in the Wheelchair. Comfort posture and support are paramount for wheelchair users, more so for the longer time they spend in their wheelchairs. This boils down to the type of seat and the wheelchair cushion deployed. Wheelchair seat cushions need to protect users against sores and bruising. Thermoplastic Urethane (honey comb)
Cushion has no risk of leaking gel or loss of air, and very light in weight and easily affordable, as compare to Foam Cushion, Air Cushion, and Gel Cushion which means, Clinicians and Biomedical or Rehabilitation Engineers need to encourage people suffering from Spinal Cord injuries and Cerebral palsy to use it. The need for developing countries to train more Professionals to care or the increasing population suffering from this disease.

Introduction

The wheelchair is one of the most important pieces of assistive technology that enables activity and participation for the individual with a spinal cord injury, serves as home for many people with spinal cord injury (SCI) (Di Marco et al, 2003; Bergstrom and Samuelsson, 2006). Estimates suggest that approximately two million individuals are suffering from spinal cord injuries, and about 300 000 people with spinal cord injuries uses wheelchairs (Phillip and Nicosia, 1992). The demands on the wheelchair are many, it must be a source of effective mobility conducted in different environments and enable and influence the extent and quality of activity while providing comfort, stability and safety not only when sitting, but also when participating in dynamic activities. Bogie et al (1995) stated that 47% of pressure ulcers occur at the ischial tuberosities (IT) or sacrum and are therefore more likely to have been initiated while seated. Provision of a wheelchair cushion that relieves and redistributes pressure and reduces risk of pressure ulcer formation is an important prevention recommendation. It is important for clinicians to understand and evaluate the pressure redistribution capabilities of various seating cushions. The acceleration of development related to seat cushions is likely in response to estimates that indicate 50% to 80% of persons with spinal cord injury (SCI) will develop a pressure ulcer (Brienza and Karg, 1998) in their life time and the costs associated with treating wounds. Cushions play a very important role in the rehabilitation of the spinal cord injury. Eitzen (2004) identified the role of the cushion as two fold. Firstly, to contribute
to a functional and balanced posture and secondly, redistributing pressure away from the critical areas of the IT and the sacrum and re-distributing pressure over a larger contact area to reduce overall and peak pressures.

**Cushion Selection**

Cushion design has been based on the belief that sitting interface pressure should be distributed evenly to reduce areas of high pressure underneath bony prominences (Yuen and Garrett, 2001). Cushion selection can be difficult as there are numerous cushions on the market each citing specific characteristics along with various amounts of pressure reduction and redistribution that make a cushion “superior.” When assessing an individual for a cushion, factors such as the degree of pressure reduction and redistribution (Garber, 1985), temperature effects (Fisher et al, 1978; Seymour and Lacefield, 1985); level of SCI, pressure relief abilities, transfer technique and lifestyle (Garber, 1985; Makhsoos et al, 2007) also need to be considered. In addition to a reduction in pressure ulcer risk, cushions must also promote adequate posture and stability for the individual with SCI (Sprigle et al, 1990). Seat cushions can be made from a variety of materials, can be static or dynamic (Garber, 1985; Makhsoos et al, 2007), and are incorporated into a variety of wheelchairs. Static seating in a comfort state is important for wheelchair users. Seat-interface pressure distribution has been used as an objective measure for discomfort prediction. Unrelieved pressure on load-bearing muscle tissues of humans can produce pressure ulcers. In a upright seated posture, the highest pressures occur inferior to the ITs. In a static posture vibration can initiate the development of pressure ulcer (Tang et al, 2010).

Spinal cord injury patients need a specialized seat inserted in the wheelchair. Seat are normally prescribed by a seating specialist who received comprehensive training in clinical evaluation, the biomechanics of setting, and fabrication techniques.

When we sit on a cushion, a number of interacting factors determine whether it is comfortable, functional, and clinically safe. Many of these factors are interrelated. Some factors are attributed to the
properties of the cushion, and others due to the characteristics and needs of the user.

**Factors that affect comfort include:**

- Poor distribution of stresses in soft tissues
- Moisture accumulation
- Heat accumulation and loss
- Compromised stability.

**Factors that determine functionality include:**

- Stability provided
- Weight of the cushion
- Frictional properties of the cushion and cover
- Cushion thickness
- Appearance
- Cost
- Durability and the need for user maintenance.

**Factors that determine clinical safety include:**

- Poor distribution of stresses on soft tissues
- Stability provided
- Frictional properties of the cushion and cover
- Moisture accumulation
- Heat accumulation and loss
- Durability and the need for user maintenance
- Flammability.

**Types of Cushion Materials Used in Wheelchair Seats**

There are four main types of Materials used for Cushions in Wheelchairs these are:

*Air Wheelchair Cushions*

These tend to be most expensive wheelchair cushions but are preferred
because they are shaped and inflated to suit the wheelchair user's needs.

_Foam Wheelchair Cushions_
These are the most traditional and economical of wheelchair cushions. They are generally light and can easily be contoured according to the user's needs.

_Gel Wheelchair Cushions_
Although more expensive, gel cushions are preferred due to increased comfort and because they contour to the posture of the user and make space for the user's legs. However, these are known to be less impact-absorbent so are often used in conjunction with inflatable tires.

_Thermoplastic Urethane (Honeycomb) Cushions_
This a new type of Cushion made from synthetic polymers and has the ability to regain it shape in the presences of heat.

_Poor Distribution of Stresses in Soft Tissues_

Stress is defined as force divided by the area over which it acts. Higher stresses occur if either the force acting over a given area becomes larger or if a given force acts over a smaller area.

_Causes_

Localized stresses in soft tissues are an inevitable consequence of sitting. Only when we are suspended in water or are weightless in space, are the stresses on our tissues evenly distributed. When our body weight is supported on a solid surface such as a cushion, localized stresses are generated which compress and deform the soft tissues. The changes in the shape of the soft tissues result in occlusion of blood vessels and lymphatics, and stimulate nerve endings which may signal discomfort to the central nervous system.

The stresses can be divided into two groups: those that act perpendicular to the skin, called normal stresses (in everyday speech we use the term pressure) and those that act parallel to the skin, called shear
stresses. When a person is in the sitting position in a wheelchair, the total force acting on the buttocks and thighs is body weight minus the supporting forces of the footrest and backrest. The greatest proportion of body weight, when sitting, is therefore supported by the area over the ITs.

Bone resists even large forces with barely perceptible deformation. Muscle and fat are far more vulnerable because they deform more readily, causing blood vessels to be occluded. The force due to body weight, when sitting, is imposed by the ITs on the gluteal muscles and fat, which become deformed due to the compressive force. In addition to the force of the ITs and the amount of tissue supporting them, tissue stiffness or tone also determines how much deformation (and therefore damage potential) is developed in the fat and muscle.

Wheelchair users with little muscle tone in their gluteal area are less able to resist tissue deformation, and are therefore more vulnerable to discomfort and tissue damage. It is important to note that heavy individuals are not necessarily more vulnerable to tissue breakdown. They normally have more fat and muscle padding, which compensate for the additional body weight that has to be supported. At greater risk is an emaciated person with flaccid gluteal tissues. The combination of inadequate padding and poor muscle tone produces higher than average deformation in the tissues that remain. Those who have lost tissue overlying the ITs due to previous pressure sores are also particularly vulnerable.

Prevention

Stresses in the soft tissues are not usually evenly distributed, and are thought to be greatest in the muscle close to the ITs, the area in which pressure sores seem to start. Necrosis migrates outward to the skin as cell constituents are released and cause damage to nearby compromised tissue. If weight bearing can be shared equally by the ITs and the nearby lateral posterior aspect of the trochanters, the force at each IT is half of that when only the ITs are loaded, and more soft tissues can share the burden. Weight distribution is, therefore, an important principle used for designing cushions that are shaped to encourage trochanteric and thigh support.
Cushion Comparisons

Foam cushions tend to be least expensive, are lightweight, and have different densities. The foam compresses over time and must be replaced. Its pressure and must be replaced. Its pressure-relieving properties vary, and therefore relieving properties vary. Air cushions are expensive but lightweight. Pressure is evenly distributed, but they require maintenance and must be properly inflated. Gel cushions are expensive and often heavy. Pressure is distributed over the gel, but they can bottom out, leak, retain heat. Thermoplastic urethane (honeycomb) cushions are the most recent development in the world of cushions. They are lightweight, washable, and offer adequate pressure relief. However, they compress over time, and are fairly expensive. Custom-molded orthotic cushions are molded orthotic cushions are a molded system and are very expensive. They must be adjusted for growth, and they can retain heat (Davin, 2012).

Advantages and disadvantages of Foam Cushions

Advantages
Relatively inexpensive, easily adapted, Comes in a range of densities and varying degrees of “memory”, and contributes to postural.

Disadvantages
Tends to wear out earlier than other cushions due to foam breakdown, May lose shape over time and compress, Increased pressure in certain areas of the body may result due to breakdown of foam with age. Examples of Foam Cushions are Invacare Comfort-Mate Extra Cushion and Jay Triad Cushion.

Advantages and Disadvantages of Air Cushions

Advantages
Relatively lightweight, waterproofed, very good pressure distribution with proper maintenance, air circulation, and Maceration prevention.
Disadvantages
Can be less stable for patients as compared to other styles of cushions, Possibility of leaks or bottoming out, Most common issue is a valve inadvertently opening, and Requires close maintenance to prevent “bottoming out” and to ensure proper pressure distribution.

Examples of Air Cushions are Roho High Profile Quadro Select Cushion and Roho Enhancer Cushion.

Advantages and Disadvantages of Gel Cushions

Advantages
Excellent pressure distribution, very comfortable, lighter active styles and designs are available by certain manufacturers, and can provide client with increased stability and support as compared to other cushions like air cushion.

Disadvantages
Much heavier than other cushions Lighter, and Can cancel out benefits of a lightweight wheelchair, Decreased shock absorption, also May “bottom out” from movement of gel being pushed to sides, and Often susceptible to cold climates.

Examples of Gel cushion are Jay Recline Cushion and Jay 3 Cushion.

Advantages, and Disadvantages of Thermoplastic Urethane (Honeycomb) Cushions

Advantages
No risk of leaking gel or loss of air. Equal pressure distribution with multiple individual cells in “beehive” formation, Very light, and can absorb shock well, and Design protects against skin breakdown by removing moisture from client.
Examples of Thermoplastic Urethane (Honeycomb) Cushions are Supracor Stimulite Contoured Cushion and Supracor Stimulite Classic Cushion.

Disadvantages
Newly developed, so no any known effect yet.

Prescription of Wheelchair

Wheelchairs are not only for mobility also serves as a home for people with spinal cord injury and order cerebral palsy disorders. Therefore it is important that we have well train clinicians who are trained in the area of Selection of Wheelchairs for patients with spinal cord disorders and Biomedical Engineers with Specialty in Rehabilitation Engineering to do the prescription and evaluation. Prescription should take into considerations certain important parameters as show in table 1 by Ragnarsson (1992). Using Wheelchairs which are not prescribe by a qualify professional will lead to serious damage of the condition suffering by the patient.

| 1 | User's age, size, weight, etc |
| 2 | User's disability and prognosis |
| 3 | User's functional skills and preferences |
| 4 | Indoor/outdoor use |
| 5 | Portability/accessibility |
| 6 | Reliability/durability |
| 7 | Cosmetic features |
| 8 | Options available |
| 9 | Service |
| 10 | Cost |
| 11 | Level of acceptance (total environment) |

Discussion

Air cushions are very comfortable because the pressure is distributed
evenly. They tend to weigh less than gel cushions and are often waterproof allowing them to be washed with ease. Apart from the cost the only other down side is that air cushions can be easily punctured leading to deflation. Foam cushion, however, can wear out or compress over time making them lose their shape and therefore reducing the comfort to the user. Memory foam, although more expensive, is a relatively new invention and certainly provides a better solution than the traditional foam used. Gel Cushion tends to weigh more than other cushion types and can leak if punctured and is more expensive. Thermoplastic Urethane (honey comb) Cushion has no risk of leaking gel or loss of air, and very light in weight and easily affordable. Wheelchairs are very important to the user's health conditions and some spend their life time in it. This calls for proper Selection of Wheelchair seat cushions which will provide comfort and stability for people with Spinal cord injuries. This shows that purchasing of Wheelchairs outside without prescription has serious consequences on the people with Spinal cord injuries and cerebral palsy which will lead deterioration of the person's condition.

Conclusion

Cushions play an important role in the rehabilitation of the spinal cord injury persons in their recovery process. Therefore well train Clinicians or rehabilitation engineers must be involved in the cushion seat selection for wheelchairs for the people suffering from this disease. Thermoplastic Urethane (honey comb) Cushion has no risk of leaking gel or loss of air, and very light in weight and easily affordable, therefore people with spinal cord injury should be encouraged by clinician and Biomedical Engineers to use this type of Cushion. Wheelchair not prescribe by clinicians and Biomedical Engineers with Rehabilitation Engineering specialty has serious consequences on the people suffering from Spinal cord injuries and Cerebral palsy which will lead to deterioration of the person's condition and should not be used. This calls for Government and Health institutions in developing Countries to train more clinicians and biomedical Engineers to able to give more support and needed care to the increasing population suffering from Spinal cord injuries, cerebral palsy and other disorders in the body that needs wheelchairs.
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Space Farming – A Case in the Justification of the Need for Space Exploration

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ABSTRACT

In August 2015, astronauts on the International Space Station (ISS) became the first humans to eat food grown in space. This was fresh red lomaine lettuce accompanying the crew's usual freeze-dried fare. Recently, a Zinnia flower has successfully bloomed on the ISS as well. While this demonstrates the success of a space farming initiative, it raises questions as to the justification for investment in space farming in the first place. The obvious reason for the launch of a space farming initiative would stem from the need for a self-sustaining supply of food for astronauts on the ISS and eventually those going to other planets or deep space. However, there are numerous additional benefits to be derived from the entire process. This paper discusses the opportunities space farming can present – and in some cases has already presented – to humankind.

Introduction

Interest in Space exploration has led to the need for the creation and development of many support systems and entities that aid the exploration effort. Among them are housekeeping data for spacecraft, the spacecraft themselves and life support systems for manned missions.
Interestingly, the challenges associated with developing these systems can lead to the creation or development of new technologies not only useful for the mission, but applicable elsewhere.

NASA conducted the plant experiment called Veg-01 to study in-orbit function and performance of the plant growth facility developed by ORBITEC and its rooting (pillows) which contain seeds to be tested on the ISS [2]. The primary reason for the launch of this initiative was the need for a self-sustaining supply of food for astronauts on the ISS and eventually for pioneers of deep space missions such as the currently planned manned mission to Mars by NASA [2]. Indeed, the Veggie system will play a critical role in NASA's upcoming mission of sending humans to Mars. Many however may seek to argue against the idea of space farming, just as they may have argued against the idea of other ventures related to space exploration as a whole, considering the huge costs associated with it.

Experiments have focused on the determination of the effects of zero-gravity on plant growth, testing of quick-grow sprouts on shuttle missions, and the assessment of the viability of different kinds of artificial lighting used in the process. The search for technologies that enable successful farming in space has led to the creation of useful technologies that enhance systems on earth. Notable among them are the NASA Air Purification Technology, The Veggie System designed by ORBITEC, and the Leaf sensor which improve the efficiency of farming by measuring leaf thickness and texting farmers when the plants need water.

Overview

Plants have been considered for food production and atmospheric regeneration since the 1960s with the earliest tests on plant growth at reduced pressure conducted at Brookes Airforce Base (Mansell et Al., Cited in [1]). Other tests have included plant growth at reduced or near-zero gravity, and growth with reduced light intensity. Research is currently being carried out by governments and private entities both on earth and on the International Space Station on how space farming can be successfully carried out.
The results of these experiments are mixed up. For example, it was realised that growing plants in a reduced pressure environment could as easily result in enhancement as it could result in repression of growth depending on the plant species being studied [1]. Nevertheless they all lead to the conclusion that plants - sometimes with some adaptation - can tolerate these low pressures [1] and other conditions abnormal to Earth-based systems.

Experiments have been targeted at how and why plants grow differently in microgravity. The European Modular Cultivation System (EMCS) has been used to conduct many of these experiments under controlled conditions on the ISS. Conditions such as temperature and humidity are monitored depending on the nature of the experiment. Concepts for greenhouses on the moon and Mars are also being explored [1].

It is in this vein that red lomaine lettuce was grown on the ISS by NASA as part of their plant experiment called Veg-01 to study in-orbit function and performance of the plant growth facility developed by ORBITEC and its rooting (pillows) which contain the seeds [2]. A set of zinnias have been grown as well.

**History**

Initiating this experiment, the Veggie unit, together with two pillows containing the red lomaine lettuce seeds and one set of zinnias were sent to the ISS in 2014.

The first pillows were activated in May 2014 by flight engineer Steve Swanson of the Expedition 39 crew. These were harvested and returned to earth in October of the same year. With the microbiological food analysis showing that the lettuce was safe to eat, astronauts were given permission to eat the next batch of red lomaine lettuce grown in space. The second plant pillows, which by then had been on the ISS for fifteen months were activated on the 8th of July 2015 and harvested 33 days later. Mike Dixon is looking at the viability of longer term crops like soybeans [3].

Space farming could prove vital to the survival of mankind. Imagine a scenario where the world population is so high, there is not
enough land on earth for adequate farming (as is currently practiced) to raise enough food for everyone. Vertical farming could prove life-saving, but that may still not enable the generation of enough food supplements.

**Scope of Work**

In justifying the need for space farming, it is necessary to highlight its advantages as well as by-products resulting from the development of the technological elements needed to make it feasible. One question that arises is whether or not the technological elements developed to support or facilitate growth of these crops under the appropriate conditions can be adapted to enhance farming on earth. The answer to that can be found in the Earth-based applications listed.

Another question is whether or not the growing of fresh crops in space could provide some psychological benefits, a concept referred to as horticultural therapy [3]. According to Alexandra Whitmore, a behavioural health and performance scientist working at the Johnson Space Centre (NASA) and currently conducting research into the issue, studies have shown that plants are associated with well-being and optimal performance. Considering the journey to Mars and other deep space missions could require humans to travel for long periods of time in a confined region of space (their spacecraft), it would be necessary to determine mitigating measures to counteract any negative psychological effects this may have on the astronauts. These countermeasures usually involve alternative meaningful work, one of which could involve gardening.

Gioia Massa also supports the notion that there will be some psychological benefits besides the ability to grow and eat fresh food in space [2]. He argues that though the ISS crew get fresh supplies of fruits and vegetables from time to time, the quantity is very limited and must be consumed quickly. Hence “having something green and growing – a little piece of earth – to take care of when living and working in an extreme environment could have tremendous value” he mentions [2].
Advantages of Space Farming:

- Provision of a sustainable source of food supply, enabling long-term space missions – Transporting food to the ISS or for that matter the Moon, Mars or any other planet, space station or colony is an expensive venture. Furthermore, a long distance mission, such as a mission to Mars (if astronauts would have to live there for prolonged periods of time) would require resupply missions where the first few spacecraft carrying food would have to leave the earth, in some cases, before the spacecraft carrying the astronauts get to Mars. With food grown on the space station, not only will the cost of transportation be reduced, but space on the spacecraft previously set aside for food can be made available for other goods. This implies the space farming initiative, if not implemented, would be a major drawback for long-term space missions as not too many astronauts can be sent at a time and the food supplies they can carry may not be adequate to sustain them for the duration of the mission. The avenue for regenerative supply of food in itself will make more manned space missions possible. Astronauts would have the advantage of access to fresh produce while in space. In addition, space farming helps to cut down on average costs associated with a manned mission to space. With a successful initiative, it will be possible to save on weight and space used for carrying food on a spacecraft for various missions, and the saved space could also be made available for other much needed apparatus for scientific experiments. Moreover, the need for resupply missions can be reduced – if not eliminated – as the need for food for the astronauts serves as one of the major reasons for a resupply mission in the first place.

- Creation of atmospheric regeneration – Space farming will provide the opportunity for organic oxygen-carbon dioxide exchange, a potentially better alternative to technology currently being used by existing life support systems that supply oxygen and remove carbon dioxide within the habitable space on the ISS. It can also facilitate a manned mission to Mars or other
planets in that regard.

- Opportunity for supplementary supply of food from Non-Earth-Based sources in the future – The world population is experiencing continuous growth, and as a result, there is a high possibility that in the future, available land resources will not be adequate enough for the necessary farming (as is currently practiced) to sustain life on earth. Methods such as land reclamation and vertical farming are being explored and can help improve the earth's sustainability, however, that may only serve to prolong the life of the earth a little further. With a successful space farming initiative, it might be possible to have plants grown on other planets or spacecraft in orbit and the resulting produce returned to earth for consumption. Alternatively, it might be possible to transport a section of the human population to the other planets, or space orbiting structures where farming can be practiced, as a way of restoring the balance between the population remaining on earth and the resources available to them. It is therefore worth considering Space farming as a necessary – though ambitious - approach to solving this problem.

- Opportunity for gardening as a recreational activity in space – In addition to being an excellent source of fresh produce, gardening can be particularly gratifying, providing the opportunity for some activity other than scientific or routine work [5]. It also provides such benefits as the opportunity for exercise, stress-relief, hand-strengthening and other forms of immunisation or healing to the human body [6]. Manned missions to deep space or distant planets require astronauts to travel long distances for long periods of time in limited space. Research has shown that prolonged habitation in a limited region of space can be psychologically traumatising for humans. Efforts aimed at reducing, or possibly eliminating this concern involve exploration of the psychological benefits of gardening in space.

- Platform for the creation of innovative technologies useful on earth - Indeed, the search for technological elements needed to make farming possible has led to the discovery of several
innovations, many of which can be applied to Earth-based systems.

Earth-Based Applications

_Nasa Air Purification Technology_
The NASA Air Purification system was originally designed for plant-growing experiments on the International Space Station (credits: Akida holdings Inc.). It has now been licensed to be used as a consumer device that keeps household air cleaner and healthier.

_Veggie_
According to Dr. Ray Wheeler, lead for Advanced Life Support activities in the Exploration, Research and Technology Programs office at the Kennedy Space Centre, the idea of using LED light to grow plants originated with NASA as far back as the 1990s. The Veggie system was designed by Orbital Technologies Corporation (ORBITEC) in Madison, working in collaboration with the Kennedy Space Centre (NASA). It can be collapsed or expanded when necessary. It features a flat panel light bank made up of red, blue and green LEDs useful both for plant growth and crew observation. The LEDs are highly efficient, durable and hardly radiate any heat. Indeed, Wheeler argues they are probably the most efficient LEDs in terms of electrical power conversion [2].

With the Earth's increasing population-to-land density, availability of space for farming can be significantly reduced. This has led many to conduct research into vertical farming as a way of maximizing potential land use for farming. The drawback with this method however is that not all plants within these vertical farms get access to adequate lighting from the sun. The LED lighting technology used for growing the red lomaine lettuce in space can be used in this vein on earth.

_Leaf Sensor_
The leaf sensor (Credit: AgriHouse brands Ltd/NASA) was designed to increase the efficiency of farming on long duration missions. It does so by measuring leaf thickness and indicating when the plants need water. It
is now being used by farmers on earth to conserve water use by only irrigating when crops need it.

Discussion

The successful growth of the red lomaine lettuce reveals the feasibility of farming in space. Recall the primary reason for a space farming initiative is to tackle the need for a sustainable supply of food for astronauts as they may need to be in space for prolonged periods of time for some missions. Atmospheric regeneration is possible as a by-product of the space farming process and can supplement, if not altogether replace, the existing life support system for oxygen supply and carbon-dioxide removal on the International Space Station. This will provide an environmentally friendly way of cutting down on the costs associated with such missions.

A careful analysis of the reasons for a space farming initiative show that not only is it necessary, but it might be critical at some point in the earth's life cycle, that food supplies from Non-Earth-based sources be available, should there not be enough food on earth to meet the demands of the increasing world population. In addition, development of technologies making space farming possible has led to benefits that are suitable, not just for space missions, but earth-based systems.

It is also noted that, gardening in space has some psychological benefits. Astronauts need to exercise regularly, and the gardening process can be therapeutic for them. The possibility of immunisation or natural healing resulting from this process makes the psychological effects of gardening well worth researching into. Therefore the possibility of gardening in space implies a potentially more interesting and less stressful work routine. Hence the notion by Alexandra Whitmore and Gioia Massa can be substantiated. This ultimately justifies the need for the space farming initiative and necessary investments thereof.

Risks and Challenges to Space Farming

The technical challenges to space farming include the necessary adaptations to handle plant growth under reduced pressure conditions for
certain kinds of plants, the effect of reduced gravity on certain crops, reduced lighting in some cases, and other environmental conditions peculiar to space (such as radiation) the plants may have to encounter. As not all plants can withstand these conditions, it is necessary to study more in depth, on a case-by-case basis, the science behind plant growth to determine what works best for the plant, and the adaptations, if necessary, that have to be made in each case.

The costs associated with space farming will be significantly higher than that for farming on earth. This is because many conditions natural to the Earth's atmosphere have to be artificially created in space. Seeds will have to be put in some pillows, or some rotary device needed to create gravity conducive for plant growth. Zero-gravity environments also place demands on water movement, hence a different approach to watering the plants will have to be adopted. If funding is not made available for the necessary research and development to make this feasible, the mission runs the risk of not being achieved. Also, for the costs involved in space missions, space available on a spacecraft for gardening or farming would be limited at this stage. In the future, Space Farm Satellites, or spacecraft set aside specifically for farming can be developed.

Conclusion

A careful analysis of the above mentioned findings reveal that space farming, though a herculean task to implement, presents essential benefits not just for space missions, but earth based systems. The provision of a source of sustainable food supply in space will help cut down on mission costs as well as enable longer-term space missions, a vital tool for the manned mission to Mars. Also the possibility of supplementary food supply from other planets or entities in space can help sustain the growing world population for a longer period of time. This makes space farming an initiative worth exploring.
References:


