

# GSU-GOMBE - 2022

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## THE USE OF ALTERNATIVE DISPUTE RESOLUTION (ADR) IN NIGERIAN COURTS: THE SHARI'AH (ISLAMIC LAW) COURTS IN PERSPECTIVE.

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### *Abstract*

*Disputes are an inevitable part of human existence hence the placement of various mechanisms to address them. Litigation is primarily used as the means of resolving rights-based disputes through the court system and this used to be the preferred choice for lots of litigants. However, the issues and challenges inherent in litigation such as its high costs, series of adjournments as well as destruction of relationships gave rise to other options. To address these issues and challenges, alternative dispute resolution (ADR), which is a means of settling disputes out of the courtroom, is utilised widely due to its numerous advantages. Nigeria is not an exception to disputes and the problems inherent in the adversarial system of dispute resolution hence the resolve of the Nigerian legal system in utilising ADR in courts. Consequently, courts such as the High Courts, Customary Courts as well as the Shari'ah Courts utilise provisions that are geared towards amicable resolution of disputes and in the context of the Shari'ah Courts, mechanisms such as Sulh (conciliation) and Tahkeem (arbitration) are used. This paper considers the use of ADR in Shari'ah courts of Nigeria and adopts the doctrinal research methodology from available literature. It is found out that the Nigerian legal system recognises and encourages the use of ADR in courts, where appropriate. Accordingly, it is recommended that ADR should be encouraged by judges and that awareness needs needs to be raised on the benefits of ADR.*

**Keywords:** *Alternative-Dispute-Resolution-Shari'ah Courts-Nigeria*

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### **Introduction**

Prior to the formal introduction of Alternative Dispute Resolution (ADR), most aggrieved persons relied on customary ways of resolving disputes.<sup>1</sup> With the arrival of political authority in the form of the state, the establishment of dispute resolution mechanisms has been closely associated with the determination of those in power to

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<sup>1</sup> Okpuwuru v. Okpokam (1998) 4 NWLR Pt.90, 554 at 586 (Per Justice Oguntade JCA (as he then was))

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govern.<sup>2</sup> Primarily, the preference of the state has been to provide processes and institutions that we would want to characterise as formal, with litigation and adjudication central to the state-sponsored system of civil justice. Thus, these institutions are there: to maintain social order; to avoid conflict; to restore harmony; to achieve equality; and to express communal identity. But, even as these formal systems of justice were being created, dissatisfaction with legal institutions increased as a result of incessant delays, absence of case management procedures, high cost, rigidity, unpredictability, destruction of relationships etc. As Auerbach has emphasised, the rejection of legal processes as an appropriate mode of decision-making in the perspective of disputes is often part of an attempt to develop or retain a sense of community: 'how to resolve conflict, inversely stated, is how (or whether) to preserve community'.<sup>3</sup>

It is as a result of the problems inherent in the adversarial system of dispute resolution that ADR has become a well-recognised alternative to dispute resolution in jurisdictions such as the United States, the United Kingdom and Nigeria. Accordingly, the Nigerian legal system contains provisions on amicable resolution of disputes. However, the focus of this paper is on the use of ADR: *Sulh* (conciliation) and *Tahkeem* (arbitration) in *Shari'ah* Courts.

## Definition of Terms

*Sulh* is derived from the Arabic word *Salaha*, which means to make peace with.<sup>4</sup> It literally means termination of a dispute (*qat'ul munaza'ah*)<sup>5</sup> or a transaction between parties to a case which is expected to lead to settlement of the dispute between them.<sup>6</sup> Technically, *Sulh* has been defined as a contract by means of which contention is prevented or set aside.<sup>7</sup> Article 1531 of the Ottoman Code, "*Majalla*" defines *Sulh* as "a contract concluded by offer and acceptance, and consists of settling a dispute by mutual consent." Therefore, *Sulh* is similar to sale and all that is lawful in sale is lawful in *Sulh* and all that is unlawful in sale is also unlawful in *Sulh*.

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<sup>2</sup>Roberts, S., & Palmer, M., *Dispute Processes: ADR and the Primary Forms of Decision Making*, Cambridge University Press, UK (2005), p.11

<sup>3</sup> *Ibid*, p.9

<sup>4</sup> Elias, E.A., & Elias, E.E., *The School Dictionary: English-Arabic*, Dar Al-Jil, Beirut, p.227.

<sup>5</sup>Mustafa al-Khin et al., *Al-Fiqh al Manhaji 'ala Madhhab al-Imam al-Shafi'i*, Dar al-Qalam (1996), Vol. 3, p.149

<sup>6</sup> Uthman, M.B., *An Overview of the Theory of Sulh in Civil and Criminal Cases*. p.151-152.

<sup>7</sup> Yelwa, A.M., *Dispute Resolution Mechanisms in the Administration of Justice under Shari'a*. Being a paper presented at the Arbitration and ADR Workshop for Judges and Kadis at the National Judicial Institute on 9<sup>th</sup>-13<sup>th</sup> May, 2011.

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*Tahkeem* is an Arabic word which means the appointment of a judge or judges to adjudicate a certain dispute or issue.<sup>8</sup> Article 1790 of the “*Majalla*” defines *Tahkeem* as arbitration which “consists of the parties to an action agreeing together to select some third person to settle the question at issue between them, who is called an arbitrator”. This process of *Tahkeem* is only acceptable in *Shari’ah* in matters that are pecuniary in nature. However, the only condition attached to an arbitrator is that he should be an expert in the area where he is to make arbitration.<sup>9</sup>

It is instructive to note regardless of the similarity between *Sulh* and *Tahkeem* as mechanisms for the resolution of disputes, they differ in the following ways: unlike *Tahkeem* which results in a binding judicial decision, *Sulh* results in a non-binding proposal for settlement.

## **Mechanisms of Dispute Resolution under the *Shari’ah***

There are various mechanisms by which disputes are resolved under the *Shari’ah*. These include *Khusuumaah* (litigation), *Sulh* (conciliation/settlement), *Tahkeem* (arbitration), Med-Arb (a combination of *Sulh* and *Tahkeem*), *Muhtasib* (Ombudsman), *Fataawa of Muftis*,<sup>10</sup> *Raddul Madhaalim* (restorative justice) and *Wasaatah* (mediation).<sup>11</sup> However, this paper focuses on the concepts of *Sulh* and *Tahkeem* as mechanisms of dispute resolution under the *Shari’ah*.

The concepts of *Sulh* and *Tahkeem* were the predominant methods of dispute resolution in pre-Islamic Arabia. The first step towards dispute resolution was *Sulh*. However, in the event of failure to settle amicably, parties proceeded with *Tahkeem* or adjudication as the next step. Tribal solidarity was a key virtue in pre-Islamic Arabia. As a result of this value and of the tribal organisation of society at that period, settlement of disputes through conciliation and peacemaking by elders and those in authority was practised through informal means and became part of the ethos of the society.<sup>12</sup> It is instructive to note that during that period, dispute resolution mechanisms were not in accordance with Islamic Law. For instance, a *Hakam* (an

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<sup>8</sup> Bouheraoua, S., & Kulliyah, A.I., *Foundation of Mediation in Islamic Law and its Contemporary Application*. Retrieved from <http://www.asiapacificmediationforum.org> on 27-3-17 at 2:50pm.

<sup>9</sup> Yelwa, A.M., *Op. cit.* p.7.

<sup>10</sup> An aggrieved person may ask for the opinion of a *Mufti* regarding his right, duty or that of the others in a matter. The *Mufti* then gives his legal opinion which may guide the party. However, such a legal opinion is not binding.

<sup>11</sup> *Wasaatah* is a benevolent, non binding procedure to end a dispute.

<sup>12</sup> Jamal, A.A., *ADR and Islamic Law: the cases of the UK and Singapore*, “NUS Law Working Paper 2015/004 May 2015, p.4. Retrieved from <http://www.law.nus.edu.sg/wps/> on 30-3-17 at 7:22pm

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arbitrator) was sometimes chosen from *Kuhhaan* (healers) and soothsayers, who were believed to possess supernatural powers and whose opinions involved the invocation of deities.<sup>13</sup>

With the coming of Islam, the pre-Islamic mechanisms that were used for dispute resolution were maintained by Islam with some modifications. For example, the *Kuhhaan* and soothsayers ceased to be appointed as *Hukkaam* based on verse 90 of *Suratul Ma'idah*, where Allah (the Most Glorified, the Most High) says: "O you who believe! Intoxicants (all kinds of alcoholic drinks), and gambling, and *Al-Ansab*, and *Al-Azlam* (arrows for seeking luck or decision) are an abomination of *Shaitan's* (Satan's) handiwork. So avoid (strictly all) that (abomination) in order that you may be successful."<sup>14</sup> Disputes were resolved in accordance with the *Qur'an*, *Sunnah*, *Ijma'* (consensus of opinion) and *Qiyaas* (analogical deduction).

The Messenger of Allah peace be upon him served as *Waseed* (mediator)/arbitrator in addition to his role as the head of the Islamic state. For example the Prophet (peace be upon him) mediated and resolved the dispute that arose between leaders as to who will place the *Hajr al-Aswad* (black stone) in its rightful place.<sup>15</sup> With the expansion of the Islamic state, the Prophet (peace be upon him) delegated some of his companions to act as *Qudaah* (judges)/mediators/arbitrators.

After the demise of the Messenger of Allah (peace be upon him), the *Khulafaa ur-Raashidoon* (rightly guided caliphs), a *Qaadi* acted as a mediator/arbitrator. Also Sulh was widely used and promoted. This was evidenced in the letter written by Caliph Umar Ibn Khattaab (may Allah be pleased with him) to Abu Musa Al-Ash'ari (may Allah be pleased with him) after his appointment as a judge: "Refer disputing parties to reconciliation for surely litigation breeds in hatred and enmities".<sup>16</sup>

Also, during the Uthmaniyyah Caliphate, *Al-Majalla Al Ahkam Al Adaliyyah* (The Ottoman Courts Manual (Hanafi)) was codified.<sup>17</sup> It is based on the Hanafi School of Islamic jurisprudence and provided for the application of *Sulh*, *Tahkeem* and *Waseeda* under the chapter on the administration of justice by the courts.

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<sup>13</sup>Wahed, H., *Sulh: Its Application in Malaysia*, Vol. 20, Issue 6, Ver. II (June 2015), P.9. Retrieved from <http://www.iosrjournals.org> on 26-3-17 at 4:45pm

<sup>14</sup> Khan, M.M. and Al-Hilali, M.T.(1996). *Interpretations of the Meanings of The Noble Qur'aan in the English Language*. Dar-Us-Salam Publishers and Distributors, Riyadh, Saudi Arabia, p.170.

<sup>15</sup> Ibn Ishaq, Muhammad Bin Yasar, *The Life of Muhammad*. Oxford University Press, London, (1955) p.85.

<sup>16</sup> Yelwa, A.M., Op. Cit. p.4.

<sup>17</sup> Retrieved from <http://www.kantakji.com> on 26-3-17 at 6:00pm.

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## The Basis of *Sulh* in Islam

*Sulh* has its basis in the *Qur'an* and *Sunnah* and *Ijma'a*. For example, Allah (the Most Glorified, the Most High) says in *Surah Hujurat*, verse 9:

*And if two parties or (groups) among the believers fall to fighting, then make peace between them both. But if one of them outrages against the other, then fight you (all) against the one that which outrages until it complies with the Command of Allah. Then if it complies, then make reconciliation between them justly, and be equitable. Verily, Allah loves those who are the equitable.*

In *Surah Anfaal*, verse 1, Allah (the Most Glorified, the Most High) says: "They ask you (O Muhammad) about the spoils of war. Say: "The spoils of war are for Allah and the Messenger." So fear Allah and adjust all matters of difference among you, and obey Allah and His Messenger (Muhammad SAW), if you are believers."<sup>18</sup>

Also, Allah (the Most Glorified, the Most High) mentions in verse 35 of *Suratun Nisaa'* that: "If you fear a breach between them twain (the man, and his wife), appoint (two) arbitrators, one from his family and the other from her's; if they both wish for peace, Allah will cause their reconciliation. Indeed Allah is Ever All-Knower, Well-Acquainted with all things."<sup>19</sup>

Furthermore, verse 128 of *Suratun Nisaa'* talks about reconciliation:

*And if a woman fears cruelty or desertion on her husband's part, there is no sin on them both if they make terms of peace between themselves; and making peace is better. And human inner-selves are swayed by greed. But if you do good and keep away from evil, verily, Allah is Ever Well-Acquainted with what you do.*<sup>20</sup>

The Messenger of Allah (peace be upon him) encouraged *Sulh* in the following *Ahaadith*: "*Sulh*, reconciliation between Muslims is in order except any reconciliation that allows *Haraam*, what is forbidden or forbids what is *Halaal*, lawful."<sup>21</sup>

"He is not a liar who lies in order to effect reconciliation between disputing parties."<sup>22</sup>

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<sup>18</sup> Khan, M.M. and Al-Hilali, M.T., Op. Cit. p.236.

<sup>19</sup> Ibid, p.122.

<sup>20</sup> Ibid, p.139.

<sup>21</sup> Wali, A.B., *The Viability of As-Sulh (ADR) to Sharia-Based States in Nigeria*. p..122.

<sup>22</sup> Ibid.

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## Conditions under which *Sulh* is Recommended

The conditions under which *Sulh* may be recommended by a judge are:<sup>23</sup>

- Where litigation may damage blood relationship among disputants. On this, Caliph Umar (may Allaah be pleased with him) is reported to have said: “Avoid litigation among people tied by kinship. Litigation among them causes animosity”.
- Where the judge is unable to comprehend the nature of the claim presented before him.
- Where the evidence presented before the court by the litigants is of equal weight.
- Where the litigants are men of great standing in the locality.
- Where the litigants are influential people and in order to avoid a breach of peace when the judgment is delivered, the judge may recommend *Sulh*.

## Effect of *Sulh* and *Tahkeem* Agreements

It is instructive to note that parties are bound by the conciliation/settlement arrived at, provided it is in line with the *Shari'ah*. Therefore, it is not permissible to set it aside to pave way for the continuity of dispute between them. This was the holding in *Dutsi v. Tofa*,<sup>24</sup> where the court relied on ‘*Mukhtasar*’ and held thus:

*Where a valid reconciliation / settlement on the face of Sharia law is effected, a party to a dispute is not allowed to subsequently set it aside in order to continue disputing it as doing so will amount to a deviation from what is known on the settlement and reconciliation to what is unknown.*<sup>25</sup>

The only condition where a *Sulh* agreement which is voluntarily entered into and is in accordance with the *Shari'ah* can be set aside is where the terms of such *Sulh* are subjected to the unilateral right of repudiation by any of the contracting party to it.<sup>26</sup>

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<sup>23</sup> Keffi, U.D., *The Legal, Social and Economic Roles of As-Sulh from the Perspective of Jurisprudence (Fiqh) of the Maliki School*, pp.193-194

<sup>24</sup> (2001) LRNN 406

<sup>25</sup> Abubakar, A., *Islamic Law The Practice and Procedure in Nigerian Courts*, Adamu Abubakar & Co. (2008), p.57.

<sup>26</sup> Wali, A.B., *Op. cit.*, p.123.



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## Application of *Sulh* in *Shari'ah* Courts

The use of *Sulh* in *Shari'ah* courts depends on whether the case before the court is civil or criminal in nature. At this juncture, we will examine whether *Sulh* can be used in criminal and civil proceedings.

## Criminal Proceedings

The Islamic criminal justice system has its origin in Divine revelation. It stands out from all laws because it is revealed by the Ultimate Law Giver, Allah (the Most Glorified, the Most High) for the benefit, betterment and improvement of humankind. Thus the ultimate objectives of the *Shari'ah* include the preservation of essentials i.e. *Darooriyyaat* namely: the preservation of religion, life, lineage, property, intellect and dignity. However, these objectives can only be preserved through the application of penal sanctions, in the event of transgressing them. In Islam, the punishment for criminal offences is determined by whether a right (as conferred by Allah) belongs to Allah (the Most Glorified, the Most High) or worshippers.

In criminal proceedings, the power of a *Qaadi* to invoke *Sulh* depends on factors such as whether the act(s) for which a suspect is before the court falls under the definition of a crime described in the various categories of crimes or whether it is an act for which *Hadd*, *Qisaas* or *Ta'azeer* punishments become applicable. It is imperative to consider the categories of crimes under Islamic law namely:

*Hudood*: *Hudood* is the plural of the Arabic word *Hadd*, which are “prohibitions ordained by Divine Law [*Shari'ah*], from which we are restrained by God with punishments decreed by Him; they form an obligation to God.”<sup>27</sup> The punishments for *Hudood* offences are provided in the *Qur'an* and the *Sunnah*. These offences impinge on the Rights of Allah (the Most Glorified, the Most High) and the Rights of Worshippers and are against the interest and basic foundation of the Islamic society. Therefore, the imposition of punishments for such offences is to purify the soul which is a prerequisite of divine mercy, safeguard society and put an end to transgression as well as to serve as deterrent to others.

Crimes affecting the Rights of Allah (the Most Glorified, the Most High) are *Zina* (fornication or adultery), *Qadhf* (slander), *Sariqah* (theft), *Shurbul Khamr* (wine drinking), *Hirabah* (highway robbery), *Riddah* (apostasy) and *Baghyu* (rebellion). While crimes affecting the rights of worshippers include murder and inflicting injurious bodily harm. It is instructive to note that notwithstanding the

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<sup>27</sup> Abdel Haleem, M., Sheriff, A.O., Daniels, K., *Criminal Justice in Islam: Judicial Procedure in the Shari'a*, I.B. Taurus & Co Ltd, London (2003), p.18.



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encouragement of the use of *Sulh* as a mechanism for resolving disputes, a *Qaadi* has no power to advice on the option of *Sulh* in *Hudood* offences or to increase or decrease punishment once a crime has been proved. This is because such offences involve the rights of Allah for which punishment has been decreed under the *Qur'an* and the *Sunnah*. However, it is pertinent to note that in the matter of *Baghyu* (which is a *Hadd* offence), it is lawful to invoke *Sulh* between the rebels and loyalists if the rebels are toiling under an erroneous or ill-conceived justification for their actions.<sup>28</sup>

*Qisaas*: *Qisaas* implies retaliation by slaying for slaying, wounding for wounding and mutilating for mutilating, etc and it is divided into two namely: *Qisaas* for homicide and *Qisaas* for wounds and injuries.<sup>29</sup> The basis of *Qisaas* is found in the following *Suwar*: *Suratul Baqarah*, verse 178, *Suratul Maa'idah*, verse 45 and *Suratul Israa'*, verse 33 where Allah mentions:

*O you who believe! Al-Qisas (the Law of Equality in punishment) is prescribed for you in the case of murder: the free for the free, the slave for the slave, and the female for the female. But if the killer is forgiven by the brother (or the relatives) of the killed against blood money, then adhering to it with fairness and payment of the blood money to the heir should be made in fairness. This is an alleviation and a mercy from your Lord. So after this, whoever transgresses the limits (i.e. kills the killer after taking the blood money), he shall have a painful torment.*<sup>30</sup>

*And We ordained therein for them: Life for life, eye for eye, nose for nose, ear for ear, tooth for tooth, and wounds equal for equal. But if anyone remits the retaliation by way of charity, it shall be for him an expiation. And whosoever does not judge by that which Allah has revealed, such are the Zalimoon (polytheists and wrongdoers - of a lesser degree).*<sup>31</sup>

*And do not kill anyone whose killing Allah has forbidden, except for a just cause. And whoever is killed wrongfully (Mazluman intentionally with hostility and oppression and not by mistake), We have given his heir the authority [to demand Qisaas, Law of Equality in punishment or to forgive, or to take Diyah (blood*

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<sup>28</sup> Uthman, M.B., Op. Cit. p.165.

<sup>29</sup> Bambale, Y.Y., *Crimes and Punishments under Islamic Law*, Malthouse Press Limited (Lagos), 2003, p.87.

<sup>30</sup> Khan, M.M. and Al-Hilali, M.T., Op. Cit. p.46..

<sup>31</sup> Ibid, p.159.

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money)]. But let him not exceed limits in the matter of taking life (i.e. he should not kill except the killer). Verily, he is helped (by the Islamic law).<sup>32</sup>

It can be deduced from the above verses that *Qisaas* applies to crimes against life and body. Therefore, where the crime is intentional and proved, a *Qaadi* must enforce the decreed punishment except where the aggrieved party or his legal guardian decides to either pardon the convict or reach an amicable settlement for *Diyah* (blood money). This view supports the views of Imam Malik, Imam Shafi'i and Imam Ahmad b. Hanbal that reconciliation in *Qisaas* is permitted.<sup>33</sup> They based their opinion on *Suratul Baqarah*, verse 178 and upon the words of the Messenger of Allah (peace be upon him) that: "The one who kills another deliberately will be handed over to the heirs of the deceased; they may kill him if they please, or they could receive blood money... And whatever they settle between them is permitted."<sup>34</sup> However, Maliki jurists are of the view that *Sulh* will not be allowed in *Qisaas* cases if the homicide involves *Geelah* (treachery) or *Hirabah* (robbery).<sup>35</sup>

*Ta'azeer*: *Ta'azeer*<sup>36</sup> is defined as "discretionary punishment to be delivered for transgression against Allah, or against an individual for which there is neither fixed punishment nor penance (*Kaffara*).<sup>37</sup> Offences attracting *Ta'azeer* have a wider scope than offences attracting *Hudood* and *Qisaas*; a *Qaadi* has discretionary powers to award punishments in accordance with certain prescribed laws and in the light of general principles and rules from the words of Allah (the most glorified, the most high) such as "The recompense for an evil is an evil like thereof..."<sup>38</sup> and the principle of *la darara wa dirar* (no harming and no reciprocation of harm).<sup>39</sup>

It is submitted that giving a *Qaadi* discretionary powers to award punishments in situations not expressly provided for in the *Qur'an* and the *Sunnah* is an imperative safeguard against any situation that may threaten the peaceful coexistence of the Islamic community. However, a *Qaadi* must take into account aspects such as the seriousness of the wrongdoing, the prevalence of crime in the community and whether the suspect is a first time offender or not before awarding punishment. He may

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<sup>32</sup> Ibid, p.371.

<sup>33</sup> Wali, A.B., Op. cit. p.123.

<sup>34</sup> Audah, A., *Al-Tashri al-Jina'iy al-Islamiy*, (1969), Vol. II, p.167.

<sup>35</sup> Uthman, M.B., Op. cit. p.162.

<sup>36</sup> *Ta'azeer* is derived from the Arabic word "Azr" which means to censure or repel.

<sup>37</sup> Bambale, Y.Y., Op. Cit. p.96.

<sup>38</sup> Khan, M.M. and Al-Hilali, M.T., p.637.

<sup>39</sup> Abdel Haleem, M., Sheriff, A.O., Daniels, K., Op. cit., p.20.

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recommend forgiveness, restitution, reprimand, community service but he should always take into cognisance the wish (es) of the wronged.

## **Civil Proceedings**

*Sulh* can be invoked in civil matters such as marriage, divorce, maintenance, guardianship, cruelty/ill-treatment, consummation, inheritance, transactions/disputes between Muslims and Non-Muslims etc.

In Islam, marriage is a sacred contract entered into between a man and a woman in the presence of Allaah (the Most Glorified, the Most High) and it is through that institution that families are brought into existence. Therefore, the success of every society depends to a large extent on the stability of families. Conversely, disputes are an inevitable part of human nature which even marriages are not insulated from and because marriage is generally regarded as a union between two families instead of two people, marital disputes which (may emanate from a wife or husband) symbolise a shared problem that affect both families. It is as a result of the tremendous importance that Islaam accords to the marriage institution that Allah (the Most Glorified, the Most High) makes specific reference to *Sulh* as the primary means of resolving matrimonial disputes. This is pursuant to *Qur'an* 4, verse 128 where Allah (the Most Glorified, the Most High) legislates concerning desertion on the part of the husband. On this, 'Ali bin Abi Talhah (may Allah be pleased with him) narrated that Ibn 'Abbas (may Allah be pleased with him) said that the verse 128 refers to, "When the husband gives his wife the choice between staying with him or leaving him, as this is better than the husband preferring other wives to her."<sup>40</sup>

It is however stated that the plain wording of the verse refers to the settlement where the wife relinquishes some of the rights she has over her husband, with the husband agreeing to this concession, and that this settlement is better than divorce. For example, the Messenger of Allah (peace be upon him) kept Sawdah bint Zam'ah as his wife after she offered to relinquish her day for 'A'ishah (may Allah be pleased with her). By keeping her among his wives, his *Ummah* may follow this type of settlement and peace are better with Allah than parting, Allah said: "and making peace is better."<sup>41</sup>

In relation to the possibility of estrangement between husband and wife (which in some cases leads to divorce), which is the most detestable of all things permitted by Allaah (the Most Glorified, the Most High), *Qur'aan* 4, verse 35 provides for the appointment of two arbitrators (preferably from the members of the affected

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<sup>40</sup> *Tafsir Ibn Kathir (Abridged) Volume 2, Darussalam Publishers & Distributors (2000), p.601.*

<sup>41</sup> *Ibid.*

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family(ies). This is with a view to brokering reconciliation. On verse 35, Allaah (the Most Glorified, the Most High) first mentioned the case of rebellion on the part of the wife. He further mentioned the case of estrangement and alienation between spouses. The scholars of *Fiqh (Fuqaha)* are of the view that when estrangement between the husband and wife happens, the judge refers them to a trusted person who examines their case with a view to stopping any wrongs committed between them. If the matter progresses, the judge refers the matter to two trustworthy persons (one from the woman's family and the other from the husband's family) to meet with the couple, examine their case and decide whether it is best for them to stay together or part ways. Even though Allah (the Most Glorified, the Most High) gives preference to staying together, and this is why Allaah said: "If they both wish for peace, Allah will cause their reconciliation".

'Ali bin Abi Talhah (may Allah be pleased with him) further reported that Ibn 'Abbas (may Allah be pleased with him) said concerning the appointment of arbitrators that if the man is in the wrong, they prevent him from his wife, and he pays some restitution. However, if the wife is in the wrong, she remains with the husband and does not pay any restitution. If the arbitrators decide that the marriage should remain intact or be dissolved, then their decision is upheld. However, if one of the spouses disagrees with the decision of the arbitrators that the marriage remains intact while the other agrees, and one of them dies, the spouse who did not agree will not inherit from the spouse who agreed while the one who agreed will inherit from the spouse who did not agree. This was collected by Ibn Abi Hatim and Ibn Jarir.<sup>42</sup>

On the other hand, where the two arbitrators disagree, Shaykh Abu 'Umar bin 'Abdul-Barr is of the view that the scholars agree that the opinion to dissolve the marriage will not be upheld. They are also of the view that the decision of the arbitrators is binding regardless of whether the spouses appointed them as agents. This is the situation where it is decided that they should stay together but they disagree whether it is binding or not when they decide for separation. He then stated that the majority holds the view that the decision is still binding even if they did not appoint them to make any decision.<sup>43</sup>

It is instructive to note that there are instances where a disputing couple are unable to reach an amicable settlement and the only option left is to institute an action in the *Shari'ah* Courts. In issues of divorce, Islamic law courts reserve the application of *Qur'an* 4, verse 35 for divorce suits in which a wife repeatedly files for divorce but

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<sup>42</sup> *Ibid*, p.448.

<sup>43</sup> *Ibid*.

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repeatedly fails to satisfy the courts that she deserves the release.<sup>44</sup> To tackle the predicament of recurring suits without success for lack of evidence, the jurists devised a procedure based on *Qur'an* 4:35 as follows:<sup>45</sup>

*If she repeatedly puts up complaints before the court against her husband and seeks separation and she fails to satisfy the court because she fails to establish the genuineness of her allegation before the court, the judge appoints a panel of two arbitrators on condition that (a) they are both upright and guided (b) they have experience about the spouse's problems with the capacity to solve them. It is preferable that they are of the spouse's blood relation, otherwise, non-relation will be accepted. They should be familiar with the causes of their (couple's) rift and work hard, as much as possible to settle them.*

*If they do not succeed and (found that) the fault(s) are/is attributable to both or they found that the fault(s) are/is with the husband or the true position is not clear, the panel recommends separation – release of the wife. It should be regarded and treated as irrevocable separation (divorce).*

*If the faults are from the wife, they should not be separated by **Talaq**, releasing the wife, they should be separated through the process of **Khul'** – the women opting out of the marriage and compensating the husband.*

*If the panel does not agree on a consensus, the court orders them to go back and carry out the investigation. If they still do not agree, the court dissolves them and sets up another panel of two arbitrators.*

*The panel must place their findings before the court. The court shall enforce their recommendation. All these are based on His words the Most Glorified in *Qur'an* 4:35.*

Islam also permits the use of *Sulh* in internal and international conflicts between Muslims and non Muslims provided it is not on purely religious matters and the resolution must be in line with the *Shari'ah*.

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<sup>44</sup> Ambali, A.A., *Stimulation and Sustenance of Economic Development Through the Use of Alternative Dispute Resolution (ADR) Systems in the Judicial Process: Sharia Court of Appeal Perspective*, p.12. Being a paper presented at the 2015 All Nigeria Judges' Conference held on Wednesday, 25<sup>th</sup> November 2015 at the Andrews Otutu Obaseki Auditorium of the National Judicial Institute, Abuja.

<sup>45</sup> Ambali, A.A., *Op. cit.* pp.13-14.

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## **Conclusion**

The role of *Sulh* and *Tahkeem* in any society cannot be overemphasised. This is in view of the fact that they are a fundamental part of the Islamic justice system which have been sanctioned by the *Qur'aan*, *Sunnah* and *Ijma'* and *Qiyaas*. More importantly these mechanisms are the most efficient and effective ways of dispute resolution because they decongest courts, restore peaceful coexistence, lead to forgiveness and brotherhood by addressing issues that may lead to hostilities, conflicts, destruction of relationships and a breakdown of law and order.

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## EVALUATION OF THE COOLING PERFORMANCE IN CONVENTION CENTRES; THUS REDUCING ENERGY DEMAND IN BUILDINGS IN NIGERIA

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### **Abstract**

*A lingering energy demand in buildings has become a difficult issue all over the world. More than 40% of energy consumption is due to buildings. With the need to improve indoor environmental quality and conditions various strategies and methods were applied in buildings. Cold countries been concerned about keeping the space warm, whilst countries with high temperatures are worried about keeping their spaces cooler. With exceptional increase in the utilization of artificial cooling mechanisms such as; air conditioning system, air coolers and fans for cooling in buildings. Increased energy consumption being one of the major reasons that have led to emission of greenhouse gases causing environmental pollution resulting to global warming and ozone layer depletion. The aim of this paper is to evaluate the cooling performance in convention centres; thus reducing energy demand in buildings in Nigeria, with a hypothesis placed that building orientation, location and regional temperature, will generally influence the effects of the cooling performance of convention centres, various cooling systems used in and within the building were determined, an evaluation of their performance was carried out to determine its effects. This research therefore embarked upon an empirical study of a convention centre in Minna Niger state with the view to explore the challenges of energy use with its antecedent challenges of both the building owners and the users, using qualitative research approach. This entail participants' observation and conduct of interviews. The findings showed that the use of active cooling techniques involving mechanical energy in one or other forms are used to cool mainly the interior parts of the building (Air-Conditioning (A/C), Air handling units, Ceiling fans) which requires a power source, creating adverse effect on the environment by increasing energy used by these buildings, The research recommends that in designing for convention centres, the use of natural cooling methods and practices in buildings is least expensive, and it would mainly depend on interaction of building and its surrounding thereby reducing energy demand in buildings.*

**Keywords:** *Cooling Performance, Energy Demand, Environment*



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## INTRODUCTION

A convention centre generally refers to large comprehensive building and group of buildings with activities such as exhibitions and conventions as their main function. Convention centres typically offer sufficient floor area to accommodate several thousand attendees. Very large venues, suitable for major trade shows which are sometimes known as exhibition centres (Gentry, 2000) stated the advantages of this type of development as its being convenient and a comfortable provision of a live-play-work and retail/commercial environment.

Creating a passive cooling structure with new technologies will help build a connection to the environment, site and city through sustainable measures, to lessen the impact architecture has on the natural world. Architecture has a responsibility to protect, preserve and improve society with sustainable design. With proper design strategies, technologies, and materials, large facilities such as convention centres can be created as energy-efficient structures serving to improve the environment and local community.

Buildings are one of the biggest energy consumption tool in the world, accounting for onequarter to one-third of all energy use and a similar amount of greenhouse gas emission (UN Habitat, 2014). Mechanical cooling in buildings generate fossils and if these systems are replaced with natural cooling methods, the problem of energy consumption would be checked. Buildings use about one third of the net energy produced globally, a proportion that will continue to increase as the population grows and becomes more urban and affluent (Griffith *et al.*, 2007). However in Minna, Nigeria large buildings mainly rely on mechanical means of cooling based on the nature of their climate, therefore the need to proffer architectural solution in reducing or eliminating this trend. The study seeks to explore the cooling requirements of convention centres and to investigate possible techniques that may be used to integrate natural cooling strategies in the design of a convention centre in the city taking into consideration the high humidity during the rainy season.

## LITERATURE REVIEW

Minna, the capital of Niger State in Nigeria, experiences a typical tropical continental climate with distinct seasonal regimes, oscillating between cool to dry and humid to wet. These two seasons; rainy and dry season reflect the influence of tropical continental air masses.

Better building designs are highly cost-efficient. The design stage is crucial, when extra effort is minimal. Three steps are needed for cool low-carbon buildings: avoid - shift - improve (see Fig. 2.1)

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Figure 2.1. Steps for low carbon buildings

Source: PEEB. (2019). Based on: Kovacic and Zoller (2015)

If buildings are adapted to the local climate and use passive cooling techniques, they can keep cool naturally. Variations depend on the climate zone, the local building culture and building use. While there are many variations, the following principles apply:

- i. In humid climates, light- to mid-weight structures and open, spacious layouts allow for constant natural ventilation.
- ii. In dry climates, buildings should be massive to block the heat during the day and naturally cool down at night.

According to the International Energy Outlook 2016 (IEO2016) report, it is projected that the total energy demand will increase by more than 48% from 2012 to 2040, as shown in Table 2.1.

Table 2.1 World energy consumption by country grouping, 2012–2040 (quadrillion Btu)

	2012	2020	2025	2030	2035	2040	2012–40 (change in percentage)
OECD	238	254	261	267	274	282	18.5
Americas	118	126	128	131	134	138	16.9
Europe	81	85	87	90	93	96	18.5
Asia	39	43	45	46	47	48	23.1
OECD with U.S. CPP	238	252	258	265	272	280	17.6
OECD Americas with U.S. CPP	118	124	125	128	132	136	15.3
Non-OECD	311	375	413	451	491	533	71.4
Europe/Eurasia	51	52	55	56	58	58	13.7
Asia	176	223	246	270	295	322	83.0
Middle East	32	41	45	51	57	62	93.8
Africa	22	26	30	34	38	44	100
Americas	31	33	37	40	43	47	51.6
Total World	549	629	674	718	766	815	48.5

Source: (Siddique *et al.*, 2018).

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The table shows a slow rise in energy consumption in the OECD (The Organization for Economic Cooperation and Development) countries, which is only about 18%, due to the developed infrastructure and slower-growing economies. About 40% of the total global energy is consumed in building sector (Ahmed *et al.*, 2015) especially for the purpose of heating and cooling of the building envelopes. Conventional air cooling systems are accountable for consuming enormous energy as well as it creates considerable negative impacts on environment.

## Natural Cooling/ Ventilation

Cooling is the transfer of energy from a space or from the air, to a space, so as to achieve a lower temperature than that of the regular environment. Various ventilating frameworks are utilised to control the temperature, dampness, substance dissemination and virtue of air inside of a space, with a specific end goal to accomplish the needed impacts for the occupants (Geetha, 2012).

## Wind-driven cross ventilation

This happens through ventilation openings on reverse sides of the confined room. Figure 2.2 reveals the representation of the cross air flow serving multi-storied structure. To guarantee enough ventilation airflow generally, there ought to be a variation of wind strain b/w the outlet as well as inlet openings & least inner resistance. This kind of analysis is considered as an orientation to the model, the computational domain name just for the atmospheric airflow around the model room. (See Fig. 2.2)

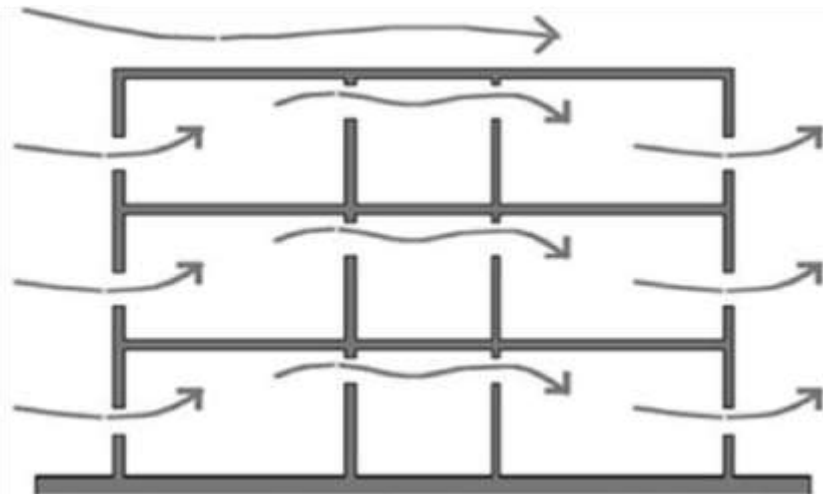


Figure 2.2. The line diagram of wind driven cross-ventilation  
Source: Chetan *et al.*, (2020).

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## Evaporative Cooling

Evaporative cooling is a method that employs the outcome of evaporation as the natural heat dissipater. Evaporative cooling is a typical type of cooling buildings for thermal comfort since it is comparatively low priced and requires less energy than other forms of cooling.

Evaporative cooling is best when the relative humidity is on the low side, limiting its acceptance to dry climates. (Ananda *et al.*, 2021).

Evaporative cooling air conditioning systems use the cooling of the evaporation of liquid water to cool an airstream directly or indirectly. This system comprises of an intake chamber, filter(s), supply fan, direct-contact or indirect contact heat exchanger, exhaust fan, water sprays, reticulating water pump and water sump, air movement is to control air circulation. In view of their size, construction, and working characteristics, air conditioning systems could be categorized as shown in Figure 2.3.



Figure 2.3. Categorization of air-conditioning systems

Source: Ananda *et al.* (2021).

Filtered and cooled by an evaporative air cooler, the outdoor fresh air is ceaselessly sent into the indoor space through the air duct and appropriated outlets. With the constant supply of fresh air, the indoor space is in a positive pressure condition, in this manner the original hot air containing odour and dust will be wiped out of the building, bringing about a cool, ventilated, clean and comfortable condition (Ananda *et al.*, 2021).

## Passive Cooling in Buildings

For reducing the cooling load on the buildings, there are different cooling methods viz. Passive Cooling Methods and Active Cooling Methods. Design or technological featured formed for providing cooling to the buildings with or without using a minimum amount of energy is known as Passive Cooling (Geetha, 2012).

## Building Envelope

In dry climate zones, dense materials such as stone and brick reduce thermal fluctuations. Traditional buildings with thick earthen or stone walls rarely need to be cooled artificially. When using lighter materials, thermal insulation is needed. In humid climate zones with open building layout, lighter materials, such as wood (only where sufficiently available, avoiding deforestation) and composite materials may be used (Kovacic and Zoller. 2015).

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## Glazing.

Making usage of double glazing (Figure 2.4) increases the rate of flow to 11-17 percent. Roos *et al.* (2001) examined its impact associated with the angle of incidence of radiations from the sun in terms of optical properties of windows controlled by the sun.

Below is Fig. 2.4 with various glazing methods.

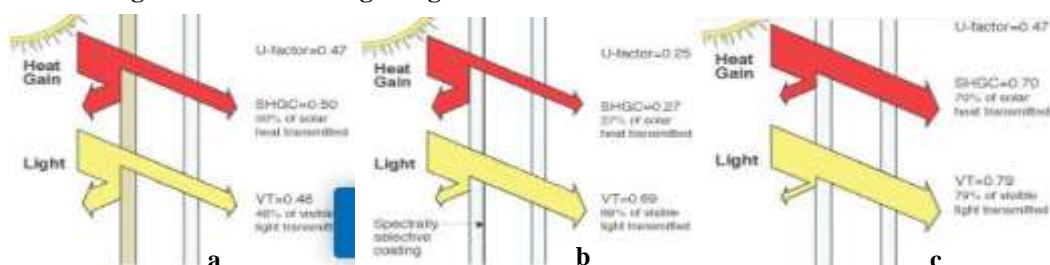


Figure 2.4. a. Double glazing with bronze tint, b. Low solar gain low-E double glazing c. Clear double glazing Source: Ananda *et al.*, (2021).

## Walling and Roofing Material.

In humid climates, the walls are light with many openings and vents for ventilation while the roofs are light and insulated, bright and reflective coatings on roofs and façades reflect solar radiation and prevent it from entering the interior, while in dry climates, reverse is the case. (Kovacic and Zoller. 2015).

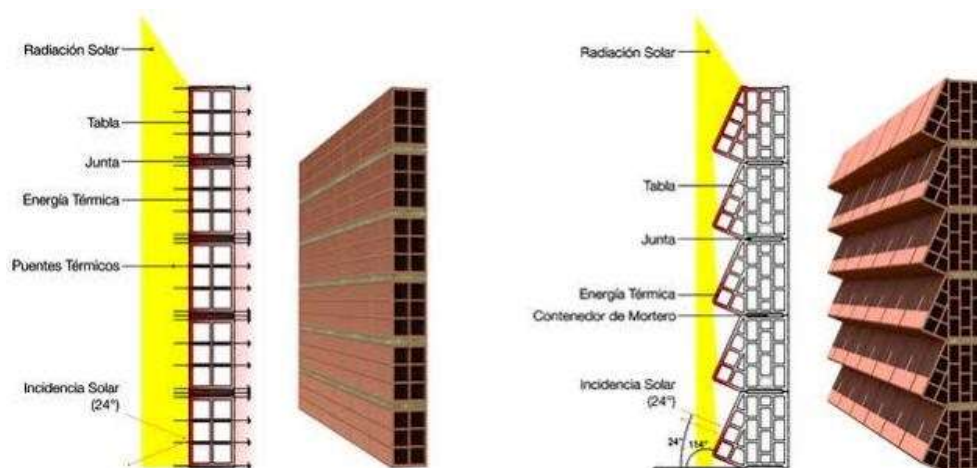


Figure 2.5. Bricks at an angle reducing the area exposed to solar radiation Source: Chetan *et al.*, (2020).



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Additionally, the aluminium fins and capillary tubes were used incorporation with the thermal mass for increasing the process of heat transfer. Insulated roofs also referred to as cool roofs are designed to reflect more sunlight and absorb less heat than a standard roof.

(See Fig. 2.6)

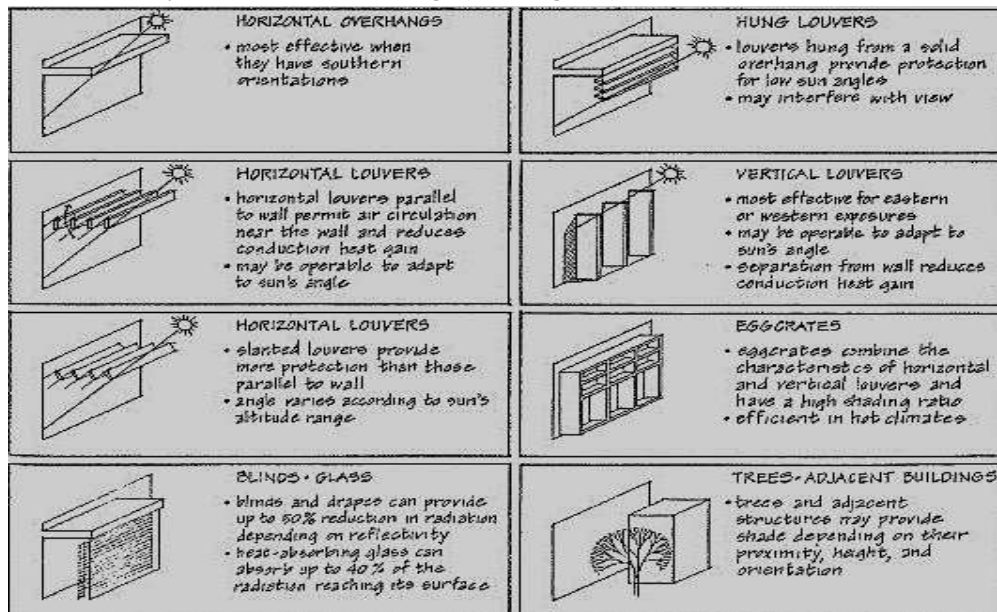


Figure 2.6. Showing Cool roof mechanism and Cool dark colour roofs

Source: American roof tile coatings (2020)

## Shading.

For reducing a direct gain of solar radiation shading is used, it is an effective technique. Shading devices shield a building exterior surfaces and interior spaces from solar radiation, their effectiveness depends on their form and angle of orientation to the sun, these devices include overhangs, louvers, blinds, egg-crates and trees adjacent to the building. (See Fig 2.7)



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Figure 2.7. The various forms of shading devices

Source: Ananda *et al.*, (2021).

Figure 2.7 shows the different forms shading devices and its application, horizontal overhangs are mostly effective when they have southern orientations, vertical and horizontal louvers permit air circulation and can be operable to adapt to the sun's angle, egg-crates combine the characteristics of vertical and horizontal louvers they have high shading ration which is most effective in hot climates.



Plate I. The use of egg-crate for shading in Sufyan\_Altuajeri house Iran Source: Mueller (2019).

## **Orientation and Site Adaptation**

### **Orientation**

Appropriate orientation on a building can provide a state of comfort in the building, according to Gut and Ackerknecht (1993), the longer axis of the building should lie along east-west direction for minimum solar heat gain by the building envelope. Fig 2.5 shows how building should be placed.



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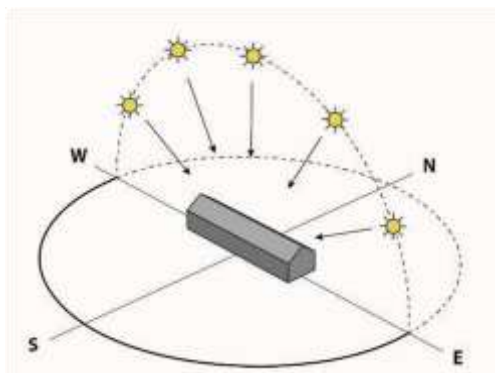


Figure 2.8. Orientation according to the sun  
Source: PEEB. (2019). Based on: Kovacic and Zoller (2015)

## Site Adaptation

The design takes advantage of the site's surroundings, such as the surrounding vegetation, water bodies and the proximity to other buildings, which can partially or completely shade and cool both the roof and the façades of the new building, to reduce the urban heat island effect, green roofs, broad-leaved trees and bushes provide shade but do not obstruct air circulation (Kovacic and Zoller, 2015). Simpson and Macpherson (2003) have shown that tree shades can reduce annual energy for cooling by 10% -50%.

## METHODOLOGY

Qualitative research method was mainly used in this study; involving a descriptive research employed as a scientific method that is used to observe and describing the nature of a subject. A desk study was done on relevant materials related to cooling performance with focus on reducing energy demand in buildings especially convention centres. Case studies were latter carried out as a primary source of data collection method, were relevant information was obtained through physical observation. An observation guide was developed by the researcher, aiding the researcher collect relevant information for analysis with the needed parameters and factors to observe and record. Table 3.1 outlines the parameter that were observed

Table 3.1. Checklist for observation and assessing sampled convention centres

Source: Author's field work

S/No	Variables
1	Ventilation (cross/ one sided)

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- Size, and location
- Provide shading devices for openings
- Select the proper glazing to reduce heat
- 2 Evaporative cooling (natural/ artificial)
- 3 Building envelope
- Provide construction and insulating materials to resist heat transfer
- Use roof spray or roof ponds for evaporative cooling to reduce heat gain
- 4 Building orientation and Site Adaptation
- Control shape, form and orientation
- Coordinate with existing and new landscape and other elements -
- Reduced paved areas to lessen heat buildup around the building Using non-

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random sampling techniques specific samples relevant to the study were selected to be subjected to observation by the researcher in view of the drafted observation schedule, in order to gather information relevant to the study. The following are listed samples (convention centres) selected to be observed as shown in table 3.2.

Table 3.2: List of Samples

Source: Author's field work

S/No	Samples	Locations	Date
1	Justice Legbo Kutigi Minna, Niger State, May 2011 International Conference Centre Nigeria		
2	Abuja International Abuja, FCT, Nigeria Conference Centre (AICC)		July 1991
3	Calabar International Calabar, Akwaibom State August Convention Centre (CICC) Nigeria 2015		
4	Kigali Convention Complex Kigali Rwanda (KCC)		November 2015
5	Qatar National Convention Doha, Qatar. Centre (QNCC)		December 2011

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## DATA ANALYSIS

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Due to the qualitative nature of this research, data gotten have been analysed using qualitative data analysis principles. The data gotten by the researcher using the observation guide was analysed using the Microsoft excel software. Afterwards, the results were presented using plates and figures.

## **Ventilation (cross/ one sided)**

### **i. Size and location**

Size and location of windows in various spaces aid proper ventilation and increase the airflow, adequate window sizes and location boost ventilation also high windows for daylighting are preferable because, if properly designed, they bring light deeper into the interior and eliminate glare. The buildings observed on both the size and location shows that 60% has adequate and large openings (windows) with their location and 40% don't have. (See fig.4.1 and 4.2)

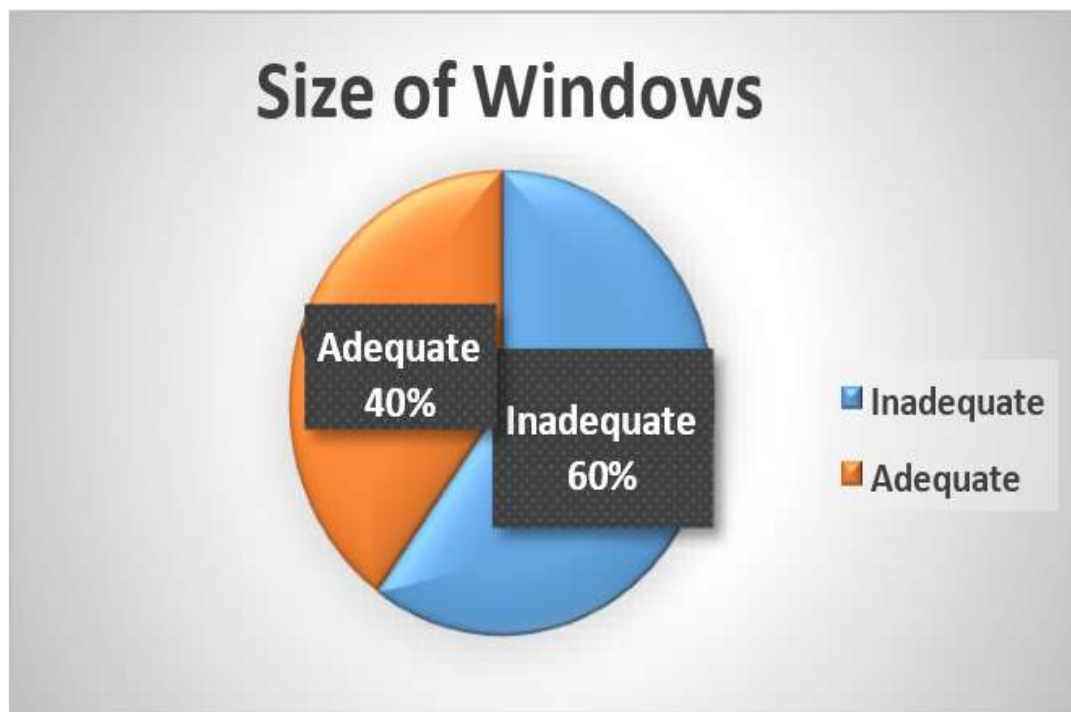
Table 4.1: Size of Windows

Source: Author's field work

<b>Samples</b>	<b>Adequate</b>	<b>Inadequate</b>
<b>Justice Legbo Kutigi International Conference Centre</b>		<input type="checkbox"/>
<b>Abuja International Conference Centre (AICC)</b>	<input type="checkbox"/>	
<b>Calabar International Convention Centre (CICC)</b>		<input type="checkbox"/>
<b>Kigali Convention Complex (KCC)</b>	<input type="checkbox"/>	
<b>Qatar National Convention Centre (QNCC)</b>		<input type="checkbox"/>

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Source: Author's field work

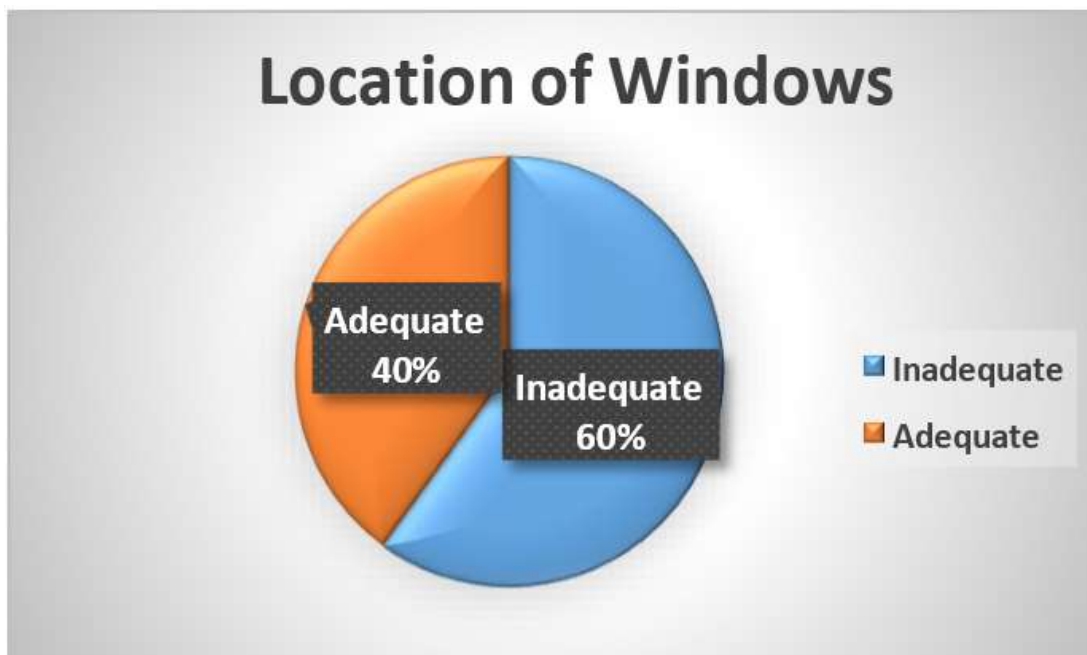
Table 4.2: Location of Windows

Source: Author's field work

Samples	Adequate	Inadequate
Justice Legbo Kutigi International Conference Centre	<input type="checkbox"/>	
Abuja International Conference Centre (AICC)	<input type="checkbox"/>	
Calabar International Convention Centre (CICC)		<input type="checkbox"/>
Kigali Convention Complex (KCC)	<input type="checkbox"/>	
Qatar National Convention Centre (QNCC)		<input type="checkbox"/>

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Source: Author's field work

## ii. Shading Devices

Shaded openings in the envelope during hot weather will reduce the penetration of direct sunlight to the interior of the building. Overhangs or deciduous plant materials on southern orientations can shade exterior walls to reduce heat gain during warmer seasons. The buildings observed shows that 100% engage shading practices and 0% don't practice. (See fig.4.3)

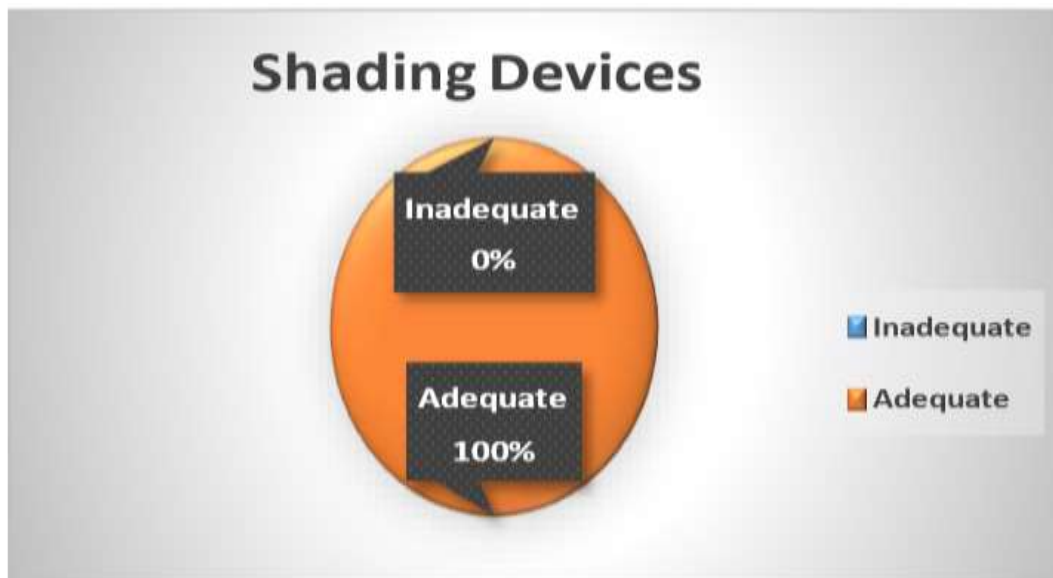
Table 4.3: Shading Devices

Source: Author's field work

Samples	Adequate	Inadequate
Justice Legbo Kutigi International Conference Centre	<input type="checkbox"/>	
Abuja International Conference Centre (AICC)	<input type="checkbox"/>	
Calabar International Convention Centre (CICC)	<input type="checkbox"/>	
Kigali Convention Complex (KCC)	<input type="checkbox"/>	
Qatar National Convention Centre (QNCC)	<input type="checkbox"/>	

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Source: Author's field work

### iii. Proper Glazing

Glazing systems have a huge impact on energy consumption. Appropriate glazing choices vary greatly, depending on the location of the facility, the uses of the building, and (in some cases) even the glazing's placement on the building. In hot climates, the primary strategy is to control heat gain by keeping solar energy from entering the interior space while allowing reasonable visible light transmittance for views and daylighting. The buildings observed shows that 40% has proper glazing systems and 60% don't not have. (See fig.4.4)

Table 4.4: Proper Glazing

Source: Author's field work

Samples	Present	Absent
Justice Legbo Kutigi International Conference Centre		<input type="checkbox"/>
Abuja International Conference Centre (AICC)		<input type="checkbox"/>
Calabar International Convention Centre (CICC)		<input type="checkbox"/>
Kigali Convention Complex (KCC)	<input type="checkbox"/>	
Qatar National Convention Centre (QNCC)	<input type="checkbox"/>	

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Source: Author's field work

## Evaporative cooling (natural/ artificial)

Evaporative cooling has been a method that employs the outcome of evaporation as the natural heat dissipater. Sensible heat coming from the atmosphere has been engrossed to be utilized as latent heat needed to become dry out the water, this can be achieved via natural or artificial means. The buildings observed on mode of evaporative cooling shows that 20% use natural means and 80% uses artificial mode (air conditioning systems). (See fig.4.5) Table 4.5: Evaporative Cooling (natural/ artificial)

Source: Author's field work

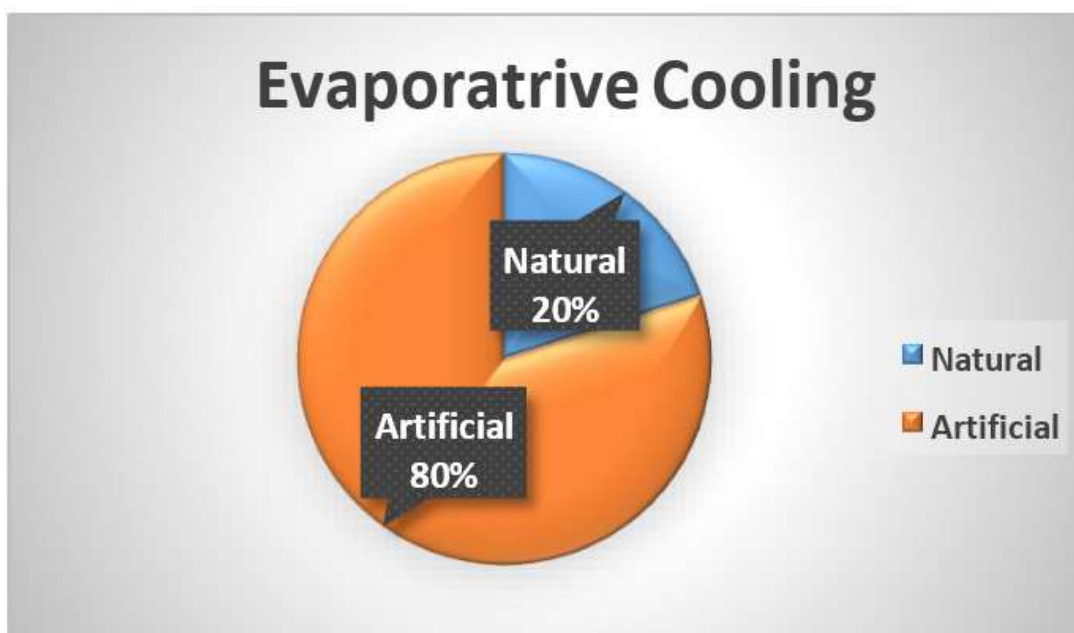
Samples	Natural	Artificial
Justice Legbo Kutigi International Conference Centre		<input type="checkbox"/>
Abuja International Conference Centre (AICC)		<input type="checkbox"/>
Calabar International Convention Centre (CICC)		<input type="checkbox"/>
Kigali Convention Complex (KCC)		<input type="checkbox"/>



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Qatar National Convention Centre (QNCC)	□	
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Source: Author's field work

## Building envelope

### i. Provide construction and insulating materials to resist heat transfer

Good specifications of construction materials and details can reduce heat transfer. Heat transfer across the building envelope occurs as either conductive, radiant, or convective losses or gains. Building materials conduct heat at different rates. Metals have a high rate of thermal conductance. Masonry has a lower rate of conductance; the rate for wood is lower still. Insulating materials, either filled in between framing members or applied to the envelope, resist heat flow through the enclosing wall and ceiling assemblies. The buildings observed shows that 60% considered various insulation and construction materials and 40% were not adequately considered. (See fig.4.6)

Table 4.6: Construction and Insulation

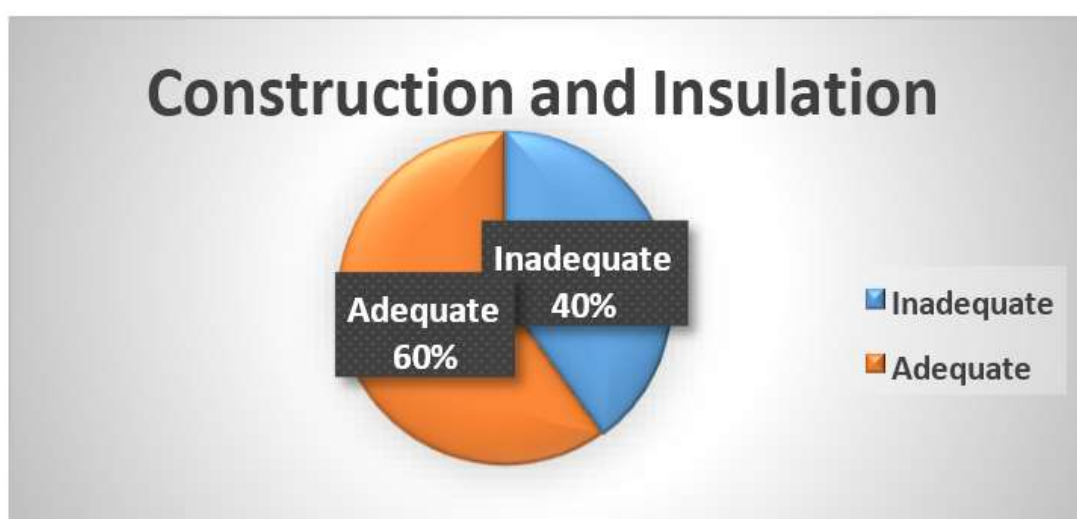
Source: Author's field work

Samples	Adequate	Inadequate
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Justice Legbo Kutigi International Conference Centre		<input type="checkbox"/>
Abuja International Conference Centre (AICC)		<input type="checkbox"/>
Calabar International Convention Centre (CICC)	<input type="checkbox"/>	
Kigali Convention Complex (KCC)	<input type="checkbox"/>	
Qatar National Convention Centre (QNCC)	<input type="checkbox"/>	



Source: Author's field work

## ii. Use roof spray or roof ponds for evaporative cooling to reduce heat gain

Building roofs and roof slabs of adequate thermal resistance is essential to provide human comfort and energy efficiency. Insulating roofs through roof spray or roof ponds, are very beneficial for energy saving and efficiency. The buildings observed shows that 40% considered use of roof spray, cool roofs and roof ponds and 60% were not adequately considered. (See fig.4.6)

Table 4.6: Roof Sprays or Roof Ponds

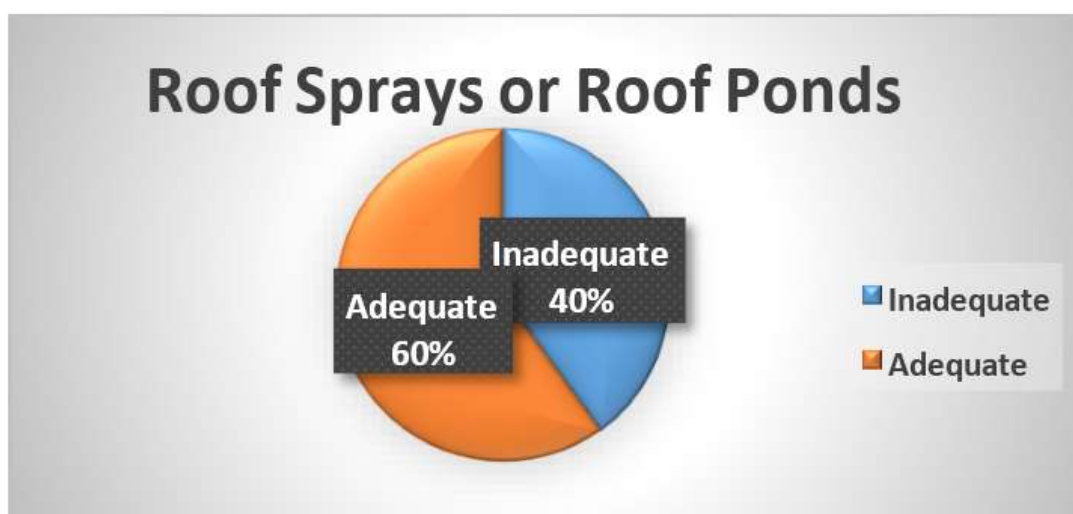
Source: Author's field work

Samples	Adequate	Inadequate
Justice Legbo Kutigi International Conference Centre		<input type="checkbox"/>
Abuja International Conference Centre (AICC)		<input type="checkbox"/>

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Calabar International Convention Centre (CICC)	<input type="checkbox"/>	
Kigali Convention Complex (KCC)	<input type="checkbox"/>	
Qatar National Convention Centre (QNCC)	<input type="checkbox"/>	



Source: Author's field work

## **Building orientation and Site Adaptation**

### **i. Control Shape, Form and Orientation**

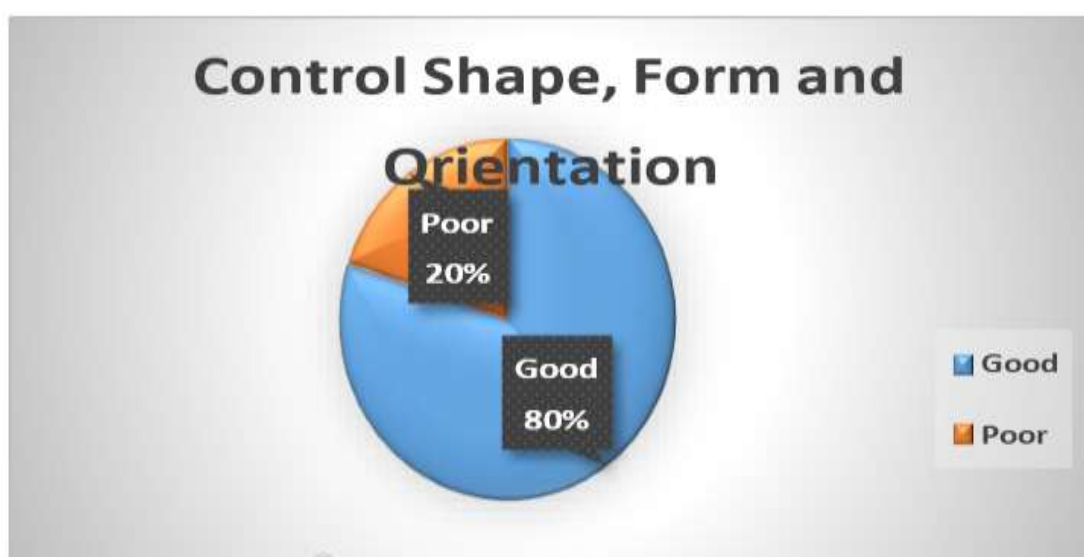
A building should be oriented from east to west along the main path of the sun, exposing only smaller façades to high solar radiation at low angles, Openings should be avoided on the west and if they cannot be avoided, they should be adequately shaded by using verandas and tall trees. In humid climates, larger distances between buildings allow for better air circulation. In arid climates, compact buildings that are close together expose less façade to the sun and provide shade also energy consumption of rectangular shaped building form is % 9-10 less than the energy consumption of L shaped building form. The buildings observed shows that 80% building orientation shape and form were good and 20% were poorly oriented. (See fig.4.7)

Table 4.7: Control Shape, Form and Orientation Source: Author's field work

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Samples	Good	Poor
Justice Legbo Kutigi International Conference Centre		<input type="checkbox"/>
Abuja International Conference Centre (AICC)	<input type="checkbox"/>	
Calabar International Convention Centre (CICC)	<input type="checkbox"/>	
Kigali Convention Complex (KCC)	<input type="checkbox"/>	
Qatar National Convention Centre (QNCC)	<input type="checkbox"/>	



Source: Author's field work

## ii. Coordinate with existing, new landscape and other elements

Landscape and other elements such as overhangs should be integral to a building's performance. Decisions about the envelope need to be coordinated with existing and new landscaping schemes on a year-round basis. The buildings observed shows that 80% considered existing, new landscape and other elements and 20% did not. (See fig.4.8)

Table 4.8: Landscape

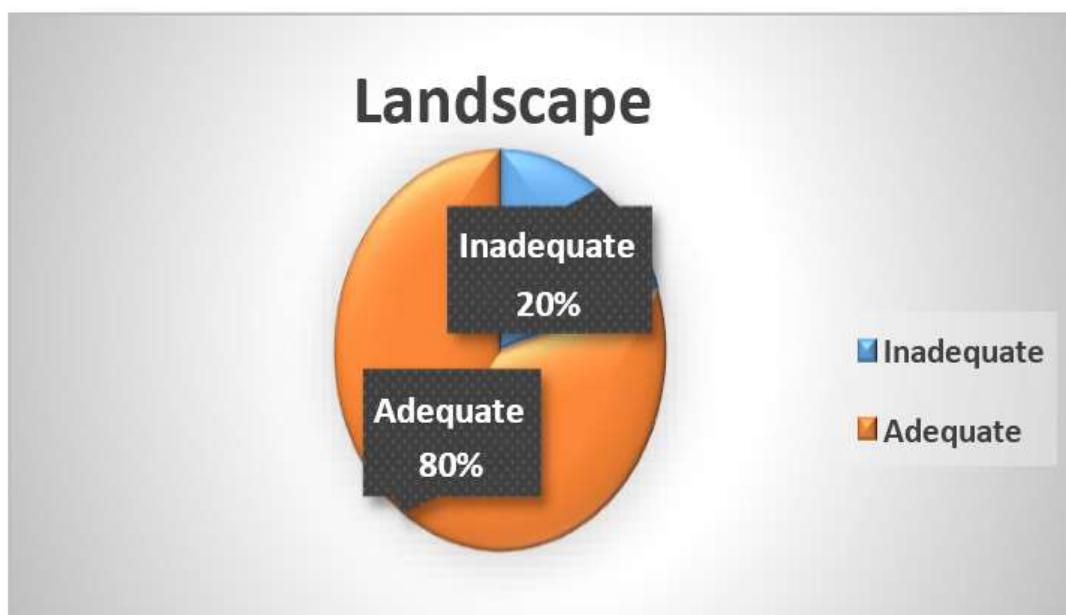
Source: Author's field work

Samples	Adequate	Inadequate
Justice Legbo Kutigi International Conference Centre		<input type="checkbox"/>
Abuja International Conference Centre (AICC)	<input type="checkbox"/>	

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Calabar International Convention Centre (CICC)	<input type="checkbox"/>	
Kigali Convention Complex (KCC)	<input type="checkbox"/>	
Qatar National Convention Centre (QNCC)	<input type="checkbox"/>	



Source: Author's field work

### iii. Reduced paved areas to lessen heat build-up around the building

Reduce paved areas to lessen heat build-up around the building that will add to the load on the building envelope, consider selection of a paving colour with a high reflectance to minimize heat gain, with considering glare factors The buildings observed shows that 80% considered less paved areas and 20% did not. (See fig.4.9)

Table 4.9: Landscape

Source: Author's field work

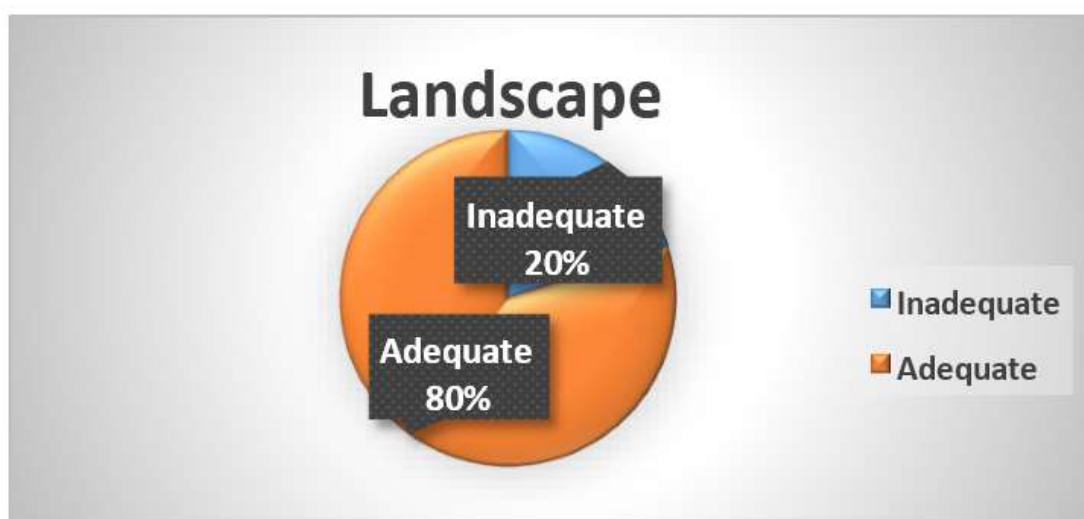
Samples	Adequate	Inadequate
Justice Legbo Kutigi International Conference Centre		<input type="checkbox"/>
Abuja International Conference Centre (AICC)	<input type="checkbox"/>	

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Calabar International Convention Centre (CICC)	<input type="checkbox"/>	
Kigali Convention Complex (KCC)	<input type="checkbox"/>	
Qatar National Convention Centre (QNCC)	<input type="checkbox"/>	



Source: Author's field work

## SUMMARY OF ANALYSIS AND FINDINGS

From the analysis carried out it is seen that most of the buildings being observed generally consumes more energy thereby increasing the energy demand in these buildings, large percentage of analysis is on the negative side of the variables considered for reduced energy use. In the following, we investigate the advantages and shortcomings of different strategies depending on the local condition, table 4.10 shows comparison between these cooling methods.

Table 4.10 Comparison between the cooling strategies adopted

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Source: Siddique *et al.*, (2018).

Strategies	Installation & maintenance costs	Results	Suitable climate conditions	Disadvantages
Natural ventilation	Very low	i. Can reduce up to 3°C ii. Lower 40% energy cost used by the air-conditioning systems	Low temperature region with available natural air flow	Free entry of dust, pollen, insects & security limitations
Evaporative cooling	Relatively high	i. Can reduce up to up to 3 to 4°C ii. May lower 50% of energy cost used by the air-conditioning systems	Hot & dry atmosphere	May cause an uncontrolled humidity & health hazard due to the development of bacteria

## CONCLUSION AND RECOMMENDATION

The emerging idea of power-efficient structures has focused many researchers to work towards the reduction of cooling load on the buildings by using cooling techniques. In this particular paper, different cooling techniques that may be put on to building have been examined. Proper care should be taken for choosing the various cooling methods to be adopted as these cooling methods are climate-specific. The climate at different locations will be varying like Dry, Hot, Warm, Sunny, Cold, and Humid conditions. Envelope design is a major factor in determining the amount of energy a building will use in its operation, and decisions about its components play a crucial role in energy costs needed for cooling. Members of the design team should coordinate their efforts to integrate optimal design features for every building type to reach the lowest energy for realizing thermal comfort for its occupants, and Careful study is required to arrive at a building footprint, shape, form, and orientation that work with the building envelope components to maximize energy benefit, and to achieve energy savings. The paper is highly recommending the proposed cooling performance design checklist to be used by the architects for providing them with the principles and design strategies.

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## REVIEW OF UNIT COMMITMENT FOR ECONOMICAL OPERATION OF POWER SYSTEM

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Polytechnic Damaturu.

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### **Abstract**

Unit commitment (UC) is an optimization problem used to determine the operation scheduled of the generating units at interval with varying loads under different constraints and environment. Many algorithms have been invented in the past decades for optimization of UC problem, but still researchers are working in this field to find new hybrid algorithm to make the more realistic. The important of UC increasing with constantly varying demand. Therefore, there is an urgent need in the power sector to keep track of the latest methodologies to further optimize the working criterions of the generating units. This paper focuses on providing clear review of the latest techniques employed in optimizing UC problems for stochastic and deterministic loads, which has been acquired from many review published paper. It has been divided in to many sections which include various constrains based on profit, security, emission and time. It emphasizes not only on de regulated and regulated environment but also on renewable energy and distributed generating systems. In term of contributions, the detailed analysis of all the UC algorithms has been discussed for the benefit of new researcher interested in working in this field.

**Keywords-** Unit commitment (UC), Optimization, deterministic load, stochastic load, evolutionary programming (EP), Hybrid

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### **Introduction**

Because human activity follows cycle, most power system supplies services to a large population experiences cycles. The unit commitment deal with the optimum amount of time for which generating unit must be operated at a time basis, (hourly) In case of electrical power system the total load on the system will generally be higher during the day time and early evening when industrial load are high and lower during the late evening and early morning when most of the people are sleeping. The use of electrical power has weekly cycle the load being lower over the weekend days than weekdays. But why is this problem in the operation of an electric power system? Why

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just not simply commit enough unit to cover maximum system load and leave them running? Unit commitment is therefore to “commit” a generating unit is to “turn it on” that is to bring the system up to speed synchronise it to the system, and connect it so it can deliver power to electrical power to the network. The problem with “commit enough unit and leave them online” is one of the economic reason, it quite expensive to run too many generating unit, money can be saved by turning unit off (de-committing them) when they are not needed.

Unit commitment for the best set of unit to be available to supply the predicted or forecast load of the system over a failure time period, “unit commitment” is therefore one way to suggest, just sufficient number of generating unit with sufficient amount of generating capacity to meet a given load economically with sufficient reserve capacity to meet any abnormal operating condition. Here we consider the problem scheduling fossil fired thermal unit in which aggregate cost such as startup cost, operating fuel cost and shutdown cost are to be minimized over daily load cycle.

Unit commitment is optimization problem. So the question here what do we optimize? Let’s say we have two generators which are the load demand. Now, the can vary at any time and it won’t be reasonable to keep on using both generator if, let’s say the load demand can be meet by using only one generator so, here we optimize an in which generator should be shut down and which should be running. This optimization becomes more essential when we are dealing with more number of power generators, because every power generators has its operating cost and obviously you would want to bring that cost down.

Unit commitment is an operational planning. The purpose of this planning is to determine a schedule called unit commitment schedule which tell us the beforehand when and which unit to start and shutdown during the operation over a pre-specified time, such that the total operating cost for that period become minimum.

The off peak and on peak demand of electricity may vary for different purposes. If the unit is properly observed, it may be possible to save some unit when the demand is less. The main objective of this paper is to operating time of different generating unit such that satisfied constraint. The unit commitment is applied to both deterministic and stochastic load [1]. The deterministic approach provide definite and unique conclusion. However, the result obtained for stochastic load may not exact. For the deterministic loads data envelopment analysis (DEA), the principal component analysis (PCA) approach is employed. DEA is a non-parametric method, in which the first input and output variable are defined. In the PCA, the numbers of variables used are reduced to minimum. However, in stochastic model, the constrained are change in to determinate constraints and then the formulation can be solved by any usual

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algorithms. The various kinds of objective functions for various environments are as follows.

## Conventional fuel based environment [2]

In eq. (1), there are three costs to minimize. The first one is  $P(i,t)$  which is generation of unit  $i$  at

Time  $t$ , and  $C(P(i, t))$  is a fuel cost of unit  $i$  at time  $t$ . The second one is the start –up cost and the third, shutdown cost.

$$\min \sum_{t=1}^{n_i} * \sum_{t=1}^{n_0} [C_i(P(i, t)) + SU(i, t) + SD(i, t)] \quad (1)$$

*Stochastic environment* [3]

Stochastic environment is one in which randomness is included either in the objective function or to the constrained. In eq. (2) the second part creates randomness due to the addition of wind generation. Nowadays, uncertainly occur in power system due to large scale integration of renewable resource like solar, wind, etc. Hence, the demand and supply may also differ for the successful and reliable operation of the system within uncertainty environment which are also called a stochastic environment.

$$\min \sum_{t=1}^N [\sum_{t=1}^T (C_i P_i, t + C_i, t, u + C_i, t, d)] + M \sum_{k=1}^N \sum_{t=1}^N (W_k, t - W_k, t) \quad (2)$$

## Literature review

Unit commitment is the problem of determine the scheduled of generating unit within a power system subject to device and operating constraints. The unit commitment problems solving techniques are classified into conventional techniques, non-conventional techniques and hybrid algorithms.

Conventional techniques include priority list method, dynamic programming solution, and Lagrange relaxation method.

Priority list method this the simplest unit commitment solution method consist a creating a priority list scheme could be obtained after an exhaustive enumeration of all unit combination at each load level.[3]

Dynamic programming (DP) has many advantages over the enumeration scheme, because it has a reduction because it has a reduction in the dimensionality of the problem, suppose we have found a unit in a system and any combination of them could be serve the (single) load there could be a maximum of  $24-1=15$  combination to test.[4]

Lagrange relaxation techniques solve the unit commitment problem “relaxing” or temporary ignoring the coupling constrain and solving the problem as if they did not exist this is done through the dual optimization procedure.[5]

Non-conventional techniques include hybrid ant colony optimization. Ant colony optimization is inspired by the rule in the real environment of ant. Real ants are

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capable of finding the shortest path from the sources of the food to the ant's nest. Every ant from population leaves substance called pheromone while getting to the source of food. This substance attracts other ants to come in to that direction.[6]

Hybrid Lagrangian relaxation- in hybrid lagrangian relaxation approach the system operating cost function of the unit commitment problem is related to the balanced and the spinning reserve constraints via two set langragian multiplier to form a lagrangian dual function. The langrangian relaxation procedure solves the unit commitment problem through the dual problem optimization attempting to reach the constraint optimum. The dual procedure will attempt to minimize the lagrangian multiplier while minimizing with respect to other variables.[7]

Hybrid Genetic Algorithm (GA) unlike other search and optimization techniques a genetic algorithm promised convergence but not optimality, not even that it finds local maxima. This implies that the choice of when to the genetic algorithm process when 50 generation have gone by with no better chromosome identified. Since there is no guarantee of optimality, successive run of genetic algorithm will provide different chromosome with varying fitness measure.[8] This is the one of the drawback of using a genetic algorithm for optimization since there is no guaranty of optimality, there is always the chance that there is a better chromosome burking somewhere in search space. The genetic algorithm is coupled with local search mechanisms to find the optimum chromosome in a region. So, if we use hybrid algorithm, the problem reduced to ensuring that we run the genetic algorithm as many time as is needed to pick out all the good regions.[9]

Hybrid particle swarm optimization (PSO) is a population based optimization techniques concept inspired by the flocking behavior of the swarm of animal like birds or fishes. An active line of research in particle swarm optimization is the introduction of various variant that were shown to improve over the particle swarm optimization.[10] Among these variant we have particle swarm optimization with inertia weight, the usage of various topologies for the particle neighborhood. These variant try to introduce variation on how balanced diversification and intensification of the search beyond the pure timing of the parameters possible in the basic particle swarm optimization algorithms [11].

Binary / real coded particle swarm optimization (BPSO) which adopts the concept of the genotype-phenotype representation and maturation of genetic algorithms. It means a feature is that the BPSO can be treats as continuous PSO. The proposed BPSO algorithm is tested in various bench mark function and it is performance compared with that original BPSO. Experiment result shows that the modified BPSO out performs the original PSO algorithm.[12]

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Fuzzy turned particle swarm optimization (FTPSO) PSO is a mathematical modeling and simulation of food searching activities of a flock of bird each particle move different velocity toward the optimal point. The velocity of a particle is calculated by three component; inertia, cognitive, and social. The particle move round the multidimensional search space until they find the optimal solution.[13] A fuzzy system is utilized to turn the inertia weight and learning the factor be best fitness (BF) the fuzzy turned particle swarm optimization (FTPSO) has been applied to a 10 and 20 bus system in MATLAB and is proven to increase the reliability of the system. It is faster than ACO and BP is capable of solving both small scale and large scale problem [14].

Mimetic algorithm (MA) is hybrid computational model of two sources. The first source is a model by a GA that mimics biological or Darwinian evolution of ideas the unit information in a GA is termed as genes are improved by crossover and mutation operators that are part of the GA and the memes are improve by a local search operators [15].

## **Environment for unit commitment**

Price based unit commitment this paper formulate the price based unit commitment (PBUC) problem based on the mixed integer programming (MIP) method. The proposed PBUC solution for generating company (GENCO) with thermal, combined-cycle, cascaded hydro, and pumped storage unit. The PBUC solution by utilizing MIP is compared with that langragian relaxation (LR) method. Test result on the modified IEEE 118 bus system show the efficiency of our MIP formulation and advantages of the MIP method for solving PBUC it is also shown that MIP could be applied to solve hydro-sub problems including cascaded hydro and pump storage unit in the LR based frame work of hydro-thermal co-ordination.[16]

Numerical experiment large system shows that the MIP based computation time and memory requirement would represent the major obstacle for applying MIP to large UC problems. It is noted that the solution of large UC problems could be accomplished by improving the MIP formulation, the utilization of specific structure of UC problems and the use of parallel processing.[17]

Profit based unit commitment PBUC must be obtained in a short time even though there is an increase in generating unit, nowadays, computing resources are available in plenty and effective utilization of these resources will be advantageous for reducing the time complexity for large scale power system. Here the message passing interface based technique is used in the algorithms in distribution and share memory model. Time complexity and solution quality with respect number processor.[18]

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Security based unit commitment since the demand response plays a more and more important role in a smart grid, security constrained unit commitment model considering the interactive impact of priced based demand response is integrated with basic security constrained unit commitment (SCUC) model, then the interactive impact are considered. In the user side the comprehensive electricity satisfaction is considered.[19] And the power flow balanced is considered in the system side which forms a more safely model. The case study on the six bus system demonstrate that the interactive impact constrained can guarantee the economics of effectiveness of DR without affecting users' welfare, and simultaneously optimize the power flow disturbance to decrease the cascading failure. [20]

## **Unit Commitment in Deregulated Environment**

In the present scenario of the deregulated market, it requires from the GENCOs to submit their power bids separately. Each bid consists of cost function and set of parameters that define the operative limits of a generating unit. Cost sub-optimal solution that results to lower price may exist and therefore the applicability of cost minimization UC models for power auction is questioned. In August 2003, Sum-im T, Ongasakul W. investigates the existence, determination and effect of competitive market equilibrium on UC power pool auction to avoid the conflict of interest and revenue efficiency.[21] A new formulation of the UC problems suitable for electric power producer in deregulated market has been provided by Valenzuela and Mazumdar.

## **Conclusion**

This paper presents a review on concept of the UC problem and methodologies proposed for solving it. In solution methodologies, more details about the newly evolved hybrid model has been given, which is the combination of both classical and non-classical methods, and can handle the present day complex UC problems commonly seen in the world. This paper is based on many research articles published in some many years and periodic bibliography update on this topic will be useful for next researchers in the field of UC. UC paper for the past decade is stated by classifying the kind of algorithm used by the authors of this paper, objective function, constrained, test problem etc.

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## VARIATION IN THE SOURCES OF DRINKING WATER IN IDAH AND THEIR SUITABILITY ON THE HEALTH OF THE PEOPLE.

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### Abstract

*This study is designed to analyse the variation in the sources of drinking water and how they affect the human health in Idah. Water samples were collected from the various sources (Groundwater, River, Rain and Packaged water) of water and were subjected to laboratory analysis to detect the water parameters. One-way Analysis of Variance was then employed to analyse the result of the laboratory test in order to determine the relationship between the water sample parameters for both wet and dry seasons. Correlation Analysis was adopted to analyse the quality of the drinking water and the possible health problems that could emanate from the water sources. The result revealed that groundwater as well as borehole is the most common source of drinking water and that typhoid, diarrhoea, cholera, dysentery, gastroenteritis and vomiting were the possible health problems that emanate from the various sources of drinking water consumed by the people of Idah with typhoid having the highest occurrence. It also revealed that there is a weak relationship among the different water-related diseases and that human activities and poor environmental management are the major causes of water pollution in the study area. The study however suggests that though the water is relatively safe for drinking, there is a need for proper hygiene and environmental management.*

**Keywords:** *Variation; Drinking Water; Health; Environmental Management*

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### Introduction

Water is a unique resource, having no substitute on the surface of the earth. Its quantity and quality vary over space and time. According to Ajibade (2004), water dissolves nutrients and distributes them to cells within the body system, regulates body temperature, supports structures and removes waste products from the body system through the skin, respiratory and excretory organs. Santra (2005) noted that

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about 70 percent of the human body is water. One could survive for weeks without food but only a few days without water. For proper functioning of the human system, water requirement varies from 3 to 10 litres of water per day of which some part may be derived from food (Fabrizi, 2016).

The importance of water to man cannot be over emphasized, water is thus regarded as one of the most indispensable substances in life and like air, it is most abundant (Okonkwo *et al*, 2008). The phenomenon of urbanization has exerted enormous pressure on the provision of safe drinking water especially in developing countries, hence most fresh water bodies world over are getting contaminated and as a result, decreasing the pot-ability of water (Chandra, Singh and Tomar, 2012; Etim *et al*, 2013).

The challenges of water supply have constituted a major issue including conflicts in some parts of the world because the earth's fresh water is diminishing due to man's activities and climate change (Samson, 2013). Access to safe drinking water supply and sanitation services is fundamental to improving public health and meeting national poverty reduction objectives because good health increases productivity. As it is now known, lack of access to quality water contributes substantially to the high burden of disease that needlessly foreshortens and impairs the lives of far too many of the citizenry. About 80 percent of all diseases may be attributed to water and sanitation related issues and they contribute to the many child deaths each year from diarrhoea, dysentery, jaundice, typhoid and cholera (MPPW, 2008). In the works of AWS Accounts 2016, it was deduced that these water-borne agents can be detected by proper analytical tests of the water properties consumed by the people.

In Kogi State, the census and housing survey carried out by National Bureau of Statistics 2009 reported that only 7 percent of households in the State have adequate access to quality water supply. 14 percent of households obtain water from vendors, 35 percent from rivers and streams and 27 percent from wells. The emerging scenario is that most households in Kogi East obtain water from pollution-prone sources.

The health burden of the consumption of poor water quality is enormous. In Idah and a host of other towns in eastern Kogi, Stream and Borehole seem to be the major sources of water supply. The human activities that go on within the drainage basins are major pollutants to these sources – bathing, washing, dumping of refuse, open defecation, use of chemicals on the land (fertilizers, pesticides) etc.

It is noteworthy to emphasize that water is essential for human life and a key factor for the location of settlement in a place which has been since the inception of civilization. Unfortunately, the availability and quality supply of this water is not guaranteed in many countries, hence the need for a better water quality to enhance

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the quality of life of the people and boost the socio-economic development of any place. This paper therefore studies the variation in the sources of water in Idah and their health implication on the residents.

## **MATERIALS AND METHODS**

### **The Study Area**

The town Idah is one of the urban centres in Kogi State and also one of the oldest settlements in Igala land. It is the traditional and cultural headquarter of the Igala people as it holds the seat of the Monarch (Attah of Igala Kingdom). It is geographically located at the south eastern part of the State and on the eastern bank of River Niger. It is lying beside the middle course of the River Niger. It is the Headquarter of Idah local government area of Kogi State. It has commercial routes (waterways) on the River Niger linking Lokoja to the north of the country; Onitsha in Anambra State to the south; Agenebode in Edo State to the west; and Enugu to the east. It is a homogeneous community dominated by the Igala's and few of other tribes. The area has a high lying soil of the Plateau which is shallow and sandy. The town is under-laid by a false-bedded sand stone formation (sedimentary rock) which could provide a source of ground water through the tapping of aquifer. The population of the area from the 2006 census figure put it at 79,755 (NPC, 2006) and by projection using the geometric growth model ( $P_t = P_0(1+r)^t$  where  $r$  is the constant rate of change;  $P_0$  is the initial population;  $P_t$  is the final population sought for) puts it at 108,698 for 2015. The climate and vegetation of Idah encourage agricultural practices. Hence much of cultivation is practised along the flood plains. It lies within the warm humid climate zone of Nigeria. The vegetation type is that of guinea savannah. The topography of the area is gently undulating and it slopes downstream (River Niger).

### **Climate and Hydrology**

The tropical wet climate of Idah in Kogi State is influenced by the guinea savannah vegetation under which it lies and is characterised by two distinct seasons. The wet season which occurs roughly between 6-7 months of the year with moderate rainfall of about 200-300mm and the dry season which occurs within 5-6 months in a year. It has high temperature of over 27°C during hot season and an annual range of temperature of about 6°C (Iwena, 2012).

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**Fig.1: Map of Idah Local Government Area showing the Neighbourhoods**  
**Source:** GIS Lab, Department of Geography and Environmental Studies, KSU, Anyigba.

**Table 1: Sources of Water in the Study Area**

Sources of Water	Frequency	Percentage
Stream	17	5.2
Borehole	206	63.2
Well	12	3.2
Rain	31	9.5
Vendors	60	18.4
Total	326	100

Source: Authors' Field Survey, 2021

Table 1 shows the sources of water in Idah and the frequency distribution of the respondents. A larger percentage (63.2%) of the respondents gets their water more

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from boreholes than other sources. Omeje and Osadebe (2017) in a similar study revealed that same is applicable in Nsukka town, due to the absence of surface water, there is heavy reliance on groundwater (borehole) as the main source of potable water supply. According to Malomo (2018), borehole water and well water are very vulnerable to contamination if not deep enough, as a result of capillarity seepage. This depends on the chemistry of the soil and the environment. If the borehole is dug in an area that is possibly receiving industrial fall-out like lead dusts, this can wash into the water thereby contaminating it.

Though rain water is seasonal, most people are not deterred as they still depend on it as their source of water since it can safely be stored in tanks or reservoirs (Jegede, 2021). 9.5% of the respondents base their water source on rain as represented on Table 1. 18.4% of the respondents buy from water vendors especially during dry season.

For this study, water samples were collected from the sources identified on Table 1 and were subjected to laboratory analysis to determine the nature of their parameters for both seasons (rainy and dry) of the year. The result is presented on Table 2.

**Table 2: Mean Value of Water Quality Parameters in the Study Area**

Water Quality (µg/l)	Sources					
	Groundwater		River water		Table water	
	Mean (Rainy)	Mean (Dry)	Mean (Rainy)	Mean (Dry)	Mean (Rainy)	Mean (Dry)
Total Hardness	36.57	38.86	36.67	12.00	30.00	13.18
Sulphate	.20	.44	.21	.30	.21	.35
Dissolved Oxygen	4.32	4.61	4.78	5.96	4.02	4.98
Chloride	12.00	33.00	11.67	25.67	28.08	25.71
Phosphate	5.66	16.11	3.95	13.90	5.10	15.12
Nitrate	.59	21.21	.63	10.67	.73	11.96
PH	5.96	5.41	7.10	6.43	6.35	5.52
Temperature	27.00	27.79	27.17	27.83	27.35	27.65
Alkalinity	40.00	14.29	21.67	21.67	25.88	18.53
COD	.89	.01	.18	.01	.10	.01
BOD	4.39	22.62	1.92	2.03	19.10	11.03
Manganese	.84	2.99	1.08	.53	1.13	3.40
Calcium	.46	56.00	.55	43.07	1.05	27.47



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Lead	0.20	.00	.69	0.00	.43	.00
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Source: Author's Laboratory Analysis, 2021

## **Pattern of the Water Quality Parameters**

The descriptive analysis as shown on Table 2 highlights the various sources of drinking water and the mean of the properties for the various seasons in the study area. The mean for Total Hardness for ground water for the rainy season is 36.57 and that of the dry season is 38.86 while river water has mean 36.67 and 12.00 for rainy and dry season respectively. For sulphate the ground water mean value for rainy season as represented on Table 2 is 0.21 and that of dry season is 0.30 while the table water mean value for rainy season is 0.21 and dry season mean value is 0.35 with F-value of 0.16 and 0.56 for both rainy and dry seasons respectively. Applying the critical value of 3.40 at a degree of freedom of 2 and 4, it is obvious that Sulphate is not significant in all the water samples analysed for both seasons.

The case of Dissolved Oxygen is similar to that of Sulphate. The mean value for ground water sample for rainy and dry seasons are 4.32 and 4.61 respectively; River water has rainy season mean value of 4.78 and dry season mean value of 5.96; table water is 4.02 for rainy season while dry season is 4.98. Operating with a Critical value of Dissolved Oxygen (3.40), at a degree of freedom of 2 and 4, the amount of Dissolved Oxygen is not significant in the water samples collected for both seasons in the study area. The mean value of Chloride in the ground water sample collected and tested for rainy season reads 12.0 and dry season mean value reads 33.0; river water sample mean for rainy season is 11.67 and dry season mean is 25.67 while table water sample for rainy season is 28.08 and 25.71 for dry season. The mean value for Nitrate in the ground water sample for rainy season reads 0.59 and that of dry season is 21.21; and the mean value of river water for rainy season is 0.63 and dry season is 10.67 while the table water mean value for rainy season is 0.73 and dry season is 11.96. Biological Oxygen Demand (BOD), Alkalinity, Temperature and Hydrogen Potency (pH) have similar results as they are all not significant in the water samples analysed for both seasons.

The three heavy metals (Manganese Mn, Calcium Ca, and Lead Pb) tested in the water samples collected in the study area for both seasons were not significant for both seasons as shown in Table 2. According to Green (2017), any water that has Manganese in significant amount, will pose a health condition of Neurological disorder. For Calcium, there is no much significant health condition associated with its much presence in water but Lead in very significant quantity in drinking water could result to cancer, interference with Vitamin D metabolism, affect mental development in infants and toxic to the central and peripheral nervous systems.

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This result indicates that total hardness is not significant during the rainy season. This can be attributed to the fact that water containing calcium carbonate at concentration below 60mg/l is generally considered as soft, hence not significant, 120mg/l is moderately hard; 120-180mg/l is hard and more than 180mg/l is very hard (McGowan, 2000). Comparing this to the result of the laboratory analysis for water hardness during rainy season as shown in Table 4.3 where the hardness value is 14mg/l with a maximum permit of 50mg/l. Total hardness as shown on the Table 4.3 for dry season reveals that total hardness for groundwater statistically is significant during dry season with a mean of 38.86 and river water 12.00, table water 13.18 which has an F-value of 5.46 having the critical value of 3.40. Since the F-value is greater than the critical value, it is presumed significant for the dry season for the water samples collected and analysed at the degree of freedom of 2 and 4.

The Nigerian Standard for Drinking Water Quality (2007), permits chloride concentration of 250mg/l and any chloride concentration in excess of 250mg/l can give rise to detected taste in water, but the threshold depends upon the associated cations. Consumers can however become accustomed to concentrations in excess of 250mg/l. (Jegade, 2018). Nitrate as shown on Table 3 is not significant for the various sources of water tested. The composite mean on Table 4 for Idah is 5.15. This is lower than the permissible nitrate content in water according to the Nigerian Standard for Drinking Water Quality (2007). This implies that the nitrate content in the drinking in the study areas is safe as shown on Table 4 and will not result in cyanosis and asphyxia blue-baby syndrome) in infants under three months of age (Nigerian Standard for Drinking Water Quality, 2007).

The Chemical Oxygen Demand for rainy season in the water samples tested is significant from the analysis carried out. This is reflected in the mean value of the water samples collected from different sources. For ground water, the rainy season mean value is 0.89 and dry season is 0.01; river water rainy season mean value is 0.18 and dry season is 0.01; Table water mean value for rainy season is 0.10 and dry season is 0.01. With an F-value of 4.46 which is greater than the critical value of 3.40, the decision rule shows that the COD concentration in the water samples for the rainy season is significant. But the COD concentration in the water samples collected for the dry season is not significant because the F-value of 0.81 is less than the critical value of 3.40 as computed on Table 3.

**Table 3: One-way ANOVA for the Relationship between Water Parameters for Dry and Wet seasons**

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		Sum Squares	of Df	Mean Square	F	Sig.
Hardness	Between Groups	1404.667	2	702.333	3.547	.040
	Within Groups	6534.333	33	198.010		
	Total	7939.000	35			
Sulphate	Between Groups	.042	2	.021	43.158	.000
	Within Groups	.016	33	.000		
	Total	.058	35			
Dissolved Oxygen	Between Groups	52.108	2	26.054	5.275	.010
	Within Groups	162.985	33	4.939		
	Total	215.094	35			
Chloride	Between Groups	7619.755	2	3809.877	5.051	.012
	Within Groups	24889.433	33	754.225		
	Total	32509.188	35			
Phosphate	Between Groups	19.711	2	9.856	4.462	.019
	Within Groups	72.896	33	2.209		
	Total	92.607	35			
Nitrate	Between Groups	8.880	2	4.440	.966	.391
	Within Groups	151.688	33	4.597		
	Total	160.568	35			
BOD	Between Groups	137.825	2	68.912	6.758	.003

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pH Value	Within Group*s	336.496	33	10.197		
	Total	474.320	35			
	Between Groups	5.767	2	2.884	2.300	.116
Temperature	Within Groups	41.369	33	1.254		
	Total	47.136	35			
	Between Groups	2.347	2	1.174	6.217	.005
Alkalinity	Within Groups	6.229	33	1.89		
	Total	8.576	35			
	Between Groups	634.722	2	317.361	1.541	.229
Chemical Demand	Within Groups	6795.833	33	205.934		
	Total	7430.556	35			
	Between Groups	.067	2	.033	30.359	.000
Temperature	Within Groups	.036	33	.001		
	Total	.103	35			
	Between Groups	4.632	3	1.544	12.526	.000
Alkalinity	Within Groups	3.944	32	1.23		
	Total	8.576	35			
	Between Groups	2280.556	3	760.185	4.723	.008
	Within Groups	5150.000	32	160.938		
	Total	7430.556	35			

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Chemical Demand	Between Oxygen Groups	.004	3	.001	.375	.771
	Within Groups	.101	32	.003		
	Total	.105	35			
BOD	Between Groups	4826.675	3	1608.892	1.000	.406
	Within Groups	51505.174	32	1609.537		
	Total	56331.849	35			

Source: Author's Statistical Analysis, 2021.

The Sulphate concentration in the water samples collected during the rainy season is not significant at 0.05 significant levels as shown on the Table 3. ANOVA. The same is for temperature which is not significant at 0.05 level of significant. The mean value of temperature recorded for the water samples collected during the rainy season is 27.0 for groundwater, 27.35 for Table water and 27.26 for rain water. According to Obeta and Ocheje (2013), Temperature is an important biologically significant factor which plays an essential role in the metabolic activities of organisms. It is also an important parameter in determining water quality as it influences pH, Alkalinity and Dissolved Oxygen. In line with the WHO Standard for Drinking Water Quality (2011), temperature is ambient; therefore the temperature values recorded were within the WHO standard for drinking water. From the above result of the ANOVA analysis for physico-chemical properties of the water samples collected from four sources during rainy season revealed that Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) were not significant amongst the other properties that were tested. COD is an important parameter for water quality assessment. According to WHO (2011) and NSDWQ (2007), COD standard for drinking water is 50mg/L and 25mg/L respectively. The COD values obtained from this study ranges between 0.04-0.08mg/L. The possible reason for this result may be due to the fact the ground water samples were free of oxidable organic and inorganic pollutants. The values obtained for BOD ranges between 4.0-21mg/L with a mean composite of 12.89mg/L. The values are lower than the WHO (2011) and NSDWQ (2007) recommended standard of 250 and 200mg/L respectively, hence they constitute little or no threat in the water. Akpan (2005) obtained values which range from 0.16-3.40mg/L in a similar study of borehole water samples from the oil impacted community in Eastern Obolo of Akwa-

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Ibom State. The result of this analysis shows similarity to that of Obeta, Ocheje and Nwokocha (2015) in their analysis of water samples from Imabolo Stream water in Ankpa. The analysis of variance carried out showed that there was no significant difference ( $p > 0.05$ ,  $d = 0.40$ ) between the BOD and COD for the water samples tested. Alkalinity was also found insignificant at 0.05 significant levels since the calculated F-value is 0.008.

## Sources of Drinking Water and Occurrences of Water Related Diseases

An analysis of the interaction between the sources of water in the study area and the occurrence of different water related diseases was done using a cross-tabulation as shown on table 4.

**Table 4: Sources of Drinking Water and Vulnerability of Water-Related Diseases**

Sources of Water	Types of ailments						Total
	Cholera	Diarrhoea	Typhoid fever	Gastroenteritis	Dysentery	Vomiting	
Groundwater	11	20	150	10	40	70	401
River water	6	5	101	5	5	31	206
Rain water	6	5	101	5	5	31	200
Table water	3	5	81	2	3	10	123
Total	26	35	433	22	53	142	930

Source: Authors' Field Survey, 2021

Table 4 revealed that typhoid is the most prevalent water-related disease. The analysis of the respondents shows that typhoid accounts for 46.5% of all the water-related diseases considered in this study. Typhoid fever is also highly associated with groundwater sources. It accounts for 34.6% of the diseases due to water as indicated by the respondents in the health centres sampled in the study area. Groundwater especially borehole is expected to be a source of clean and potable drinking water (Talbot, 2018). The result obtained is suggestive of possible contamination of groundwater source which could be due to poor hygiene and sanitation (poor waste management) (Mogasale, Maskery and Ochiai, 2014). However, Obeta and Ocheje (2013), in their study of the assessment of groundwater quality in Ankpa Urban of Kogi State revealed that groundwater is a good source of drinking water as most of

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the parameters tested in their study returned values that fell within the acceptable limits set by both NSDWQ (2007) and WHO (2011). On the contrary, they noted that the water obtained from the boreholes if used for drinking purpose could result to some health challenges such as renal arterial changes in kidneys (Obeta and Ocheje, 2013; Sanjoy and Rakesh, 2013), blue baby syndrome in babies and goitre in adults (Ogedengbe and Akinbile, 2004, Shyamala, Shanti and Lalitha, 2008).

The general pattern of water-related diseases in the study area is Typhoid > Vomiting > Dysentery > Diarrhoea > Skin disease > Cholera > Gastroenteritis. Table 4 also revealed that groundwater is the highest source of water-borne diseases in the study area; this is closely followed by the river water, rain water and table water is the least. This is because, table water in most cases is treated hence the low association it has with water-borne diseases (Alasdair, 2017).

Haseena (2017) noted that untreated drinking water and faecal contamination of water is a major cause of diarrhoea. *Campylobacter jejuni* spread diarrhoea 4% to 15% worldwide. Fever, abdominal pain, nausea, headache are symptoms of diarrhoea. The disease cholera is caused by contaminated water, while the causative organism is *Vibrio cholerae*. The symptoms of this disease are watery diarrhoea, nausea, vomiting and watery diarrhoea leads to dehydration and renal failure.

The World Health Organisation estimates that 80% of diseases worldwide are water-borne. Alarmingly, groundwater in one-third of India's 600 districts is deemed unfit for drinking-with dangerous levels of fluoride, iron, salinity and arsenic. About 65 million people suffer from *fluorosis*, a crippling disease caused by excess fluoride – a condition commonly found in the Rajasthan state region, in Northern India. Poor water quality becomes inevitable when water gets contaminated with industrial waste, human waste, animal waste, garbage, untreated sewage, chemical effluents, etc. Drinking polluted water leads to water borne diseases and infections such as *amoebiasis*, *giardiasis* and *toxoplasmosis*.

Table 5 shows the correlation analysis of water sources and the prevalence of water-related diseases. The results indicated a strong association ( $r = 0.86$ ) which means that occurrence or prevalence of water-related diseases is related to sources of water.

**Table 5.: Correlation Analysis for Drinking Water Quality and the Possible Water-Related Ailments in Idah**

Sources of Water	Sources of Water	Types of ailments
Pearson Correlation	1	.86**
Sig. (2-tailed)		.009



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	Sum of Squares and Cross-products	836.065	140.419
	Covariance	.900	.151
	N	930	930
	Pearson Correlation	.86**	1
	Sig. (2-tailed)	.009	
Types of ailments	Sum of Squares and Cross-products	140.419	3215.592
	Covariance	.151	3.461
	N	930	930

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The coefficient of determinant ( $r^2 = 0.74$ ) indicated 74% dependence of water-related disease on water sources. The study on water and water-borne diseases by Nwabor *et al.* (2016) corroborated this where it noted that the unavailability of pipe-borne water and the dependence of rural dwellers on surface waters which are often contaminated with faecal materials are undoubtedly the major causes of the rising prevalence of water-borne diseases. Since the correlation coefficient for the types of ailments is 0.86 which is equivalent to 1.0, and the correlation for a two-tailed analysis is significant at 0.01, it therefore implies that there is a positive correlation between the sources of drinking water in Idah, and the possible water-related ailments in the areas.

## Findings

1. Borehole is the major source of drinking water in the study area. A greater number of the people living in the study area get their drinking water from boreholes.
2. The source of the drinking water in the study area has significant effect on the quality of the water as shown from the result of the ANOVA carried out on Table 3 where the F-values of the various properties of the water samples were displayed. The acceptable threshold of the composite mean of the water properties explains why the physico-chemical properties of the drinking water do not constitute danger to the water. Hence the water is relatively safe for drinking.
3. Typhoid, cholera, diarrhoea, dysentery, gastroenteritis and vomiting are the possible health problems that could result from the drinking water in the study area. The study revealed that the drinking contributed to the occurrence of the ailments mentioned though no much death cases have been recorded.

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The findings also revealed more occurrence of typhoid fever than other ailments and a weak relationship among the different water-related diseases. The study however reveals that the human activities and poor environmental management are the major causes of water pollution and the water quality varies with season. Dependence on other sources aside from rain is more during the dry season. Another factor which may not be affected by the human activities within the water sources is the geological composition of the area which is constant.



**Plate 1: Inachalo River in Idah with activities leading to pollution of the water source.**

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Unsanitary and unhygienic environment and human activities lead to water pollution which cause most of the water-related diseases discussed earlier. Plates 1 and 2 below shows some of the unsanitary and unhygienic environmental conditions and human activities that could lead to human pollution.

## **Conclusion**

Sources of drinking water are subject to contamination and require appropriate treatment to remove disease-causing contaminants. Contamination of water supplies can occur in the water source as well as in the distribution system after water treatment has already occurred. There are many sources of water contamination, including naturally occurring chemicals and minerals, local and land use practices, manufacturing processes, and sewer overflows or wastewater releases. The presence of contaminants in water can lead to adverse health effects in both young and old (CDC, 2019). Contaminated water and poor sanitation are linked to transmission of diseases such as typhoid fever, cholera, diarrhoea, dysentery, hepatitis A, skin disease, gastroenteritis, and vomiting. WHO (2019) noted that absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks.

It however concludes that the drinking water from the various sources in Idah is relatively safe and has not caused any major dearth or epidemics.

## **Recommendation**

The study however, established the fact that the quality of drinking water in the study area is affected by the presence of certain physical, chemical and biological properties found in the water. On this note therefore the following recommendations are made as to how to ensure that the people consume water that is not harmful to their health.

1. Though borehole is covered and more hygienic and most convenient to explore unlike the well water that is exposed to certain human influences, it however has its long term environmental implications. The government should reinstate the public water reservoir system where pipe-borne water is run through to various houses in a neighbourhood.
2. Every drinking water should undergo scrutiny (test) the source notwithstanding at a prescribed interval (three months) and periodic monitoring (six months) (by packaged water manufacturers, borehole owners and the individuals) for quality assurance is very essential. This is because the water source can be polluted at any time through the introduction of some certain elements into the water source

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especially river. This regular testing of water will help to ascertain the quality of the water at any point in time.

3. During rainy season, the rain water should be stored in clean tanks and should be washed regularly to avoid contamination..

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## PROFILING LACCASE PRODUCING FUNGI FROM SOIL HABITAT

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### Abstract

This research work was carried out to profile laccase producing fungi from soil and water habitat. Samples were collected from different location from both soil and water. Laccase producing fungi were screen with mineral salt agar and supplemented in guiacol for 7 days. The isolates were *Fusarium spp* (39%), *Aspergillus niger* (15%), *Aspergillus flavus* (15%), *Abisidia spp* (15%), *Rhizopus spp* (8%) and *Penicillium spp* (8%). Laccase producing fungi were *Rhizopus spp*, *fusarium sp* and *Aspergillus sp*. In conclusion, *Rhizopus spp*, and *Fusarium spp* are good laccase producers and can be utilize in food preservation, and various industrial application.

**Keywords:** Laccase, Profiling, Fungi, Soil, Habitat.

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### INTRODUCTION

Laccases are critical and spread in business applications inside sustenance industry, material industry, beautifiers, manufactured science, soil bioremediation and biodegradation of natural phenolic contaminations and evacuation of endocrine disruptors (Cuoto and Herrere, 2006). Lacasses are gathering of multi-copper containing chemicals that catalyze one electron oxidation of phenolic mixes with related decrease of oxygen to water. Lacesses are ordinarily dispersed in organisms, higher plants, bugs and microorganisms. The utilization of parasitic catalyts in the different fields of biotechnological based enterprise has been enhanced as of late. The look for sorted out and green oxidation advancements has make the expansion of mindfulness in the utilization of proteins to supplant the ordinary non organic strategies (Samson, 2011). Among the different existing oxidant compounds in contagious laccses (benzene diol: oxygen: oxidoreductases: EC 1.10.3.2) have been of awesome significance since they have cut substrate specificity; they don't require the option or blend of a low sub atomic weight cofactor, extra steady and use the catalyst in an immobilized state (Dwivedi *et al.*, 2011). However disclosure of laccase with high generation rate which upgraded sound qualities is exceptionally critical for mechanical applications (Desai *et al.*, 2011). Approximately couple of fungi laccases have been separated, despite the fact that genomic investigations have uncovered



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that it is perhaps a broad chemical in microbes. Revelation of laccases with different substrate specificities will enhanced strong qualities is imperative for modern applications (Bugg, *et al.*, 2011).

## **Objectives of the research**

- To isolate and identify fungi that produces laccase
- To access the prevalence of laccase producing fungi.

## **Study area and sample collection**

This research was carried out in Ibrahim Badamasi Babangida University, Lapai, Niger state. Soil samples were collected from four different areas within the school environment (the school farm, main school gate, CASTER and the student's hostel). The soil sample was taken at a depth of 5-10cm below the ground with spatula and sterile polythene bags. All samples were transferred to the laboratory for further evaluation.

## **Sample preparation**

Potato Dextrose Agar (PDA) was prepared according to manufacturer's instruction and autoclaved at 121°C for 15 minutes.

10 test tubes were sterilized and distilled water of 9ml was pipetted into the test tubes of 1g of soil sample was transferred into the first tube and was shake vigorously to have a homogenous mixture (stock). From the stock, 1ml of the mixture was pipetted into the second test tube containing distilled water and the steps were repeated until a dilution of  $10^{-10}$  was obtained. 1ml of  $10^{-6}$  and  $10^{-7}$  were pour plated into sterile petri dishes containing PDA to determine the fungi load count respectively and incubated at 25°C for 72 hours.

## **Microscopic examination of fungi**

A sterile inoculating wire loop was used to pick the fungi isolate and was spread on a clean glass slide containing two drops of lactophenol cotton blue dye. The slide was then mounted on a microscope and viewed with x10 objective lens. Features such as spore, hyphae, color of the isolate, conidia, antheridia (female reproductive organ), archegonia (male reproductive organ) and others were compared with those of known taxa using fungi atlas for proper fungi identification (Samson, 2011).

## **Screening of the Isolates for laccase production**

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The isolated fungi from the soil was inoculated on PDA media petri dish enriched with tannic acid and was incubated. The isolate was observed for the development of brown colored precipitate and assessed on daily basis. The isolate that show faster growth rate was selected as the potent stains and was taken for further analysis.

## Production of Laccase

The fungi isolate was prepared before enzyme production by taking one loopful of colony from the old culture and inoculating it into the prepared nutrient broth. The inoculated broth was left in the shaker at 37°C for 24hrs. About 1ml of pre inoculum was added to 100ml of enzyme production media at 120 rpm at 37°C orbital shaker.

## RESULTS AND DISCUSSION

A total of six (6) species of fungi were isolated, which include: *Fusarium sp*, *Aspergillus niger*, *Aspergillus flavus*, *Absidia sp*, *Rhizopus sp* and *Penicillium sp*. The result obtained shows that *Fusarium sp* is the most prevalent with 39% and *Aspergillus niger*, *Aspergillus flavus*, *Absidia sp* had 15% each, *Rhizopus spp* and *Penicillium sp* had 8% each.

Table 1: Percentage of Occurrence of Fungi Isolate

S/N	Fungal Isolates	No of occurrence	% of occurrence
1	<i>Fusarium sp</i>	5	39
2	<i>Aspergillus niger</i>	2	15
3	<i>Aspergillus flavus</i>	2	15
4	<i>Absidia sp</i>	2	15
5	<i>Penicillium sp</i>	1	8
6	<i>Rhizopus sp</i>	1	8
	<b>Total</b>	<b>13</b>	<b>100</b>

Source: Lab work 2021

The isolates were screened for laccase production and *Rhizopus*, *Fusarium* and *Absidia* species were able to produce laccase. Overall prevalence of laccase producing fungi isolated from soil sample was determined, results show that laccase producing fungi were more prevalent in soil with 62% while non laccase producing were 38%.

Table 2: Fungal isolates producing laccase

S/N	Fungal Isolates	Production of Laccase
1	<i>Fusarium sp</i>	+

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2	<i>Aspergillus niger</i>	-
3	<i>Aspergillus flavus</i>	-
4	<i>Absidia sp</i>	+
5	<i>Penicillium sp</i>	-
6	<i>Rhizopus sp</i>	+

Source: Lab work 2021

**Key:** + = Laccase positive

- = Laccase negative

## Conclusion and Recommendations

In conclusion, *Rhizopus spp*, and *Fusarium spp* are good laccase producers and can be utilize in food preservation, and various industrial application.

It is recommended that further studies should be carried out on laccase producing fungi.

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## LEARNING EXPERIENCES OF FEMALE STUDENTS STUDYING COMPUTER SCIENCE AT TERTIARY INSTITUTIONS IN NIGERIA USING STACKED AUTOENCODER AND STATISTICAL ANALYSIS

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### Abstract

*This study investigates the under-representation of female gender in computer science education courses in tertiary institutions in Nigeria. Several studies were carried out to explore the reasons for this gender imbalance in Computer Science program, but there has been limited data and research work to provide an exhaustive understanding of existing findings. This study applied a Mixed Research design to examine the learning experiences the female gender studying Computer Science in Kaduna State College of Education, Gidan Waya and Federal College of provide an and Qualitative data were collected through interviews and questionnaires. A model was developed using Stalk Auto Encoder Deep Learning Network was developed and was simulated on MATLAB 2021a. The model was further evaluated using t test and classification performance metrics. The Cheryan et al. (2017) framework was also considered in evaluating the model. The findings shows that these students are capable and competent to study Computer Science thereby repudiating the assumptions of male chauvinism in that makes female students demotivated. The findings of the study recommend feminist pedagogy to enhance the learning experience of female learners in Computer Science.*

**Keywords:** Computer Science, Gender imbalance, Female Students, Agentic learners, Stalk Autoencoder

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### Introduction

In Nigeria, the combined gross enrollment for Primary, Secondary, and tertiary schools for female was 57% compared to 71% for males (Ogwuche & Shamo, 2019; Rudd, 2019). In 2019, women or girls made up 24.1% of Tertiary school students studying computer Science in Nigeria (Statista Research Department, 2022). Recently many female students are currently enrolling in Computer Science in

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tertiary institutions in Nigeria. The government, schools, and industry have all made repeated attempts to improve on the enrolment of female students (Onifade et al., 2021). These efforts have not been successful in bridging the gap thence further study is required to elucidate the causes and find solutions and correct the gender imbalance in the field of technology (Adeosun & Owolabi, 2021). The present study aims to contribute to this, investigating women's experiences of studying computer science at tertiary schools to better understand the reasons behind some female computer scientists' disengagement with the field. Explanatory frameworks which focus on the experiences of computer science students are scarce. In the works of Cheryan et al. (2017) and El-Hout et al. (2021) examined women's participation in biological fields such as medicine and biology, which have a more equal gender balance than other fields such as computer science and engineering. Although it does not focus exclusively on technology, the framework is highly relevant to this research and therefore forms the theoretical foundation for this study using Stacked Autoencoder Deep learning approach.

## **Research Question**

How can the framework proposed in Cheryan et al. (2017) be modified and used to modelled female students studying Computer Science learning experience in Tertiary Institutions in Nigeria?

To what extent is the modified framework proposed in Cheryan et al. (2017) successful in modelling female students studying Computer Science learning experience in Tertiary Institutions in Nigeria?

The following hypotheses were set to guide the study and will be tested at 0.05 level of significance:

H0: There is no significance difference between the mean of students who had early exposure in programming and students that had no exposure.

H0: There is no significance between the mean of students experience and performance in programing course

H1: There is significance difference between the mean of Assumptions made about female inferiority and performance in programing course.

H1: There is significance between the mean of Students with right support and Student Performance in Programing Course.

H0: There is no significance between the mean of Students with future plans and Student Performance in Programing Course.

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## Literature

Cheryan et al. (2017) has three components that work together to make some fields unappealing or unfriendly to women: these fields' male cultured, women's lack of early exposure and Women's lack of confidence in their abilities. The model is intended to provide a comprehensive picture of women's experiences in various professions. However, some aspects of women's experiences in Science Technology Engineering and Mathematics (STEM) are not addressed in the framework. Yates & Plagnol, (2021) opined that the framework does not address everyday sexism, microaggressions, or sexual harassment that women in STEM areas faced, nor women's struggle to figure out how to best handle these situations.

The concept of a 'gendered organization' by Acker in 1990 (Nkomo & Rodriguez, 2018) has helped us better understand women's experiences in Scientific organizations and the problems they face in furthering their careers (Yates & Skinner, 2021). The term refers to corporate cultures that profess to be fair and meritocratic, implying that all employees are held to the same standards and given similar opportunities, but in reality, favour males by setting higher standards and providing opportunities that are more suited to men. The gendered classroom concept has yet to catch on with the current realities (Goriss-Hunter et al., 2018; Jule, 2018; Leyva et al., 2021).

The second feature of the model is the lack of early field exposure. Many children are first exposed to computers through games (Danovitch, 2019; Relkin et al., 2021). Boys and girls spend similar amounts of time on screens throughout their adolescence, according to new research, but the nature of their interaction with technology differs: boys spend significantly more time playing video games, while girls spend significantly more time interacting with their friends on social media sites (Booker et al., 2018). These disparities have been shown to have an impact on early exposure to the genders.

According to Cheryan et al. (2017), the final explanation for women's underrepresentation in scientific fields is that they have lower levels of computer self-efficacy. This trait has been extensively researched, and Berdousis & Kordaki, (2016) argue that a lack of confidence in their skills to perform computer-related tasks is the single most relevant factor in women's under-representation in computer science. Women regularly rate their computer talents lower than men, despite evidence showing men and women perform comparably in computer courses (Samuel, 2020; Huang et al., 2020). This gap is attributable to both women's and men's underestimating of their skills (Charlesworth & Banaji, 2019; Roper, 2019; Alam, 2022).

Many approaches to addressing women's underrepresentation in computer science and related fields have been undertaken, with varying degrees of success. One successful strand of interventions in the classroom has focused on relationships between the students. When teachers and classmates encourage students to choose

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and stick with computer science courses, both male and female students are more likely to do so (Ryoo et al., 2020). Peer programming, a pedagogical strategy in which students are partnered up, two students to one computer, taking turns at the keyboard to work on coding, has proven to be a good experience for female students and has resulted in greater coding skills (Hogan & Devi, 2019; Bowman et al., 2020). All women's computer lessons have been proven to be successful. Other feminist pedagogy provides separate streams for experienced and inexperienced students, access to female teaching assistants, and female peer networks are all examples of successful feminist pedagogy (Fukushima & Bourrier, 2019; Almasri et al., 2022). The Dialogue-Based Socratic Approach (Peters & Besley, 2019; Alshaikh et al., 2021) in teaching is supposed to help students find the answers on their own, with teachers assisting them with tips to lead them to the answers. Hence, there is a need for further exploration of the experiences of women studying computer science courses in Higher Education in Nigeria.

## Method

In this study, Mixed Method approach was used in the Research Design. The Mixed Method involves the use of Quantitative and Qualitative approaches (Epizitone & Oludayo, 2020). The interpretative technique assumes that reality and meaning are formed inside an individual via social interactions (Elliott & Timulak, 2021). The Quantitative approach was used to analyze the data appropriately (Rudd et al., 2021). Hossain et al. (2019) applied the Mixed method to analyze students' academic achievements.

## Data Collection

Participants were chosen using Random Sampling, to find women who were enrolled in computer science programs and had completed at least one academic year of their courses. The Dataset of students' academic results was collected from the Computer Science Departments in Kaduna Student College of Education (KSCOE), Gidan Waya and Federal College of Education (FCE), Zaria. The Dataset had six columns shown in six (6) columns and hundred (100) rows. The values of question answered "Yes" is coded as "1" and "No" is coded as "0". Shown in table 1

Table 1: Sample of the Dataset in Excel

<b>Programming</b>	<b>Early Experience</b>	<b>Student Experience</b>	<b>Female inferiority</b>	<b>Right Support</b>	<b>Future plan</b>
69	1	1	1	1	1
70	1	1	0	1	1
71	1	0	0	1	1
80	1	1	0	1	1
74	1	1	0	1	1
78	0	1	0	1	1



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The Data is analyzed using Stalk Autoencoder Deep learning and Statistical Tools on MATLAB 2021a. The two-sample t-test is a parametric test that compares the location parameter of two independent data samples. The classification performance metric of samples. The and F1 score were used to evaluate the developed classification model.

## Results and Discussion

The Stalk Autoencoder model was simulated with the Dataset of students' academic results. Figure 1 and figure 2 shows the Deep learning model. Figure 1 shows the input layer with 100 inputs connected to the Encoder and Decoder Layers with 10 and 100 hidden neurons respectively. This layer then connects to the output layer to produce the output.

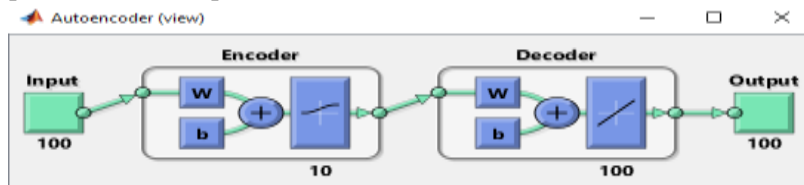


Figure 1:Auto Encoder Model

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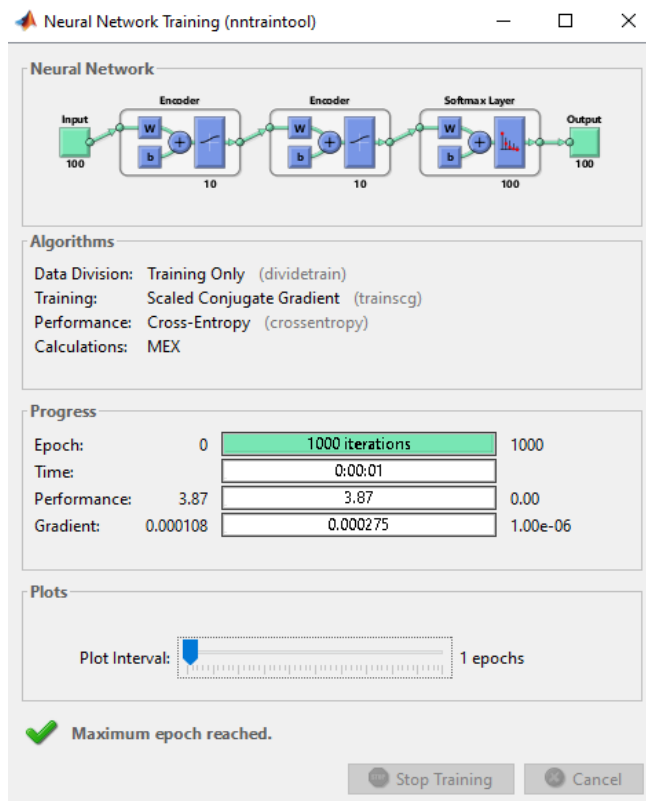


Figure 2: Training of the Stalk Autoencoder

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Table 2: Classification Performance of the model

Parameter	Value
Accuracy	0.9523
Precision	0.9112
Recall	0.9351
F1 Score	0.9229

From table 2, the model had a classification accuracy of 95.2%, Precision of 91.12%, Recall of 93.51% and an F1 score of 92.29%. It shows that the Deep learning algorithm was able to classify the results and the variables accurately.

## Early exposure

The t test of Programming course and early experience is shown in Table 3.

Table 3: Programming course and early experience

Description	Value
Degree of freedom Df	197
Standard Deviation sd	5.5361

From Table 3, the returned value of  $h = 1$  indicates that  $ttest2$  rejects the null hypothesis at the default 5% significance level even if equal variances are not assumed. This shows that there is significance difference between students who had early exposure in programming and students that had no exposure. Hence exposing female student to computer games and computers at home shows significant performance in students' performances.

## Student Experience

Table 4: ttest for Student experience and Student Performance in Programing Course

Description	Value
Degree of freedom Df	198
Standard Deviation sd	5.5201

Table 4: shows the TTest for Student experience and Student Performance in Programing Course. The Null hypothesis is accepted which states that there is no significance between students experience and performance in programing course. This shows that female student's performance is affected by their experiences in class.

## Assumptions of female inferiority

Table 5: ttest for Assumptions made about female inferiority and Student Performance in Programing Course

Description	Value
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Degree of freedom Df	198
Standard Deviation sd	5.5201

Table 5: shows the ttest for Assumptions made about female inferiority and Student Performance in Programing Course. The alternate hypothesis is accepted which states that there is significance between Assumptions made about female inferiority and performance in programing course.

## **Women do not get the right support**

Table 6: ttest for Students with right support and Student Performance in Programing Course

Description	Value
Degree of freedom Df	198
Standard Deviation sd	5.5201

Table 6: shows the ttest for Students with right support and Student Performance in Programing Course. The alternate hypothesis is accepted which states that there is significance between the mean of Students with right support and Student Performance in Programing Course.

## **Future Research**

The goal of this study was to learn about the experiences of female students; hence all of the participants were female. However, learning about the experiences of a larger representative sample of students, including male students with hybrid machine Learning algorithm, might help us better understand the phenomena.

## **Conclusion**

To better understand the experiences of female computer science students in Tertiary Institutions, this study used a Mixed Research approach. As a result, it adds to the existing literature, which is dominated by quantitative investigations. This research backs up Cheryan et al. (2017)'s framework which emphasizes the impact of technological self-efficacy, early computer exposure, and culture on participants' career ambitions. The agentic approach to pedagogy is one facet of the culture that has possibly been under-explored in prior research. The emphasis on competitiveness, mastery and self-directed learning does not always appeal to community learners, as evidenced by the findings of this study.

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Feminist pedagogy has been used to create courses that question society's institutions, assumptions, and status quo (although typically in more social courses). Women's confidence appears to be eroded by the computer science courses described by the participants in this study, and feminist pedagogy may offer a mechanism for students to confront oppressive social systems and develop critical thinking abilities to aid in logical problem-solving.

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## MICROCONTROLLER-BASED SMART IRRIGATION SYSTEM: DESIGN, REALIZATION, AND EXPERIMENTATION

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### ABSTRACT

*Plants in specific regions of the world especially Africa are adversely affected by prevailing drought. Presently, the major concerns in the agricultural sector are; water and labor management. This work considers the design analysis of a low-cost microcontroller-based irrigation controller capable of managing irrigation for a small area of land-based on real-time values of soil moisture. The method employed is to continuously monitor the soil moisture level to decide whether irrigation is required. In particular, the microcontroller-based circuit device acts as an irrigation management controller through continuous monitoring of moisture content of the soil using FC 28 rain sensor, and comparing the values with two set reference threshold values; the upper limit, and lower limit, then induces the corresponding action required. When the soil moisture content goes below the lower-limit value set by the user, the system observes this and begins irrigation action. Results obtained show that this design is cost-effective, and guarantees efficient water supply and effective labor management. Also, irrigation test results show that the duration of spray largely depends on the soil texture, grass identity, and moisture content. In particular, the sprinkler irrigation method in loamy soil took longer than in sandy soil, while clay soil irrigation took the longest time.*

**Keywords:** *Draught, Microcontroller, Threshold, Irrigation, Moisture*

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### Introduction

Irrigation is an artificial supply of water to the root of a plant. It has been utilized to help with crop production, landscape management, and re-vegetation of disturbed soils in arid climates as well as during dry spells. Irrigation aids in crop production by shielding plants against frost, thwarting weed growth, and minimizing dust. Watering cans, mechanically operated water channels, and backpack sprinklers all

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seem to be popular irrigation methods in the past. A tremendous amount of water is lost in this situation.

The conventional or traditional forms of irrigation need to be improved. To maximize the use of water for crops, an integrated model must be created. An efficient irrigation system must should have part that can independently monitor and regulate the amount of water supplied to the plants without error or assistance from a human.

Field irrigation can be carried out by an integrated system without the need for human interference. It can be achieved with the aid of electronic appliances and detectors like computers, timers, sensors, and other mechanical equipment.

In this research, an automated irrigation system was designed to minimize water input and human intervention, while satisfying the plants.

The following tasks were carried out by the system:

- i. To constantly keeping track of the amount of soil water that plants have access to.
- ii. To use the data collected from the sensing device, and decide if the plant need to be hydrated.
- iii. To provide the plants with the appropriate amount of water they need.
- iv. To stop providing water once the plants have received the required amount. Because there is a finite amount of water accessible for the irrigation system, it is essential to have this functionality.

## **Related work**

Mahir Dursun et al. presented an efficient method for reducing water use by installing a solar-powered drip irrigation system in an orchard. They used Artificial Neural Networks (ANN) to assess the soil moisture content and administer water evenly over the required area. The technique reduces water use by stopping unnecessary irrigation. This method reduces daily energy and water use by approximately 38%. (Dursun, 2011)

For a field of hyperacidity, Farid et al. presented a workable solution built on an intelligent and efficient system. The system comprises of a Zigbee-GPRS remote monitoring and database platform and a feedback FLC that logs important field metrics using certain sensors. Without making any physical modifications, the system is installed in already-existing drip irrigation systems. To determine the proper timing and duration for irrigation, FLC collects data from various sensors and applies fuzzy rules. (Farid, 2010)

In his presentation, Singh et al. offer a fuzzy logic-based solution for an irrigation controller used in the growth of vegetable plants. In this system, the amount of water

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provided to the plants is determined by their size and the soil's capacity to retain moisture, both of which are influenced by environmental factors such as temperature, wind speed, and water budget. Using a controlled and effective method, the system provides water to plants. The pump controller is supplied with power using solar energy conversion technology. (S. Singh, 2012.)

Xin et al. described an autonomous precision irrigation system that combined a center pivot irrigation system with wireless subterranean sensor networks and a hydraulic drive. By monitoring the soil conditions in real-time with wireless underground sensors, the wireless underground sensor-aided center pivot system was able to manage irrigation on its own. (Xin, 2013 )

Robert et al., promoted commercial wireless sensing and control networks using valve control hardware and software. The valve actuation system included the development of custom node firmware, actuator hardware and firmware, an internet gateway with control, and communication and web interface software. The system uses a single hop radio range using a mesh network with 34 valve actuators for controlling the valves and water meters. (Robert, 2013)

Awati et al. created a wireless sensor network-based automatic irrigation control system. In order to establish and assess the calibration functions for the system's integrated sensors, sensors were integrated into a wireless monitoring network. The system compares the two sensor types' measuring ranges and response times in a layer of drying soil. Data were delivered via Internet access after being transmitted over a distance of several kilometers. (J.S., 2012)

In order to compare the measuring range and response times of both sensor types in a soil layer during drying, Nolz et al. connected the sensors into a wireless monitoring network. The sensors' integration into the telemetry network was successful. Data were sent over many kilometers and made accessible through Internet connection. (Bhandari, 2013)

According to Christos et al., autonomous closed-loop zone-specific irrigation can be implemented by designing an adaptable decision support system and integrating it with a wireless sensor/actuator network. When developing application logic, ontologies place an emphasis on the system's adaptability and flexibility and facilitate the use of automatic inferential and validation procedures. By using a machine learning technique to analyze logged datasets to extract new information and expand the system ontology to handle the situation, new rules are created. (Christos, 2014)

## **Materials**

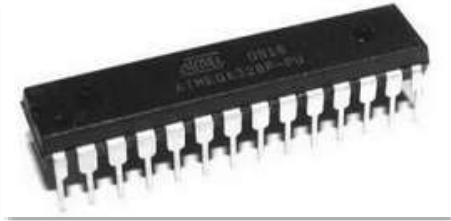
### **i. Arduino**

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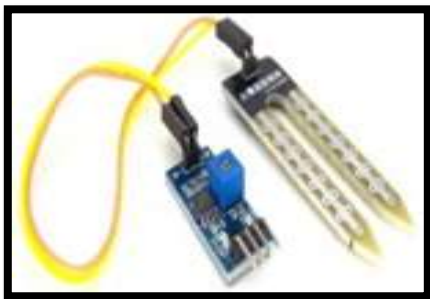
The Atmega328p microcontroller was utilized in this study to manage and coordinate all of the system's components. It features 32KB of flash memory, an 8-bit data bus, and runs between voltage ranges of 3 to 5.5 volts. In some situations, it uses less power. (Rahman, 2017)



**Figure 3:** Atmega328p microcontroller (Rahman, 2017)

## ii. Moisture Sensor

Using some soil characteristics, such as electrical resistance, dielectric constant, or interaction with a neutron as a proxy for the moisture content, the FC-28 sensor moisture module was utilized to quantify the volumetric water content indirectly. The module features a potentiometer to regulate the level of sensitivity and requires an operating voltage between 3.3V and 5V. (Vani & Rao, 2016)



**Figure 4:** Structure of an FC-28 Soil Moisture Sensor (Danita, 2018)

## iii. Water Pump

In this study, water was moved through the system at usable working pressures from a reservoir to the field using a DC pump that runs on 12 volts. This type of DC pump is a centrifugal pump that disperses fluid using an impeller.

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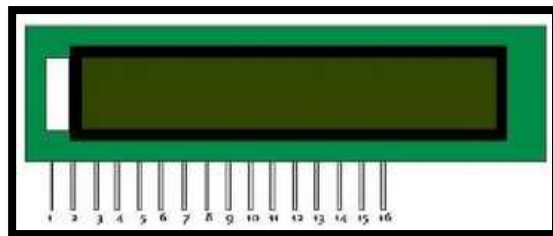
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**Figure 5:** Structure of a 6 Volt to 12 Volt dc Water Pump

#### iv. Liquid Crystal Display (LCD)

Due to its low cost, ease of programming, and ability to show a variety of characters and animations, a 16x2 Liquid Crystal Display (LCD) was chosen. Command and Data registers are present in this LCD. Data that will be displayed by the LCD is stored in the Data register, while command instructions are stored in the Command



register.

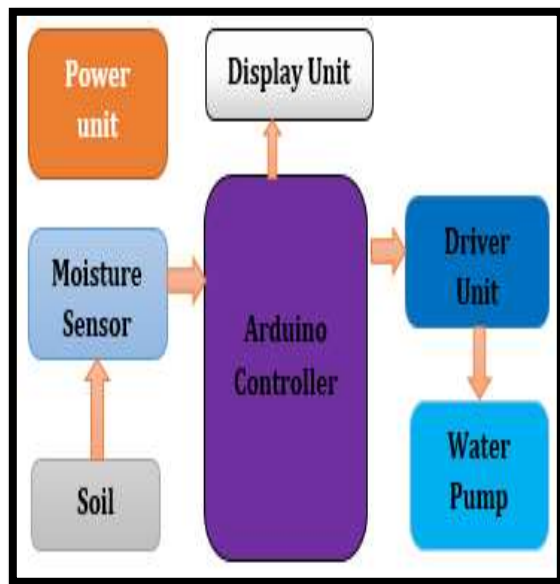
**Figure 6:** Structure of a liquid crystal display (LCD)

#### Methodology

The system has three major parts; the sensing unit, the control unit, and the output unit which were achieved using sensors, controller, and actuator respectively as shown in Figure 5.

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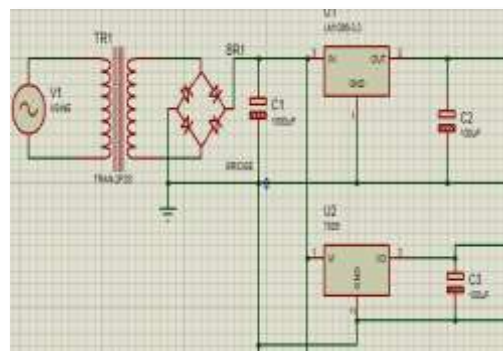


**Figure 7:** Block Diagram of an Irrigation System

## a) System units

### i. Power supply

A 12V/1.5A step-down transformer was used to create a portable power source, as depicted in Figure 6. The LM 7812 and LM 7805 regulators were utilized to generate



a 12 volt and 5 volt output respectively.

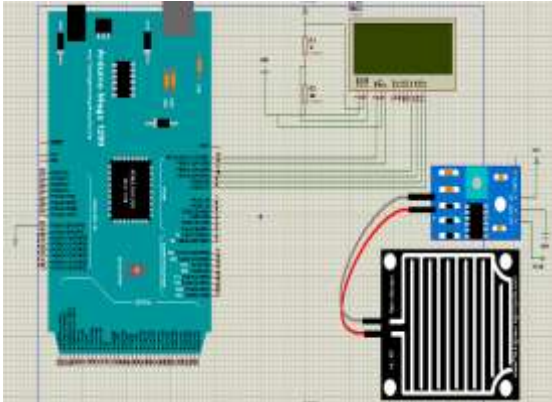
**Figure 8:** Circuit diagram of the system's power unit

### ii. Sensing unit

The amount of moisture around the plant was measured using an FC-28 moisture sensor which is powered by a 5 volt DC. The sensor transmits voltage to the microcontroller for processing and further action at a level proportional to the



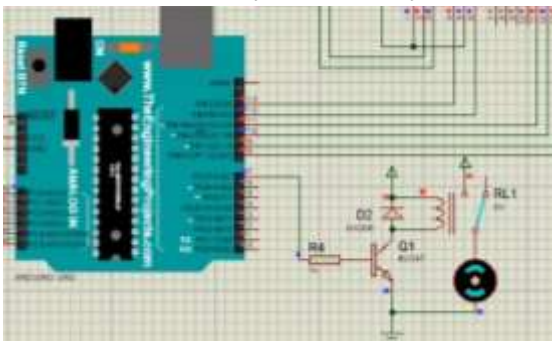
moisture level reading. Figure 7 illustrates how its output pin was attached to pin 53 on the microcontroller.



**Figure 9:** Circuit Diagram of the sensing unit of the monitoring system

- iii. **Control unit**
- iv. **Actuation unit**

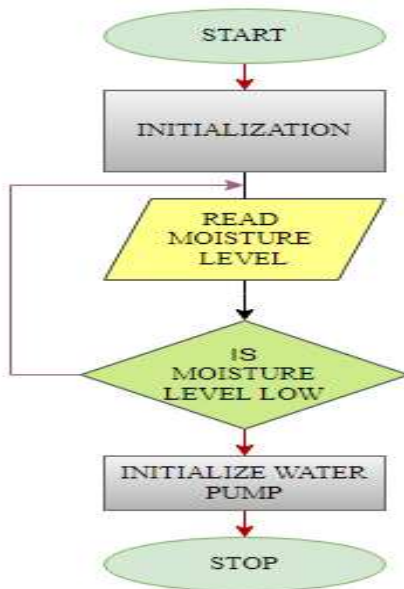
The actuator's principal duty is to normalize the field's moisture content. For this device, a 12V DC water pump that could control the farm's moisture level was integrated into the system. The actuator's connection to the microcontroller is depicted in Figure 9. It was linked to pin 14 of the microcontroller via a 10kW resistor, and it was driven by a 12V relay switch.



**Figure 10:** Circuit Diagram of the actuation unit of the monitoring system

- b) **Principle of operation**

The flowchart in Figure 10 explains the basic workings of the system's control device. First, the system's moisture threshold values were defined and uploaded into the sensing and response unit for comparison with the acquired value.



**Figure 11:** System Flow Chart

An initialization procedure is carried out by the system when it is switched ON, and this sequence was shown on the LCD. The controller measures the field's moisture content, and the sensing device reads it. The system then compares the field's current moisture level to the threshold values uploaded. The system activates the actuator to maintain the required moisture level if the moisture is below the threshold value; otherwise, it will keep track of the moisture level until it is below the threshold value. For as long as it is plugged into a power source, the system will keep an eye on this parameter.

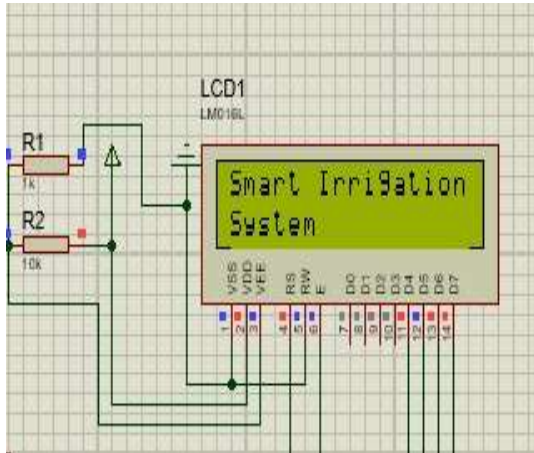
## 1) Result and discussion

### A. Simulation results

This section presents simulation results that were achieved during the design of the control circuit of the monitoring device. After safe system booting, the system undergoes some series of initialization which will be displayed on the LCD as shown in Figure 8.

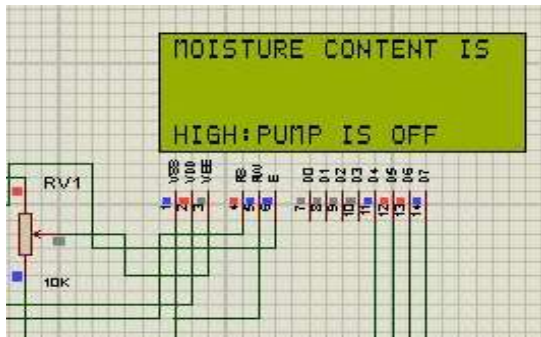
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**Figure 12:** System welcoming note

Additionally, as seen in figures 9 and 10, it shows the present moisture content of the field and the condition of the actuator (pump).



**Figure 13:** Farm status (favorable)



**Figure 14:** Farm status (Unfavorable)

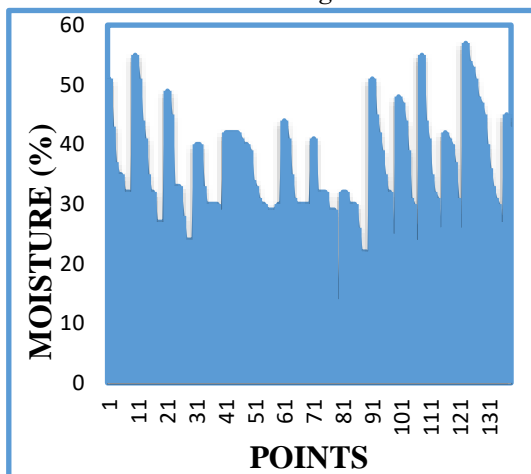
## B. Moisture variation

On the LCD, the field's moisture level's immediate variations were shown. Figure 11 depicts the fluctuations in the field's moisture level over the course of four weeks,

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as measured at three regular intervals each day—morning, noon, and early evening.



**Figure 15:** 4 weeks field moisture variation

The soil used in this research is sandy-loam soil and by setting the threshold value for moisture as 15%, the result obtained showed that the maximum, minimum, and average moisture content recorded during the 4 weeks experimentation was 55%, 18%, and 32.6% respectively. Based on the data collected, the level of moisture content of the field increases after 2-3 days.

## Conclusion

This work presents the design and implementation of a low-cost microcontroller-based irrigation controller capable of managing irrigation for a small area of land-based on real-time values of soil moisture. An Atmega328p microcontroller, Fc 28 moisture module, and 12 dc pump were used to continuously monitor the soil moisture level of a field and then decide whether irrigation is required. When the soil moisture content goes below the lower-limit value set by the user, the system observes this and begins irrigation action. Results obtained show that by setting the threshold value for moisture as 15%, the result obtained showed that the maximum, minimum, and average moisture content recorded was 55%, 18%, and 32.6% respectively. Based on the data collected, the level of moisture content of the field increases after 2-3 days. This design is cost-effective and guarantees efficient water supply and effective labor management.

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## ASSESSMENT OF THE ROLE OF CO-OPERATIVE SOCIETIES IN THE DEVELOPMENT OF ENTREPRENEURSHIP AMONG YOUTH IN KADUNA STATE, NIGERIA

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### **Abstract**

*This research work was conducted to assess the role of co-operative societies in the development of entrepreneurship among youth in Kaduna State. The following research questions guided the study were; What are the activities of co-operative societies in developing entrepreneurship attitude among youth in the study area? What are the challenges of the co-operative societies in entrepreneurship development of youth in the study area? Multi-stage sampling techniques were employed in selection of 201 co-operative members in Kaduna metropolis. A questionnaire was developed based on 5-point Likert scale to gather the data. Frequencies and simple percentages were used to analyze the respondent bio data while mean score was used based on the research questions. Research results show that the activities of co-operative societies in developing entrepreneurship attitude among youth includes assisting members in developing business plant, encouraging savings habit among youth, creating cheap and easy avenue for loans, providing socio-economic security to youth and creating awareness on self reliance e.t.c result also show that challenges of the co-operative societies in entrepreneurship development of youth include weak financial strength, poor management, lack of managerial and technical know-how and fraud and financial malpractice. It was recommended among others that the youth should be encouraged to join co-operative society which will attract the attention of the government. Since most government policies revolves around the youth.*

**Keywords:** *Assessment of role, Co-operative societies, Development, Entrepreneurship among youth.*

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### **Introduction**

Youth development has received the attention of many experts and researchers, organizations such as United Nation Organization (UNO) International Labour Organization (ILO), United Nations International Children's Emergency Fund (UNICEF), World Health Organization (WHO), Non-Governmental Organization NGO, as well as the government. This is because as declared by the National Youth Policy (2010), they constitute an invaluable asset of the nation, because of courage, innovativeness, inquisitiveness and high level of self-confidence, which is also

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considered to be a main source of nation building they are not only a vital source of the state but also a change agent, the youths are pioneers of economic, social, political and cultural transformation and change driving force. Youth development as captured in National Youth Policy (2004-2014), is an intentional comprehensive approach that provides space opportunities and support for young people to maximize their individual and collective creative energies for personal development as well as development of the broader society of which are an integral part (NYP, 2014).

Helms (2005) on the other hand defined co-operative society as an association of persons who have voluntarily joined together to have a common end through the formation of a democratically controlled enterprise, making equitable contribution to the capital required and accepting a fair share of the risk and benefit of the undertaking in which the member activity participate. On the other hand it could be seen as a voluntarily association of persons having mutual ownership in providing themselves some needed service on non-profit basis usually organized as a legal entity to accomplish objectives through joint participation of its members.

As it is, the problems faced by youth in Nigeria today are complex. Co-operative environment provides working conditions more favorable to youth engagement than to other organizational forms because of it democratic governance structure and organizational aims which go beyond profit maximization.

Young people have the opportunity to develop social consciousness and attain a sense of self actualization through their democratic governance; co-operative societies also explore young members to democratic values and culture. The experience attained through engaging with an environment of accountability and solidarity gives young people the confidence to take on leadership roles in various contexts even beyond the cooperative movement.

## **Statement of the Problem**

The major problem confronting the youth today is unemployment which leads to high rate of poverty. World Bank (2013) confirms 112million Nigerians living below poverty line. This followed another depressing disclosure by the World Bank, which said that the population of Nigerians in poverty has increased considerably and significantly. The figure represents about sixty seven percent (67%) of the entire population. In spite of all the orchestrated policies and programmes of successive government in Nigeria as well as several works and researches conducted by various authors and organization, the Nigeria youth still leave a lot to be desired.

Such programs which range from in school education programme for physical and mental development of out of school programmes aimed at shaping the character and



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behavior of the youth, as well as promoting competitive spirit and national unity and integration. In the light of these problems, the researcher wants to probe into the role of co-operative societies in the development of entrepreneurship among youth in Kaduna State.

## **Objectives of the Study**

The general objective of this study is to assess the role of co-operative societies in the development of entrepreneurship among youth in Kaduna State.

The specific objectives are as follows:

- i. To find out the socio-economic characteristics of members
- ii. To find out the activities of co-operative societies in developing entrepreneurship attitude among youth in the study area.
- iii. To ascertain the challenges of the co-operative societies in entrepreneurship development of youth in the study area.

## **Research Question**

The following research questions guided the study:

- i. What are the socio-economic characteristics of members?
- ii. What are the activities of co-operative societies in developing entrepreneurship attitude among youth in the study area?
- iii. What are the challenges of the co-operative societies in entrepreneurship development of youth in the study area?

## **Literature Review**

### **Conceptual Framework**

#### **The Concept of Cooperatives**

The term co-operative is derived from the Latin word co operatic, where the word co- means with” and opera means to work” thus co-operative means working together. So those who want to work together with some common economic objective can form a society, which is term as co-operative society” it is a voluntary association of persons who work together to promote their economic interest.

The International Co-operative Alliance (ICA) in its Statement on the Co-operative Identity, in 1995, defines a cooperative as “an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically controlled enterprise.” It is a business voluntarily owned and controlled by its member patrons and operated for

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them and by them on a nonprofit or cost basis (UWCC, 2014). It is a business enterprise that aims at complete identity of the component factors of ownership, control and use of service, three distinct features that differentiate co-operatives from other businesses (Laidlaw, 2019).

The International Labour Organization (2018) Define co-operative societies as an association of persons usually of limited means who have joined together to achieve common economic goals through the formation of democratically controlled business organization, making equitable contribution to the capital required and accepting a fair share of risk and benefit of undertaken.

## **The Concept of Youth and Development**

Youth is best understood as a period of transition from the dependence of childhood to adulthood independence as members of a community. Youth is more fluid category than a fixed age-group.

The United Nation Organization (UNO) defines as those persons between the ages of 15-24 years, without prejudice to other definition by member states. They went on to declare that young people between the ages of 15-24 represent approximately 18% of the global population nearly 1.2 billion people. 87% of youth live in developing countries, 62% of youth live in Asia, and 17% of youth live in Africa. As members of societies, youth deserve full access to education, adequate health care employment, financial service, participation in public lives.

## **The Activities of Cooperative**

According to Usman (2010) said that the activities of any co-operative depend on the type of society. The socio-economic activities of cooperative societies include.

- i. To assist members to plan wiser, richer and sooner.
- ii. To encourage savings habit that is more convenient to the members.
- iii. To provide socio-economic security for members, thus enhancing industrial harmony and productivity.
- iv. To creates cheap and easy avenue for loans by members for productive and emergency purpose.
- v. To gives members the opportunity to own property with jointly and individually

## **The Challenges of Cooperative Societies for Youth Development**

According to Akinwunmi (2016) is leadership. If there is purposeful leadership, if leaders are transparent, dedicated and truly serving, the cooperative society will

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succeed. A true leader does not cut corners, does not inflate contracts so as to receive kickbacks, does not have favorites among members and does not mismanage the resources.

Asaolu (2014) as quoted by Mass Mobilization for Social and Economic Recovery (MAMSER) in its studies of 1998, while identifying the problems facing cooperative societies in Nigeria to be generally due to political and socio-economic factors.

The socioeconomic and political environment in Nigeria poses a great challenge to the youths. Economic and social statistics present a sober picture that leaves much to be desired. Almost half a century after flag independence, the economy continues to be dominated by the primary sector agriculture, oil and minerals. This is partly because the country has not been able to create an environment for high value added economic activities (Andow, 2018).

## **Methodology**

### **The Study Area**

Kaduna State is located at the centre of Northern Guinea savannah. It lies between latitudes  $9^{\circ}10'$ - $11^{\circ}30'$  north and longitude  $6^{\circ}9'$ - $10^{\circ}10'$  east. It has a total area of about 67,000 square kilometres (KADP, 2007) with a population of 6,066,562 people comprising of 3, 112, 028 males and 2, 954, 534 females, the estimated population of Kaduna State as at 2015 would be 8, 252, 366 people with annual population change 2006-2015(+1.4% per year) (NPC 2016). This study assesses the role of cooperative societies in the development of entrepreneurship among youth in Kaduna State. To this end, this chapter discusses and describes the design and procedure for the study, the population and the sample used. A description is also made of the instrument for data collection as well as its validity and reliability. Also discussed in this chapter is the procedure for the administration of the instrument, statistical analysis as well as the limitation of the study.

### **Research Design**

A survey method was used for this study. This method involves gathering data about the target population from a selected sample and generalizing the findings obtained from the analysis of the sample to the entire population. This method was adopted because it enabled the researcher to discover relative incidences and distribution on the characteristics of the population. Besides, it facilitated the researcher to assess the role of cooperative societies in the development of entrepreneurship among youth in Kaduna State.

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## Population of the Study

The study was conducted using 10 registered cooperatives societies within Kaduna metropolis, the population consists of all the members of the cooperatives used for the study. The cooperatives used for the study include:

S/N/LOCATION	NAME OF SOCIETY	DATE OF REG	REG.NO.
1.KD NORTH L/G. AREA	GWARI/JAMA'A RD ASHEIYEWU AGRIC. COOP.	2/8/2010	KDS/DKA/CS/0516
2. “	KAD STATE BLIND WELFARE COOP SOCIETY	2/12/2010	KDS/DKA/CS/0737
3. “	ZANGO AYA RD KAWO FARMERS COOP SOCIETY	9/02/2006	KDS/DKA/CS/1276
4. “	MURTALA SQUARE FINANCE/INVESTMENT COOP SOCIETY LTD	14/4/2011	KDS/DKA/CS/1579
5. “	UNGWAR MAISAMARI BAPTIST INVESTMENT COOP SOCIETY LTD	11/4/2011	KDS/DKA/CS/1570
6 “	RAFIN GUZA MATA MAKIYAYA MPCs	11/3/2010	KDS/DKA/CS/1627
7. “	ABAKWA CENTRAL FARMERS COOP SOCIETY	17/6/1996	KDS/DKA/CS/1802
8. “	HIGHER HEIGHET MPCs LTD	13/9/2011	KDS/DKA/CS/2046
9. “	KATURU ROAD FARMERS COOP. SOCIETY LTD	3/5/2012	KDS/DKA/CS/3753
10. “	KIFC MPCs LTD	23/3/2011	KDS/DKA/CS

Source: Field Survey (2021)

## Sample and Sampling Procedure

Multistage sampling procedure was adopted in selecting the respondents for the study. In the first stage a total of 10 registered cooperative societies were randomly

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selected within Kaduna metropolis, in the second stage the sample for the study was proportionately selected among the selected cooperative societies based on their population using simple random sampling. A total of 201 respondents were selected, this gives every member of the selected cooperative societies equal chance to be selected for the study. To determine the sample size for the study, Krejcie and Morgan (1970) sample size table cited in Ogbu (2012) was used.

## **Research Instruction**

The instrument used for the study was the questionnaire. The questionnaire was developed by the researcher. Questionnaire is appropriate because the members of the cooperative society under study were literate. Besides the questionnaire method facilitated easy coverage and is more appropriate in survey studies of this nature (Nwana, 1982) cited in Ogbu (2012). The questionnaire was tagged Assessment of the Role of Cooperative Societies in the Development of Entrepreneurship among Youth in Kaduna State (ARCSDEY) Questionnaire.

The instrument was designed on 5-point Likert scale of strongly agree, agree, undecided, disagree, and strongly disagree. The items in the questionnaire were generated through a view of previous studies. In scoring the items related to the Likert type 5-point scale, respondents had a possible total score ranging from 5 to 1 which represented a respondent opinion. The higher the score, the more influenced the respondent was by the scale. The design of the questionnaire was clustered around five sections. Section A consist of items related to the personal date of the respondents such as sex, age while section B to E contained information dealing with the subject matter of the investigation.

## **Results**

The data generated is presented using tables. The demographic variables of the respondents involved in the study are presented in table of frequencies and percentages. The responses to the individual items in the questionnaire were presented along the research questions in the study. In the course of scoring the items, the magnitude of the respondents' response to the option in the five point Likert scale was used to determine the direction of the respondents' opinion.

## **Socio-economic Characteristics of Respondents**

**Table 1: Sex Distribution of the Respondents.**

<b>Items</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Male	115	57.21

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Female	86	42.79
<b>Total</b>	<b>201</b>	<b>100</b>

Source: Field work (2016)

Source: Field Survey (2021)

Table 1 shows the socio-economic characteristics of the students based on sex status. In the table 115 respondent representing 57.21% are male while 86 respondent representing (42.79%) are female.

**Table 2: Marital Distribution of the Respondents.**

Items	Frequency	Percentage (%)
Single	15	7.46
Married	181	90.04
Divorcee	4	1.99
Widow	1	0.49
<b>Total</b>	<b>201</b>	<b>100</b>

Source: Field work (2016)

Source: Field Survey (2021)

Table: 2 show the socio-economic characteristics of the students of the based on marital status. In the table 15 respondents representing (7.46%) are single, 181 respondents representing (90.04%) are married, 4 respondents representing (1.04%) are divorcee and finally 1 respondent representing (0.49%) is a widow.

**Table 3: Age Distribution of the Respondents.**

Items	Frequency	Percentage (%)
15-20	5	2.49
21-25	16	7.96
26-30	35	17.41
36 and above	145	72.14
<b>Total</b>	<b>201</b>	<b>100</b>

Source: Field Survey (2021)

Source: Field Survey (2021)

Table 3 shows the socio-economic characteristics of the students of the based on age status. In the table 5 respondents representing (2.49%) are between the ages of 15-20, 16 respondents representing (7.96%) are between the ages of 21-25, 35 respondents representing (17.41%) are between the ages of 26-30

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and finally 145 respondent representing (72.14%) are between the ages of 36 and above.



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**Table 4: Respondent Occupation**

Occupation	Frequency	Percentage (%)
Civil servant	98	48.75
Business	16	7.96
Trader	22	10.94
Farmer	19	9.45
Tailor	17	8.45
Carpenter	10	4.97
Builder	7	3.48
Printer	12	5.97
<b>Total</b>	<b>201</b>	<b>100</b>

**Source:** Field work (2021)

Table 4.4 above shows the occupation of respondents used for the study. From the table, 98 respondents representing (48.75%) are civil servant, 16 respondents representing (7.96%) are business man and women, 22 respondents representing (10.94%) are traders, 19 respondents representing (9.45%) are farmers. 17 respondents representing (8.45%) are tailor, 10 respondents representing (4.97%) are carpenter, 7 respondents representing (3.48%) are builders while 12 respondents representing (5.97%) are printer. This brings the total number of respondents to 201 (100%).

**Research question 2:-** What are the activities of cooperative societies in developing entrepreneurship attitude among youth in the study area?

**Table 4.5: Distribution according to the activities of cooperative societies in developing entrepreneurship attitude among youth in the study area**

S/N	Statement	SA	A	U	D	SD	X	Remarks
19	Establishing of vocational skill acquisition centre	111	71	-	5	14	4.00	Agree
20	Organizing training workshop for youth on development of entrepreneurial skill	91	100	-	3	7	3.78	Agree
21	Assisting youth in developing To creates cheap and easy avenue for loans for members	130	74	-	-	2	4.20	Agree

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22	To provide socio-economic security to members	95	81	-	1	24	3.18	Agree
23	Creating awareness on self reliance	95	96	-	2	8	3.78	Agree
24	Giving members the opportunity to own property jointly or individually	95	81	-	1	24	3.18	Agree
25	Assisting members in developing business plant							

**Source:** Field Survey (2021)

The data on the table 4.5 above shows the activities of cooperative societies in developing entrepreneurship attitude among youth in the study area. In item 19 result shows that a larger number of the respondents (N= 201; X = 4.00) agree that their cooperative assist members in developing business plant. In item 20 result shows that a larger number of the respondent (N = 201; X = 3.78) agrees that their cooperative society encourage savings habit among youth. In item 21, result shows that a larger number of the respondent (N=201, X = 4.20) agree that their cooperative society creates cheap and easy avenue for loans for members. In item 22 result shows that larger number of the respondents (N = 201; X = 3.18) agree that their cooperative society provide socio-economic security to youth. In item 23 result shows that a larger number of respondents (N= 201; X = 3.78) agree that their cooperative society create awareness on self reliance. Finally, in item 24 result shows that a larger number of respondents (N= 201; X = 3.18) agree that their cooperative society give members the opportunity to own property jointly or individually

**Research Question 2:** What is the impact of cooperative society's activities in developing entrepreneurship attitude among youth in the study area?

**Table 4.7: Distribution according to the impact of cooperative society's activities in developing entrepreneurship attitude among youth in the study area**

S/N	Statement	SA	A	U	D	SD	X	Remarks
25	I own personal poultry farm.	99	83	-	5	14	3.59	Agree
26	I was able to acquired proper entrepreneurship skills	91	100	-	3	7	3.78	Agree

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27	I was able to established computer business center	130	74	-	-	2	4.20	Agree
28	I own catering outdoor services though the activities of cooperative society	95	81	-	1	24	3.18	Agree
29	I produce Soap with the help of Vocational training received from cooperatives	95	96	-	2	8	3.78	Agree
30	It develops leadership skills for taking over responsibility within and beyond the cooperative sector	100	91	-	-	10	3.66	Agree
31	It helps develop ethics	66	116	-	5	14	3.10	Agree
32	It helps young people to become creative in cooperative environment	88	94	-	5	14	3.02	Agree

**Source:** Field Survey (2021)

The data on the table 4.7 above shows the impact of cooperative society's activities in developing entrepreneurship attitude among youth in the study area. In item 25 result shows that a larger number of the respondents (N= 201; X = 3.59) agree that their society help them to own personal poultry farm. In item 26 result shows that a larger number of the respondent (N = 201; X = 3.78) agrees that were able to acquired proper entrepreneurship skills through their cooperative society. In item 27, result shows that a larger number of the respondent (N=201, X = 4.20) agree that they were able to established their owned computer business center. In item 28 result shows that larger number of the respondents (N = 201; X = 3.18) agree that they owned catering outdoor services through the activities of their cooperative society. In item 29 result shows that a larger number of respondents (N= 201; X = 3.78) agree that they produced soap with the help of vocational training received from their cooperatives. In item 30 result shows that a larger number of respondents (N= 201; X = 3.66) agree that activities of their cooperative society helps to develops leadership skills for taking over responsibility within and beyond the cooperative sector. In item 31 result shows that a larger number of

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respondents (N= 201; X = 3.10) agree that activities of their cooperative society helps to develop business ethics. Finally, in item 32 result shows that a larger number of respondents (N= 201; X = 3.02) agree that activities of their cooperative society helps young people to become creative in cooperative environment.

**Research Question 3:** What are the challenges of the cooperative societies in entrepreneurship development of youth in the study area?

**Table 4.6: Distribution according to the challenges of the cooperative societies in entrepreneurship development of youth in the study area**

S/N	Statement	SA	A	U	D	SD	X	Remarks
33	Weak financial strength of the society	155	40	-	-	6	4.00	Agree
34	Poor management of the society	100	91	9	1	10	3.96	Agree
35	Lack of managerial and technical know-how	86	95	-	-	10	3.89	Agree
36	Fraud and financial malpractice	75	106	-	10	10	3.03	Agree
37	Lack of cooperative knowledge	101	83	-	7	10	3.55	Agree

**Source:** Field Survey (2021)

The data on the table 4.6 above shows the challenges of the cooperative societies in entrepreneurship development of youth in the study area. In Item 33, results indicate that a larger number of respondents (N= 201; X = 4.00) agree that their cooperative society financial strength is weak. In item 34, a larger number of the respondents (N = 201; X = 3.96) agree that their cooperative society poor management affect their cooperative society. In item 35, a larger number of respondents (N = 201, X =3.89) agree that lack of managerial and technical know-how affect their cooperative society. In item 36, a larger number of respondent (N = 201 X = 3.03) agree that fraud and financial malpractice affect their cooperative society. Item 37, show a larger number of respondents (N = 201 X = 3.55) agree that their cooperative society lack of cooperative knowledge.

## Discussion

This study assesses the role of cooperative societies in the development of entrepreneurship among youth in Kaduna State. This result is based on the opinions of respondents understudy.

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The result shows that activities of cooperative societies in developing entrepreneurship attitude among youth includes assisting members in developing business plant, encouraging savings habit among youth, creating cheap and easy avenue for loans, providing socio-economic security to youth and creating awareness on self reliance e.t.c. This result is in agreement with the views of Usman (2010) who said that the activities of any cooperative depend on the type of society. The socio-economic activities of cooperative societies include assisting members to plan wiser, richer and sooner, to encourage savings habit that is more convenient to the members, to provide socio-economic security for members, thus enhancing industrial harmony and productivity, to create cheap and easy avenue for loans by members for productive and emergency purpose and to gives members the opportunity to own property with jointly and individually.

Impact of cooperative society's activities in developing entrepreneurship attitude among youth includes owning personal poultry farm, to acquiring proper entrepreneurship skills, opportunity of establishing computer business center, owning catering outdoor services, developing leadership skills for, promptly taking over e.t.c. This statement is in agreement with opinion of Adebolu (2018) who stated that youth can be referred to the entire time of life when one is young, including childhood but often refers specifically to the time of life that is neither childhood nor adulthood but rather somewhere in between. Youth is an alternative word to the scientifically oriented adolescent and the common terms for youth are young person and young people.

Challenges of the cooperative societies in entrepreneurship development of youth include weak financial strength, Poor management, lack of managerial and technical know-how and fraud and financial malpractice. This findings is in agreement with the work of Atiomo, (2017) who mentioned that miss governance is marked by exclusion of the people from governance, non-accountability of public officials, lack of transparency in decision-making, electoral fraud and the colonisation and personalization of the state and national resources by the political elite. This situation presents particular challenges for the Nigerian youths.

## **Conclusion**

From the findings, it reveals that adequate savings are not been mobilized and loans provided by the society is limited and cooperative societies are finding it difficult in meeting and enhancing a very good percentage of their development activities. Education could be a significant indicator that can effectively mobilize cooperative group to attract government presence to assist the group. This has been the reason

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why cooperative society have existed in isolation to government assistance which is a hindrance to effective performance by cooperative society in discharging its development activities. Failure of members to participate actively will reduce the performance of the society in savings mobilization.

It is therefore believed that if the recommendations of this study will be implemented by both members, committee members of the society and the government, it will aid the cooperative society in effectively contributing to youth Entrepreneurship Development.

## **Recommendations**

The following recommendations are made based on the major findings of this study. The recommendations are aimed at addressing challenges of the cooperative societies in entrepreneurship development of youth in the study area.

1. Members should show participation and being more active for a stronger and stable society. Education could be a significant indicator that can effectively mobilize cooperative group to attract government presence to assist the group. This has been the reason why cooperative societies have existed in isolation to government assistance which is a hindrance to effective performance by cooperative society in. Also lack of education could greatly hinder the leadership structure of the group. Education of members could also help to organize cooperative societies for an effective and efficient managements, which could help to bring back the already loss of trust and confidence in leaders. This could be achieved through capacity building of members in areas of bookkeeping, recording, general administration of the group, as well as improved welfare packages for Members.
2. Adequate knowledge of cooperative education should be instilled in members and committee members by organizing seminars and workshop.
3. The youth should be encouraged to join cooperative society which will attract the attention of the government. Since most government policies revolves around the youth.
4. Government should create an enabling environment for cooperative society by Providing basic infrastructural facilities for the society

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## EFFECT OF HERBICIDES ON SOIL MICROBIAL DYNAMICS (AZOTOBACTER, ACTINOMYCETES, HETEROTROPHIC AEROBIC BACTERIA, ARTHROBACTER, FUNGI)

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### ABSTRACT

Field studies were conducted to investigate the effect of herbicides on soil. Four groups of herbicides; 2,4 D-Calliherb, glyphosate and paraquat were used at the rate of 350 ml in 15 L sprayer while 3 kg/h for triazine powder. There were five treatments, each replicated five times and were laid down in a randomized complete block design (RCBD). The herbicides were applied, and after seven days reading collection were started. Two way analysis of variance was used. Methods used in Microbial determination involved Ashby medium for Azotobacter isolation, agar medium for Actinomycetes and M9 mineral salt medium for Heterotrophic aerobic bacteria incubated at 30°C Azotobacter count (AZB) in triazine and 2,4-D Calliherb treated soil increased from 7th day to 28th day after treatment, which ranged from (7.4 x 10<sup>3</sup> to 14.55 x 10<sup>3</sup>) and (8.3 x 10<sup>2</sup> to 14.78 x 10<sup>3</sup>) CFU/g soil respectively. Similarly Azotobacter count was observed in paraquat and Glyphosate treated soil, which varies from (11.9 x 10<sup>2</sup> to 8.4 x 10<sup>3</sup>) and (10.5 x 10<sup>2</sup> to 5.80 x 10<sup>3</sup>) CFU/g soil respectively at (p<0.05). Results revealed that herbicides application significantly affected the activity of Azotobacter, Arthrobacter, heterotrophic aerobic bacteria, actinomycetes and fungal population.

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### INTRODUCTION

Herbicides are used to limit reduction in crop yield and quality due to weed competition, yield contamination and interference with harvesting. Herbicide use has undoubtedly contributed to crop yield increase and the efficiency of production. However, their widespread have detrimental and unexpected effects on wildlife both within crops and in associated semi-natural habitats in farmland (Jauzien and

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Rodwell, 1995). Developments in assessing risk to non-target organisms since that time have concentrated on non-target areas, particularly field boundaries, where pesticide drift is likely to occur (Stefanoviš *et al.*, 2007). However, significant changes in both population size and ranges have been recorded for common bird species of farmland (sustainability indicators) over the past 30years (Stefanoviš *et al.*, 2001). There are concerns that significant ecological changes have occurred or are occurring within arable and horticultural crops associated with herbicide use (Moore-Kucera and Dick, 2008). There is the need to understand the direct and indirect potential effects of herbicides, which may be mediated by the removal of plant biomass or particular plant species with which higher trophic taxa are associated, or by affecting processes within soils (Full *et al.*, 2000). During the last decades, a large number of herbicides have been introduced as pre and post-emergent weed killers in many countries of the world (Stefanoviš *et al.*, 2000). In Nigeria, herbicides have since effectively been used to control weeds in agricultural systems (Adenikinju and Folarin, 1976).

Presently, because of the continued realizations of the usefulness of herbicides, larger quantities are applied to the soil by farmers. However, the fate of these compounds in the soils is becoming increasingly important since they could be leached; in which case ground water is contaminated or immobile, and persists on the top soil (Ayansina *et al.*, 2013). These herbicides could then accumulate to toxic levels in the soil and become harmful to microorganisms, plant, wild life and man (Amakiri, 1982). There is an increasing concern that herbicides not only affect the target organisms (weeds) but also the microbial communities present in soil functions which include organic matter degradation, the nitrogen cycle and methane oxidation (Hutsch, 2001).

Glyphosphate and paraquat have been reported to cause activation in soil cellulase and invertase (Ratcliff *et al.*, 2006), while, diquate and paraquat increased fungal populations (Krzysko-Lupicka *et al.*, 1997). A degradative microbial population that has adapted to the compounds may exist in many contaminated locations. Therefore, it is necessary to search for various microorganisms which would be able to reduce water or soil pollution. All the transformations of nutrients occurring in soil are stimulated by the enzymes that condition their conversion into forms available to plants and microorganism. Microbial enzymes are frequently referred to as indicators of purity of soil environment (Aon and Colaneri, 2001). Microbial activity measurements appear as good indicators of the degree of pollution of contaminated soils (He *et al.*, 2007).

## **MATERIALS AND METHODS**

Study was conducted in Dukkumari, Damaturu local Government Area of Yobe state, Nigeria. Yobe State is located in the North Eastern Region of Nigeria at latitude 120

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00°N and longitude 110 30'E. It lies within the Sahel savannah vegetation, the climate is characterized by long hot and dry season from October to May and short rainy season from June to September with annual mean rainfall of 500-1000 mm for period of five years (Peel, *et al* 2007). The average temperature in the State is about 30oC that is experienced annually around April (Iloeje, 2001).

## **Treatments and Experimental Design**

Treatments consist of four groups of herbicides (triazine, 2,4-D calliherb, glyphosate, paraquat, and control). These were laid down in a Randomized Complete Block Design (RCBD) replicated five times.

## **Herbicides Application**

The herbicides were applied using a CP Knaps Sack Sprayer with a proljet nozzle at company recommended rates of 4l/h (at 350 ml in 15 L sprayer) for paraquat, glyphosate and 2,4-D Calliherb, while recommended rate of 3 kg/h (for triazine powder). Each herbicide was applied to one plot except for the Control.

Soil samples were collected from a depth of 0-3 cm from each plot (Saeki and Toyota 2004). Each plot was divided into 5 blocks, and from each block five soil samples collected randomly. Samples collected from each block were referred to as sub-samples and were thoroughly mixed to form one composite sample. The composite samples were homogenized, sieved (2.0 mm) and analysed. The effect of different herbicides in the soil was analysed in response to soil enzyme activity and microbial enumeration with respect to control soil in triplicates at regular intervals i.e. 7, 14, 21 and 28th days after treatment for period of 4 weeks respectively.

## **Determination of Azotobacter**

An *Azotobacter* activity was determined using the method of Clark (1965). Ten grams of soil samples were weighed and dissolved into the 90ml of sterile distilled water at 30°C for 15 minutes. After this, solutions were serially diluted in a proportion of 10<sup>-1</sup> up to 10<sup>-9</sup> in sterile distilled water. From these, 1 ml of each dilution was planted on to triplicate agar Ashby medium (5g glucose, 5g mannitol, 0.1g CaCl<sub>2</sub>.2H<sub>2</sub>O, 0.1gr MgSO<sub>4</sub>.7H<sub>2</sub>O, 5mg Na<sub>2</sub>MoO<sub>4</sub>.2H<sub>2</sub>O, 0.9g K<sub>2</sub>HPO<sub>4</sub>, 0.1g KH<sub>2</sub>PO<sub>4</sub>, 0.01g FeSO<sub>4</sub>.7H<sub>2</sub>O, 5g CaCO<sub>3</sub> and 15 g agar in 1 L distilled water, pH 7.3) and incubated at 30°C for 72 hour.

## **Determination of Actinomycetes**

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Actinomycetes were determined using the method of Rahaman *et al.* (2011). One gram of dried soil was suspended in 99 ml distilled water and serially diluted in distilled water up to  $10^{-7}$ . An aliquot of 0.1 ml of each dilution was taken and spread evenly over the surface of actinomycetes isolation agar (AIA) medium (Pine and Watson, 1959) supplemented with cyclohexamide (50 µg/ml) and nystatin (50 µg/ml). Waksman (1961), plates were incubated at 30°C for 7 days. After 7 days incubation, whitish pin-point colonies, characteristic of actinomycetes, with a clear zone of inhibition around them was observed.

## **Determination of Total Heterotrophic Aerobic Bacteria**

Adopting the method of Fisher *et al.* (1992), microbial counts of bacteria that utilized substrates as sole carbon sources were carried out using M9 mineral salts medium. The substrates used were naphthalene, benzene, toluene, ethylbenzene, xylene, 1-methylnaphthalene, 2-methylnaphthalene, m-cresol, p-cresol, 1-naphthol and 2-naphthol in the vapour phase (was added as a few crystals, in the case of solid substrates or 100 µl in a pipette tip, in the case of liquid substrates, to the lids of sealed petri dishes). A control plate with no added carbon sources was used to indicate little or no growth in the absence of a carbon source.

## **Determination of Fungi**

Culture media used are Nutrient agar (NA), potato dextrose agar (PDA) and Eosinmethylene blue (EMB) agar (LABM) and were all prepared according to the manufacture's specification. Serial dilution of the effluents was carried out and 1 ml each of the diluents was aseptically introduced into different plates after which sterile prepared medium was introduced using the pour plate technique and incubated at the 37°C for 24hrs. Biochemical tests were carried out on pure bacterial cultures using standard methods (Anon, 1994; Cappucino and sherma, 1998).

In estimating the fungi, PDA plates supplemented with streptomycin inoculated with the serial diluents of samples by pour plate technique and incubated at 30°C for 72 hrs (Adesemoye and Adedire, 2005). Macroscopic and microscopic examinations including staining for morphological characteristics were carried out on fungal isolates and identification was done based on the characteristics using oxidase, catalase, and motility.

## **RESULTS**

### **Effects of herbicides on the Microbial Dynamics**

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The variations in microbial population in different herbicide treated soil were presented in terms of  $\log_{10}$  transformed of CFU/g soil (Figure 1-5). Herbicides application significantly affected the activity of *Azotobacter*, *Arthrobacter*, heterotrophic aerobic bacteria, actinomycetes and fungal population ( $p < 0.05$ ). *Azotobacter* count (AZB) in triazine and 2,4-D Calliherb treated soil increased from 7<sup>th</sup> day to 28<sup>th</sup> day after treatment, which ranged from ( $7.4 \times 10^3$  to  $14.55 \times 10^3$ ) and ( $8.3 \times 10^2$  to  $14.78 \times 10^3$ ) CFU/g soil respectively. Similarly AZB count was observed in paraquat and Glyphosate treated soil, which varies from ( $11.9 \times 10^2$  to  $8.4 \times 10^3$ ) and ( $10.5 \times 10^2$  to  $5.80 \times 10^3$ ) CFU/g soil respectively (Figure 1). The AZB count with respect to different herbicides and days after treatment was found to be significant ( $P < 0.05$ ).

The effect of triazine on *Arthrobacter* count (ARB) showed an increasing trend from 7<sup>th</sup> day ( $16.7 \times 10^2$  CFU/g soil) to 21<sup>st</sup> day ( $24.7 \times 10^2$  CFU/g soil) after treatment. However, the effect of 2,4-D Calliherbe showed a decreased in trend in *Arthrobacter* count up to 14<sup>th</sup> day ( $53.6 \times 10^2$  CFU/g soil), and then gradually increased and found to be highest on 28<sup>th</sup> day ( $59.7 \times 10^2$  CFU/g soil) after treatment. Further, the *Arthrobacter* count in paraquat and glyphosate treated soil exhibited an increasing trend from 7<sup>th</sup> day to 28<sup>th</sup> day, which varies from ( $10.5 \times 10^3$  to  $20.5 \times 10^3$  CFU/g soil) and ( $7.05 \times 10^3$  to  $9.8 \times 10^3$  CFU/g soil) respectively (Figure 2). The control soil significantly showed high ARB count as compared to treated soil ( $p < 0.05$ ). The heterotrophic aerobic bacterial count (HAB) in triazine treated soil showed an increasing trend from 7<sup>th</sup> day ( $18.6 \times 10^6$  CFU/g soil) to 28<sup>th</sup> ( $25.4 \times 10^6$  CFU/g soil) after treatment. Significant difference was also observed in HAB population at different days after the application of 2,4-D Calliherbe which varies from 7<sup>th</sup> days ( $31.4 \times 10^6$  CFU/g soil) to 28<sup>th</sup> day ( $35.2 \times 10^6$  CFU/g soil). Paraquat application significantly reduced HAB count ( $p < 0.05$ ) from 7<sup>th</sup> day ( $8.9 \times 10^2$  CFU/g soil) to 28<sup>th</sup> day ( $1.32 \times 10^2$  CFU/g soil) after treatment (Sebiomo *et al.*, 2011). Glyphosate treated soil exhibited an increasing trend from 7<sup>th</sup> day ( $5.29 \times 10^5$  CFU/g soil) to 28<sup>th</sup> day ( $7.3 \times 10^5$  CFU/g soil) (Figure 3).

Actinomycete count showed significant difference ( $p < 0.05$ ) among the different herbicide treated soil. An increasing trend was observed from 7<sup>th</sup> day to 28<sup>th</sup> day in triazine and 2,4-D Calliherbe treated soil, which varied from ( $9.5 \times 10^2$  to  $13.5 \times 10^2$ ) CFU/g soil and ( $12.4 \times 10^2$  to  $14.9 \times 10^2$ ) CFU/g soil respectively. Similar trend was also exhibited in paraquat and glyphosate treated soil, which ranged from ( $2.7 \times 10^2$  to  $6.6 \times 10^2$ ) CFU/g soil and ( $8.3 \times 10^2$  to  $10.3 \times 10^2$ ) CFU/g soil respectively. The ACT count were severely affected by paraquat treatment as compared to other herbicides furthermore, Glyphosate was observed to be less toxic than paraquat against the actinomycetes (Figure 4). The variation in

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ACT count with respect to different herbicides and days after treatment was significant ( $p < 0.05$ ).

The fungal count in Triazine, 2,4-D Calliherbe and paraquat treated soil exhibited an increasing trend from 7<sup>th</sup> day to 28<sup>th</sup> day after treatment, which varied from ( $1.57 \times 10^3$  to  $2.64 \times 10^3$ ) CFU/g soil; ( $70.5 \times 10^3$  to  $75.7 \times 10^3$ ) CFU/g soil and ( $2.1 \times 10^2$  to  $29.2 \times 10^2$ ) CFU/g soil respectively. The data suggested that the FUN count was moderately inhibited by paraquat as compared to triazine and 2,4-D Calliherbe. However, the application of 2,4-D Calliherbe resulted in higher FUN count as compare to other herbicides application as well as the control (Figure 5). The FUN count in Glyphosate treated soil was found to be less on 14<sup>th</sup> day ( $2.5 \times 10^2$  CFU/g soil. but gradually increased after 14<sup>th</sup> day. The variation in FUN count with respect to different herbicides and days was significant ( $P < 0.05$ ).

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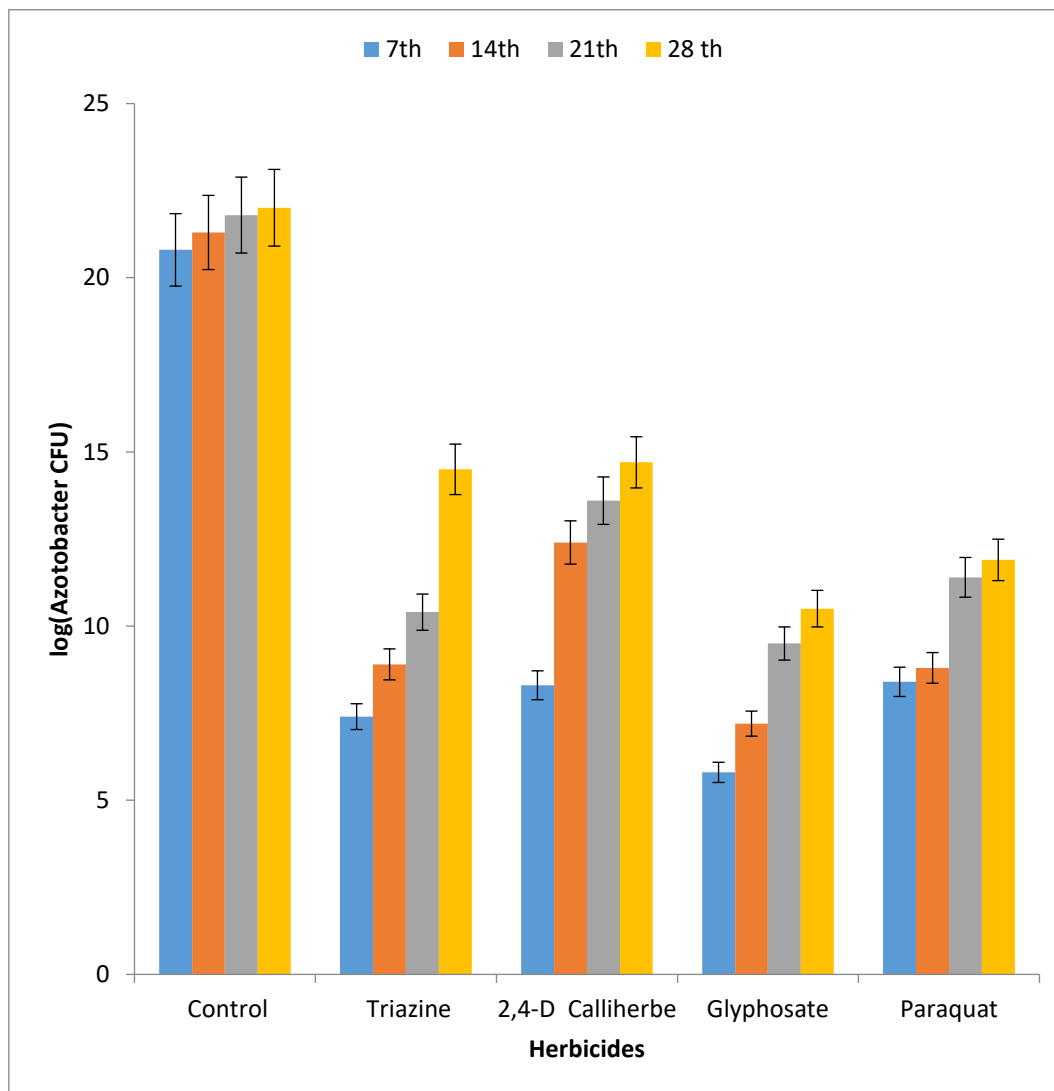


Figure 1: Effect of herbicides on the population of *Azotobacter* bacteria



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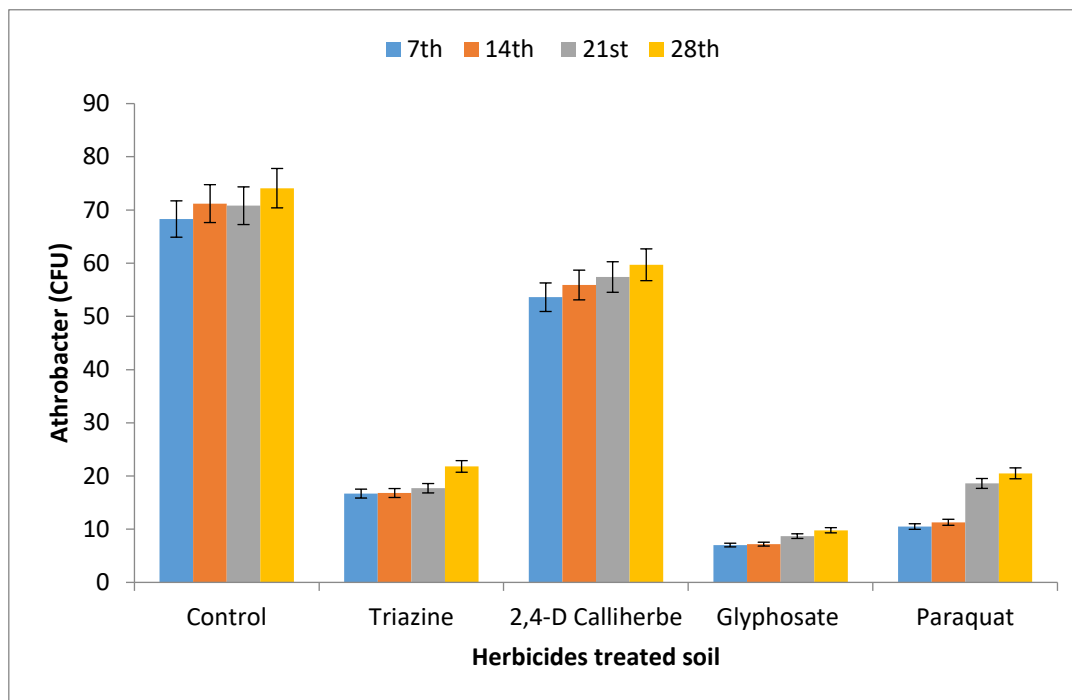


Figure 2: Effect of herbicides on the population of *Athrobacter* bacteria

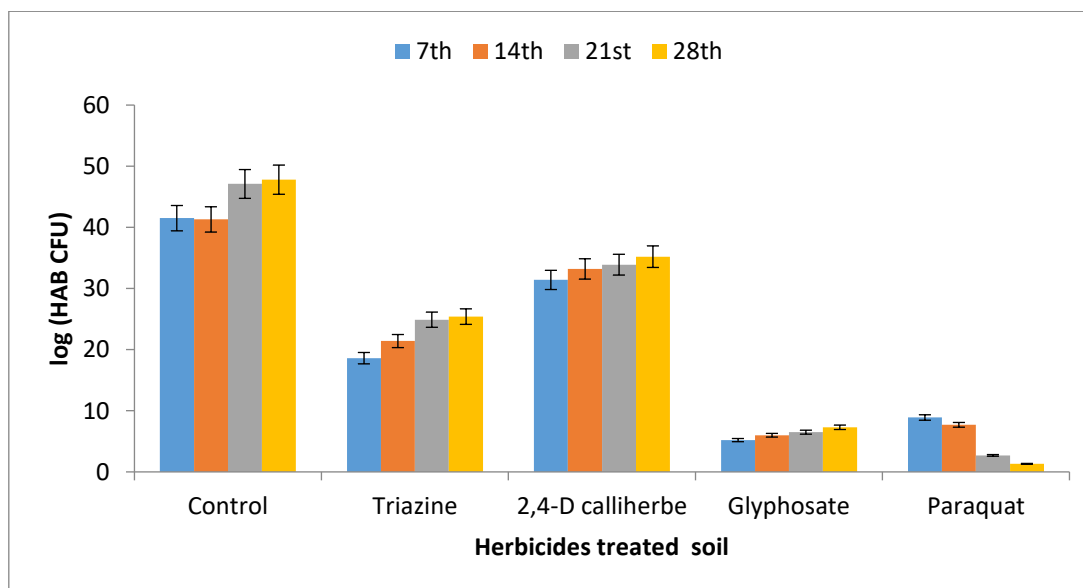


Figure 3: Effect of different herbicides on Heterotrophic aerobic bacteria (HAB) Population

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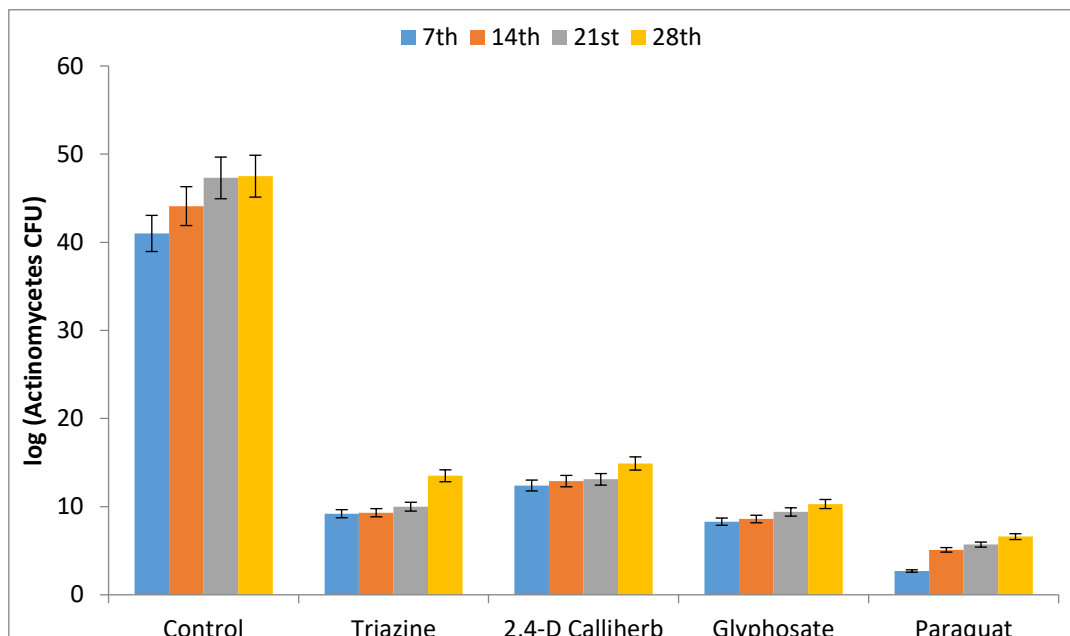
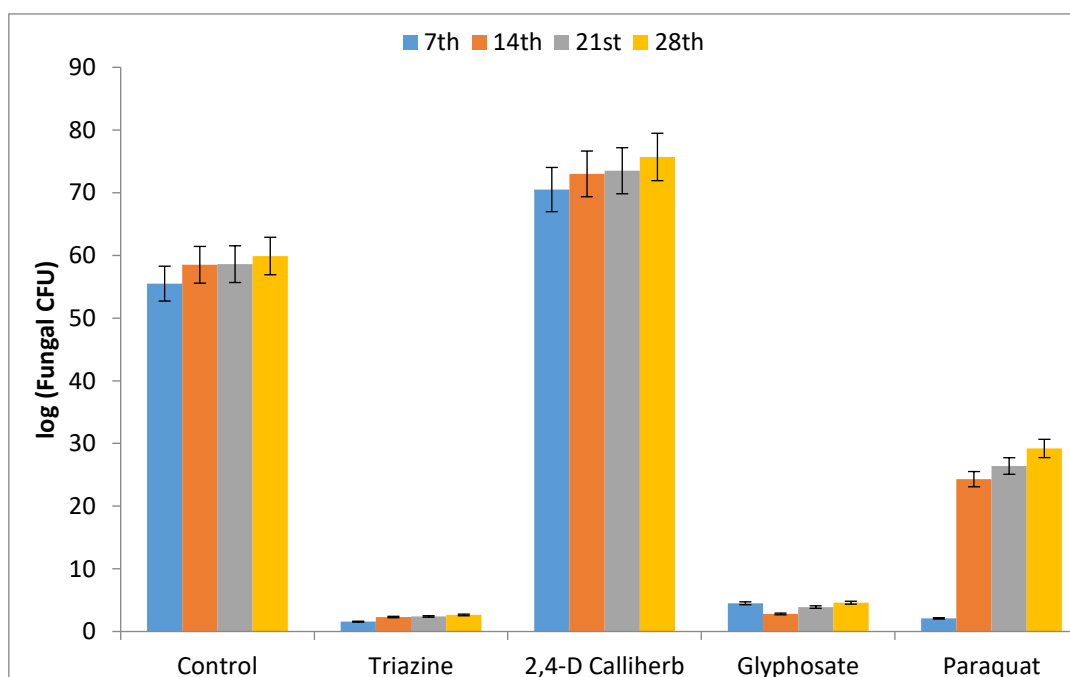


Figure 4: Effect of herbicides treated soil on the population of Actinomycetes bacteria (ACT)



## Figure 5: Effect of herbicides on the Fungi population

### DISCUSSION

#### Effects of Herbicides on the Microbial Dynamics

Unintended consequence of herbicides application may be the reduction of sensitive and/or stimulation of certain microbial groups with or without detriment of co-existing microbial populations that may compete for available resources. Microorganisms are a highly heterogeneous group, including aerobes, anaerobes, heterotrophs, autotrophs, saprophyte, symbiont and parasites. The fate of the herbicide residues in soil is a matter of great concern since they would persist on top of soil (Ayansina *et al.*, 2013), accumulate to toxic level and become harmful to microorganism (Amakiri, 1982), and bring about changes in nutrient levels (Taiwo and Oso, 1997; Wang *et al.*, 2008). Some microorganisms have the ability to degrade herbicide, while others were adversely affected depending upon the application rate/dose and type of herbicide used (Wilkinson and Lucas, 1969; Ayansina and Oso, 2006; Sebiomo *et al.*, 2011). Thus, the effect of herbicides on soil microbial population may be either stimulating or depressive depending on the type of the agrochemicals its concentration, mode of application, groups of microorganisms and environmental conditions (Subhani *et al.*, 2000; Zain *et al.*, 2013). Herbicides decomposition is frequently faster in soil that contains high organic matter, presumably because of more vigorously microbial activity. Use of herbicide can reduce total microbial populations in soil, where some researchers attribute it to reduced input of organic residues (Waiwright, 1978). Various studies have revealed that herbicides can cause qualitative and quantitative change in soil microbial populations (Taiwo and Oso, 1997; Busse *et al.*, 2001; Ayansina and Oso, 2006; Latha and Gopel, 2010).

There was gradual rise in *Azotobacter*, *Arthrobacter*, heterotrophic aerobic bacteria, actinomycetes as well as fungal count in different herbicide treated soil in course of time. The initial rise in microbial count in herbicide treated soil may be due to their ability to temporarily mineralised and use the herbicide as energy source (Kunch *et al.*, 1985). However, the decline in HAB count was exhibited in Paraquat treated soil and fungal count in Glyphosate treated soil, which may be due to the fact that the microbial populations were tolerant to the treated herbicide, therefore were susceptible to the product of soil herbicide interaction, which could have possibly been bactericidal or fungicidal (Taiwo and Oso, 1997). There exist positive correlation between microbial population and soil organic matter, and the variation in microbial activity represents capacity of soil microorganisms to respond to the inputs of herbicides soil (Sebiomo *et al.*, 2011). An increase in reproductive ability of bacteria

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with time after the initial phase of depression, resulting from toxic effect of triazine was reported (Kole and Dey 1989; Yu *et al.*, 1993).

The *Azotobacter* is found to be less as compared to total bacteria (Barman *et al.*, 2009). Similarly, *Azotobacter* could not regain its lost population indicating it's relatively higher susceptible than the total bacterial population to triazine. Triazine decrease the fungal count as compare to other soil microorganisms (Min *et al.*, 2007; Xia *et al.*, 2011). Enhancement of soil microorganisms was probably associated with the degradation of triazine. High concentration of triazine application decreases the soil microbial count and had adverse effects on microbial activity (Xia *et al.*, 2011). However the fungal population (unlike bacteria) took more time to recover from the detrimental effect caused by herbicides (Shukla and Mishra, 1997). Besides, herbicides can influence fungal count directly or indirectly by affecting the interaction of fungi with other microorganism (Wardle and Parkinson, 1990; Araujo *et al.*, 2003). The order of inhibition of triazine on soil microorganism is bacteria > actinomycetes > fungi. Higher rate of 2,4-D Calliherbe application impaired microbial parameters, enzyme activity to a greater extend and had a long lasting negative effect on soil fertility (Perucci *et al.*, 2000). These xenobiotic compounds force the microbial biomass to direct a large part of its energy budget into reducing mineralization activity. Paraquat is also known to be bounded strongly and coherently to soil components including clay minerals and organic matter, therefore limit the access of microorganisms to paraquat in soil (Smith and Mayfiel, 1997; Bromilow, 2003; Isenring, 2006).

Absorption of paraquat rapidly decreases the bioavailability of herbicide in soil, and the capability of absorption to deactivate paraquat application (Robert, 2002). Some microbial species are capable of metabolizing paraquat as a source of carbon (Tu and Bollen, 1968). The presence of glyphosate may cause changes in microbial population as well as overall microbial activity (Wardle and Parkinson, 1990). Glyphosate is degraded primarily by microbial metabolism. The degradation of glyphosate is slower in soil with a higher adsorption capacity. Degradation rate was also affected by specific soil microbial community (Carlisle and Trevors 1988), and also vary considerably in different soils. Some microbes such as actinomycetes and azotobacter may use herbicide as a source of carbon and energy (Radosevich *et al.*, 1995). Glyphosate is an organophosphonate that can be used as a source of P, C and N by either gram-positive or gram-negative bacteria (Van Eerd *et al.*, 2003), and hence increase in bacterial abundance and biomass (Zabaloy *et al.*, 2008) and fungal count (Araujo *et al.*, 2003; Ratcliff *et al.*, 2006). The increased in the population of actinomycetes and fungi after glyphosate treatment was observed (Araujo *et al.*,

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2003). Certain microbes such as (fungi and actinomycetes) are able to metabolized xenobiotic like pesticides, and thus have the ability to flourish and multiply following an initial transient decrease in number. Actinomycetes showed a significant increase in glyphosate treated soil with time, which indicated that actinomycetes may use glyphosate as nutrient and energy source (Araujo *et al.*, 2003).

## CONCLUSION

Soil is a part of the terrestrial compartment, and supports all terrestrial life forms. Thus, without proper soil protection policies, numerous problems may arise, like reduction of soil fertility, erosion, groundwater contamination, insufficient water holding capacity and loss of biodiversity. To assess soil quality, it is essential to measure all potential changes in biological soil properties, because they are highly sensitive to any environmental perturbations and stresses. A usual approach to diagnose soil quality, is to use a soil microbial indicators, which are very sensitive and respond quickly to environmental alterations.

## RECOMMENDATIONS

From the results of this study, the following recommendations are made:-

1. There is need to develop possible ways of developing new improved herbicides which is less toxic to the soil
2. Further studies is required on organic herbicides which is a better option to synthetic herbicides effect on soil enzymes and microbial population in long term application.

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## COMPARATIVE ANALYSIS BETWEEN FORCES ACTING ON A CARBON STEEL AND METAL MATRIX CONNECTING ROD

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### ABSTRACT

*The purpose of this research is to compare the results of the common forces acting on metal matrix composite connecting rod and the Regular (carbon steel) connecting rod and use the value of the result obtained to advance reasons why automotive application especially connecting rods are made by metal matrix composite materials. Metal-matrix composites (MMCs) have emerged as a class of materials widely used in the engineering field. The general characteristics possessed by metal matrix composites are found to be the reason for using it in the automotive application in preference to high energy intensive metals. The research work commenced with casting of the metal matrix composite sample connecting rod by stir-casting method and purchasing the Regular (carbon steel) connecting rod. The two types of connecting rods were earlier tested on a Toyota starlet of 12 valve model E series live engine. Theoretical calculation of forces acting on the two types of connecting rod, ie, Regular (carbon steel) connecting rod, and MMC connecting rod was carried out and the result obtained are: 23760N, 12672N,  $3.14 \times 10^{-6} \text{N/m}^2$ , and 84.7Mpa: 10464.8N, 1358.53N,  $2.84 \times 10^{-6} \text{N/m}^2$ , and 81.7Mpa respectively, show that stress induced in metal matrix connecting rod is lower than that of the regular (carbon steel) connecting rod. Hence the replacement of connecting rod material with MMC will give improved strength and reduce induced stress in the structure.*

**Keywords:** *Connecting rod, MMCs, Stiffness. Stir- casting, Whipping stress.*

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### INTRODUCTION

Metal-matrix composites (MMCs) have emerged as a class of materials for advanced structural, aerospace, automotive, electronic, thermal management, and wear applications. The general characteristics possessed by the composite materials are found to be the reason for using it in the automotive applications such as the connecting rod. The automobile engine connecting rod is a high volume production, critical component. It converts the reciprocating motion of the piston into rotary motion of the crankshaft. Lighter connecting rods helps to decrease load caused by

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forces of inertia in engine as it does not require big balancing weight on crankshaft (Kuldeep et al,2013).The reduction in weight, increased in stiffness and increase in strength of a metal matrix composite (MMC) connecting rod when compared to the conventional steel connecting rod have motivated researchers in this area in recent times, but the current cost to produce a metal matrix connecting rod still makes this technology unfeasible for mass production (Aigbodion,etal,2016).

The connecting rod has sometimes been described as one of the most important components in a conventional engine design. Here, the alteration from a stepped to a generously radiused shoulder of the connecting rod at the junction of the shank to big-end bolt lugs significantly reduced stress concentration in the connecting rods and is one of the important modifications that ultimately made possible a safe doubling in power output(Nunney,1998).

The automobile engine connecting rod is a machine member which is subjected to alternating direct compressive and tensile forces to a complex state of loading. It undergoes high cyclic loads of order of  $10^8$  to  $10^9$  cycles which range from high compressive loads due to combustion to high tensile loads due to inertia ,it is the intermediate member between the piston and crankshaft. Its primary function is to transmit the push and pull from the piston pin to the crank pin thus converting the reciprocating motion of the piston into rotary motion of the crank.

The nature of the loading on the connecting rod is that it is subjected to a combination of axial and bending stress and, the former arising from reciprocating inertia forces and cylinder gas pressure and the loss from centrifugal effects as it transmit the push and pull from the piston pin to the crank pin. “Due to its large volume production, it is only logical that optimization of the connecting rod for its weight or volume will result in largescale savings”, It can also achieve the objective of reducing the weight of the engine component, thus reducing inertia loads, reducing engine weight and improving engine performance and fuel economy.

The experimental material used for the research is metal matrix composite connecting rod produced by stir-casting method, and purchasing the regular carbon steel connecting rod to serve as control.

## **Methods**

The two types of connecting rods were earlier tested on a Toyota starlet of 12 valve live engine model E series of Single overhead camshaft (SOHC) = 1.3L.

It is a four stroke, four cylinder compression ignition engine with the following parameters.

Bore x stroke; 73.0mm x 77.4mm

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Displacement; 1,295cc

Compression ratio; 5:1

Standard output range of the engine is from 65hp (48kw) to 82hp (61kw) at 600rpm with a torque of 98N-m at 3000 rpm to 7716ftlb 104N-m) at 5,200 rpm.

## **Theoretical analysis.**

A connecting rod consists of a long shank a small end and a big end. The crosssection of the shank may be rectangular, circular, tubular “I section and H section”. Generally circular sections are used for low speed engines while I section is preferred for high speed engines (Dharun and Arun, 2013)

A connecting rod is subjected to the following forces;

1. Force due to gas or steam pressure and inertia of reciprocating parts.
2. Inertia bending force, and
3. Force acting on a horizontal plane

## **Experimental calculation on Regular (carbon steel) connecting rod.**

Engine specifications:

Single overhead camshaft (SOHC) = 1.3L

Diameter of the piston = 110mm

Mass of the reciprocating parts = 2kg

Length of the connecting rod from centre to centre = 325mm

Length of stroke = 150mm

R.P.M = 2500

Compression ratio = 5:1

Maximum force on the piston due to pressure

$FL = \pi D^2 \times \text{pressure}$

$= (73)^2 \times 2.5 \times \text{mm} \times \text{mm} = 10464.8 \text{ N}$

Force in the connecting rod:  $FC=FL=23760\text{N}$ .

Inertia force of reciprocating parts is maximum, when the crank is at the inner dead centre, i.e. when  $\theta = 0$

Therefore  $FI = MR (\theta_{\text{max}})^2 r$

$= 2 (261.8)^2 \times 0.075 = 12672\text{N}$

## **Experimental calculation on MMCs connecting rod.**

Available Data:

Diameter of piston = 73mm

Mass of reciprocating parts = 2kg

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Length of connecting rod from centre to centre = 120mm

Length of stroke = 77.4mm

RPM = 1100

Compression ratio = 5:1

Taking density  $P = 2.86\text{g/cm}^3 = 0.00286\text{kg/cm}^3$

Maximum explosion pressure = 2.5 N/mm<sup>2</sup>

Maximum bending or whipping stress due to inertia bending forces

$\sigma_c(\text{max}) = 31.4 \times 10^6 \text{ N/m}^2$

Maximum compressive stress in the connecting rod will be,

$\sigma_c(\text{max}) = \text{MPa}$

Maximum force on the piston due to pressure

$FL = \pi D^2 \times \text{pressure}$

$= (73)^2 \times 2.5 \times \text{mm} \times \text{mm} = 10464.8 \text{ N}$

## Discussion and Results

Theoretical calculation of forces acting on the two types of connecting rod, ie, Regular (carbon steel) connecting rod, and MMC connecting rod was carried out. As the connecting rod perform its primary function to transmit the push and pull from the piston pin to the crank pin and converting the reciprocating motion of the piston into rotary motion of the crank, gudgeon pin position at each stage and resultant inertia forces (parallel and perpendicular) components acting on the connecting rod, Fig. 3.0, i.e. :

In the connecting rod PC, a crank OC, rotates with a uniform angular velocity

$\omega$  rad/s. Also in CQNO as shown in fig.3.0

## CONCLUSIONS

The following conclusions can be drawn from this study:

The results obtained show that the forces acting on the Regular (carbon steel) connecting rod is higher in magnitude intensity and has maximum induced stress.

It is clear that the stress induced in the metal matrix composite connecting rod is found to be lower than that of regular connecting rod.

Lighter connecting rods help to decrease load caused by forces of inertia in engine.

Replacement of connecting rod material with MMC will give good strength, reduced weight, and induced stress in the structure, hence its usage for connecting rod material is highly recommended.



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## ISOLATION OF HYDROCARBON UTILIZING BACTERIA FROM PETRO-CHEMICAL POLLUTED SOIL IN BAUCHI METROPOLIS, NIGERIA.

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### Abstract

The aim of the study was to isolate Hydrocarbon Utilizing Bacteria from Petro-chemical polluted soil. A total of twenty-five soil samples were collected from five different mechanic workshop in Bauchi metropolis. The samples were bulked together to form one composite soil sample. The samples were examined for temperature, pH and moisture content. In this present study 13 bacteria genera were isolated by enrichment culture technique using nutrient agar, and utilization of hydrocarbon by the isolates were investigated on agar agar supplemented with 0.2ml refined petroleum products (Petrol, engine oil, diesel and kerosene). The isolated bacteria were characterized by morphological and biochemical test. Total heterotrophic bacteria count ranged from  $1.59 \times 10^4$  to  $8.5 \times 10^4$  cfu/ml and total hydrocarbon utilizing bacteria count ranged from  $1.0 \times 10^4$  to  $7.0 \times 10^4$  cfu/ml, the bacteria isolates found in all sample sites were mainly staphylococcus sp, Arthrobacter, flavobacterium and Alcaligenes faecalis. The highest degradation performance was observed on micrococcus sp, pseudomonas sp and Bacillus sp and the lowest degradation performance was observed on staphylococcus sp, flavobacterium sp, and corynebacterium. The temperature values obtained from different petrochemical polluted soil during this investigation fall within mesophilic range and the pH of each soil sample tends from slightly acidic towards neutrality.

**Keywords:** Petro-chemical, Hydrocarbon, Bacteria and Degradation.

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### INTRODUCTION

The discovery of petroleum resulted in tremendous changes on the globe. It speeds up civilization through mechanization and industrialization. In addition to the good improvement attributed to petroleum, it has ushered in environmental contamination, wreaking havoc on the biotic and abiotic components of the ecosystem (Mi-ilion *et al*, 2009). Chemical compounds that enters the ecosystem as a result of human activities build up in soil and water reservoirs. As a result, soil could be thought of as a long-term repository of environmental toxins from which these substances reach terrestrial food chain and subsurface water. The ability of soil microorganisms to multiply swiftly even in unfavorable environmental conditions indicated a high level of receptivity to either positive or negative effects such as those

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caused by contaminants (Adriaens *et al*, 2001). Several researchers have reported that soil contamination with crude oil can cause shift in microbial populations (Ellis *et al*, 2001). Microorganisms that can utilize petroleum oil and hydrocarbon for growth, nutrition and metabolic activities are abundant in oil contaminated environments. Microorganisms in the soil play a critical role in the survival of the terrestrial ecosystem. They are important in the detoxification of toxins such as heavy metals and radionuclides, as well as the recycling of elements (such as carbon, nitrogen, Sulphur and phosphorus) and cleanup of oil spillage (Makut and Ishaya, 2010). Rise in crude oil mining activities as well as poor maintenance of oil pipelines and transportation vessels. As a result, crude oil and its products are released into the land and aquatic habitats. Despite the fact that some microorganisms have hydrocarbon-degrading capability (Romanus, *et al*; 2015). Extremely high quantities of crude oil pollution in the environment may have hampered the expression of the characteristics, resulting in an imbalanced carbon-nitrogen (C; N) ratio. Oil spills cause this disequilibrium which is harmful to microorganisms.

## **MATERIAL AND METHODS**

### **Sampling Sites/Location**

Soil samples (about 200g each) were collected from petro-chemical polluted soils mainly from Bauchi State, metropolis. A scoop was used to remove debris of organic particles from the surface of the soil. Surface soil (0 to 10 cm deep) was collected from each site at random with sterile spatulas. Altogether 25 soil samples were collected from different sites in Bauchi metropolis. The temperature of each soil sample was taken, specific sites included are Gwallameji mechanic workshop and Yankari garage. Dass moto-car workshop, Yelwa mechanic workshop and Dan Gombe mechanic workshop. These samples were used as the source of petroleum-degrading microorganisms. The age of contamination of these sites varied from 3-25 years.

### **Determination of physiochemical properties of soil.**

The following physiochemical parameters of each contaminated soil samples were analyzed, moisture, pH and temperature of each soil sample was determined.

### **Sterilization of glassware and media**

Petri dishes, test tubes, flasks, etc. were sterilized in hot air oven at 160°C-180°C for 2 to 3 hours. Before they were put in the oven they were washed, dried and packed in aluminum foil.

Media was sterilized by autoclave at 121°C for 15 minutes.

### **Enumeration of total heterotrophic bacterial count**

The total heterotrophic bacterial count was enumerated using the pour plate method on nutrient agar. Soil suspension were prepared by 10-fold serial dilutions with one

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gram of soil and 0.1ml of  $10^4$  and  $10^6$  dilutions was spread on the plates in triplicates, and incubated at  $30^\circ\text{C}$  for 24 to 48 hours. The coliform forming units (CFU) of the bacterial were counted after incubation. According to Jayanthi, (2015).

## **Enumeration of Hydrocarbon Utilizing Bacteria**

Hydrocarbon utilizing bacteria in the sample were enumerated by viable count method using the surface spreading technique on nutrient agar. Soil suspension were prepared by 10-fold serial dilution with 1g Of soil and 0.1ml of  $10^{-4}$  and  $10^{-6}$  dilutions was spread onto nutrient agar plates in triplicates. After inoculations of the nutrient agar plates with the samples, a sterile filter paper (Whatman No.1), impregnated with crude oil, was aseptically placed onto the inside of the lid (cover) of petri dishes and sealed with a masking tape. The filter paper saturated with crude oil served as a sole carbon and energy source for growth of the microorganism on the surface through a vapours pressure phase transfer. The plates were incubated in an inverted position at room temperature for seven days, after which the average counts from triplicates plates were counted and recorded.

## **Utilization of Petroleum Products by isolates**

A loop full of isolates on nutrient agar were picked and inoculated on agar - agar plates in triplicates 0.2ml of each test substrate (petrol, engine oil, diesel, kerosene) was measured and spread aseptically on the surface of the agar-agar and plates were inverted and incubated at  $35^\circ\text{C}$  for 24 \_\_ 48 hours and the utilization of each test substrates were estimated visually, according to (Nada, 2007).

## **Morphological characterization for bacterial identification**

Morphological examination was done by phase contrast microscopy and other methods according to (M. nada 2007) and Bergeys Manuel of systematic Bacteriology (1984) as follows.

## **Gram staining**

For each bacterial isolate a heat fixed smear from 24 hours old cultures was prepared, stained with crystal violet solution for 1-2 minutes, rinsed rapidly with water and iodine solution was added and the smear was blot dried. The slide was washed with 95% ethanol for 15 seconds, rinsed with tap water and stained with slaframine for 20 seconds. The slide was air dried and examined under microscope.

## **Motility**

Tubes of motility medium were prepared by soaking the gelatin in the water for 30 minutes and other ingredients were added and sterilized at  $115^\circ\text{C}$  for 20 min. The

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medium was stabbed with the isolate to a depth of about 5cm. and incubated at the 37c. Motile organisms migrated through the medium which became turbid: growth of non-motile organism was confined to the stab.

## **Biochemical tests for bacterial identification**

Generally, biochemical test in addition to Gram's reactions are important in the identification of bacteria. This is because some bacteria species have similar morphological cultural or even staining reaction, which make exhaustive biochemical test important in bacteria identification.

### **Catalase test**

The catalase test was carried out as described by Oguile *et al.*, (2001). Two drops of hydrogen peroxide (3%) was placed on a clean grease-free glass slide. Using a clean glass rod, the test organism was transferred to one of the drop and other used as the control. Formation of bubble or effervescence on the slide indicates a positive result.

### **Oxidase test**

The method used was the wet filter paper described by Oguile *et al.*, (2001). This is used to differentiate bacteria that can produce oxidase enzyme from non-oxidase producing type. Oxidase catalases the electron transport between the bacteria electron donor in the bacteria and a redox dye (tetraethyl p-phenylenediaminedihydrochloride) which is reduced to deep purple color. 1% tetraethyl p-phenylenediaminedihydrochloride was dissolved in 1 litre of distilled water. These constitute the oxidase reagent. A small portion of the isolates was smeared on part of a filter paper strip. The reaction was observed for about 10 seconds. A positive reaction was indicated by an intense deep-purple coloration within 5-10seconds.

### **Coagulase test**

The coagulase test was carried out as described by Oguile *et al.*, (2001). A drop of normal saline was placed on both ends of a clean microscopic slide. A colony of the test organisms was emulsified in each of the drops to make two thick suspensions. Then a drop of plasma was added to one of the suspensions and mixed thoroughly and gently and observed for clumping within some seconds. This method is to detect blood coagulase.

### **Indole test**

The indole test was done as described by Oguile *et al.*, (2001). The indole test was employed to determine the ability of an isolate to breakdown the amino acid tryptophan with the enzyme tryptophanase to liberate indole. A test tube of 1%

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peptone water was inoculated with the test organism and incubated for 48 hours at 37°C. then 0.5ml of Kovac's reagent (prepared by dissolving 5g p. dimethylamino-benzaldehyde in 75ml of amylalcohol and 25ml concentrated hydrochloric acid) was added to the test tube and was shaken gently. Indole positive indicated a reddish concentric ring while negative result indicated a brown concentric ring at the upper layers of the medium.

## **Sugar fermentation test**

The isolates were further characterized by their ability to ferment a number of sugars such as glucose, lactose and sucrose. The basal medium used for the test was peptone water. The medium was prepared by dissolving 15g of the peptone water in a liter of distilled water according to the manufacturer's specification. 30ml of phenol red (indicator) and 2.5g of sodium chloride (NaCl) were added to 970ml of the peptone water. Sodium hydroxide (NaOH) was added to adjust the pH and get a full reddish color. 300ml of each of the peptone water was transferred to three different conical flasks designated for a particular sugar. The solution in each of the conical flask were dispensed into test tubes containing inverted Durham tubes, stoppered with cotton wool and wrapped with an aluminum foil. The test tube was inoculated with test organism and incubated for 24 hours at 37°C. acid production was indicated by change in color of the indicator to yellow, and also gas production was observed in Durham tubes.

## **Urease test**

Urea base of 2.4g was added to 95ml of distilled water and 10ml of phenol red was also added and autoclaved for 15 minutes at 121°C. It was then allowed to cool to 50°C and 5 ml was dispensed aseptically, into each of the test tubes. The test isolates were inoculated into the test tubes with a wire loop. Change in color to intense red-pink indicated positive result while negative result shows no color change.

## **RESULT**

The table below represents the mean count of total heterotrophic and hydrocarbon utilizing bacterial from each soil sample.

**Table 1: Bacteria counts of petro-chemical polluted soil from different sample sites**

Sample site	Mean Values of Bacteria (CFU/ml)	
	Total Heterotrophic Bacterial(THB)	Total Hydrocarbon Utilizing Bacteria (THUB)
A	1.59 x 10 <sup>4</sup>	1.0 x 10 <sup>4</sup>
B	6.6 x 10 <sup>4</sup>	2.5 x 10 <sup>4</sup>
C	8.5 x 10 <sup>4</sup>	7.2 x 10 <sup>4</sup>
D	7.4 x 10 <sup>4</sup>	2.0 x 10 <sup>4</sup>

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E	5.2 x 10 <sup>4</sup>	5.2 x 10 <sup>4</sup>
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A = Gwallameji mechanic site; B = Yelwa mechanic site, C = Dass park mechanic site; D = Yankari mechanic site; E = Dan Gombe mechanic site.

The table above shows variation in the total heterotrophic bacteria count and hydrocarbon utilizing bacteria count from each soil sample.

**Table 2: Distribution of Bacterial Isolates According to sample sites**

Isolates	Sampling sites				
	A	B	C	D	E
<i>Micrococcus sp</i>	-	+	+	+	+
<i>Staphylococcus sp</i>	+	+	+	+	+
<i>E. coli</i>	+	+	+	-	-
<i>Bacillus sp</i>	-	+	+	+	+
<i>Arthrobacter sp</i>	+	+	+	+	+
<i>Flavobacterium sp</i>	+	+	+	+	+
<i>Achromobacter sp</i>	+	-	+	+	-
<i>Vibrio sp</i>	+	+	-	-	-
<i>Alcaligenes faecalis</i>	+	+	+	+	+
<i>Norcadia sp</i>	+	+	-	-	-
<i>Streptococcus sp</i>	+	-	-	-	-
<i>Pseudomonas sp</i>	-	+	+	+	+
<i>Corynebacterium sp</i>	-	+	+	+	+

Key: Present (+), Absent (-)



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A = Gwallameji mechanic site; B = Yelwa mechanic site, C = Dass park mechanic site; D = Yankari mechanic site; E = Dan Gombe mechanic site.

The above table shows a variation in the distribution of bacterial isolates from each soil sample sites.

**Table 3: Distribution of Bacterial Isolates according to utilization of petroleum product**

Isolates	B	C	D	E
<i>Micrococcus sp</i>	+	+	+	+
<i>Pseudomonas sp</i>	+	+	+	+
<i>Bacillus sp</i>	+	+	+	+
<i>Flavobacterium sp</i>	+	+	-	-
<i>Corynebacterium sp</i>	+	-	-	-
<i>Staphylococcus sp</i>	+	+	-	-

**Key: (+) = Positive utilization, (-) = No utilization**

The above table indicated that half of bacterial species have the ability to utilize the commonly used petroleum products in the sampling sites. But the lowest degradation ability was observed on *Corynebacterium sp*, which utilized only petrol then followed by *Staphylococcus sp* and *Flavobacterium sp*.

**Table 4: Physiochemical parameters that determine survival of the bacteria in the soil sample**

Sample site	Temperature (°C)	Moisture (%)	pH
A	33	71.2	6.9
B	35	66.1	6.7
C	32	67.0	6.0
D	34	70.0	6.5

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E 38 66.4 6.6

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The above table indicated that degradation of petroleum hydrocarbons occur at a wide range of temperature, moisture, and pH tending towards neutrality.

## DISCUSSION

Detection of hydrocarbon utilizing bacteria from petrochemical polluted soil was investigated. The result of bacterial count (Table 1) shows that Gwallameji mechanic site had the lowest total heterotrophic bacterial count of  $1.59 \times 10^4$  (cfu/ml) and lowest hydrocarbon utilizing bacterial count of  $1.0 \times 10^4$  (cfu/ml) followed by Dass park mechanic sites which had total heterotrophic bacterial count of  $8.5 \times 10^4$  (cfu/ml). and Yankari mechanic sites had total heterotrophic bacterial count of  $7.4 \times 10^4$  (cfu/ml). and hydrocarbon utilizing count of  $2.0 \times 10^4$  (cfu/ml). Gwallameji mechanic sites had existed for 3 year, Yelwa and Dass park mechanic site had existed for over 25 years. And Dan Gombe had being in existence for over 10 years. Analysis of variance, for the total heterotrophic bacteria count, and hydrocarbon utilizing bacteria revealed that the counts between sample sites were significantly different ( $P < 0.05$ ). this difference in bacteria count of each sample site may be due to organic contents, accumulation of resistance component such as cyclo-alkane, and also may be due to rate of contamination of each sites. Eze and Okpokwasili, (2019; Baldwin, 2007). Distribution of bacterial isolate according to sample sites shows (table3) that bacterial *genera isolated* during this study were 13 *genera*. The bacterial isolates found in all sample sites were mainly *Staphylococcus sp*, *Arthrobacter*, *Flavobacterium*, and *Alcaligenesfaecalis* were found in all sample sites. However, *Micrococcus sp*, *Bacillus sp*, *Pseudomonas* and *Corynebacterium sp* were also present in all sample site with the exception of Gwallameji. *Vibrio sp* and *Norcadia sp* were present in Gwallameji and Yelwa only while *Streptococcus sp* was only found in Yelwa sample site. These organisms have been previously implicated with petroleum product degradation (Umealoikwa, 2003, Zang et al., 2006). However, the variation in the distribution of this bacterial isolates may be attributed to seasonal differences or more petrochemical activities, as well as increased atmospheric content of the soil and in the environment (Eze and Okpokwasili, 2010). Distribution of bacterial isolates according to utilization of refined petroleum product in (table 4) shows that half of bacterial species have the ability to utilize the commonly used petroleum products in the sampling sites. But the highest degradation performance was observed on *Micrococcus sp*, *pseudomonas sp*, and *Bacillus sp*. This is in accordance to the findings of Nada, (2007) and (2013). While, the lowest degradation performance was observed on *staphylococcus sp*, *Flavobacterium sp*, and *Corynebacterium*. These bacterial species have been

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previously implicated with refined petroleum products degradation (Makut and Ishaya, 2010). It was clear from the result obtained that all sites harboured hydrocarbon utilizing bacterial, although there was variations in the utilization of refined petroleum products by the isolates. Yasmineen, (2015) and Zulfa, et al, (2016) reported that variation in the utilization of petroleum hydrocarbon by soil microbes is attributed to various enzymes encoded in their plasmid. This investigation took into consideration factors affecting survival of these microbes in the soil. These factors (table 5) shows that biodegradation of petroleum hydrocarbon occur at a wide range of temperature, moisture and pH. The temperature values obtained from different petrochemical polluted soils during this investigation fall within mesophilic range. This means that the temperature of different petrochemical polluted soils support mesophilic organisms. Temperature plays very important roles in biodegrading of petroleum hydrocarbons, firstly by its direct effect on the chemistry of the pollutant and secondly its effect on the physiology and diversity of microbial (Okoh, 2006). Venosa and Zhu (2003) also reported that ambient temperature of an environment affects both the properties of spilled oil and the activity or population of microorganisms. The pH of each petrochemical polluted soils sample tends from slightly acidic towards neutrality. Neutral pH, enabled biodegradation activity of bacterial in soils. Obire, et al; (2002). Moisture content also plays vital role in utilization of refined petroleum hydrocarbon by soil microbes. Efficient utilization of petroleum hydrocarbon occurs from 50% to 80% moisture contents (Nada, 2007).

## **Conclusion**

This study revealed that discharge pollutants from a place where petrochemical activities take place is considering one of the critical problems to the environment, due to negative impact it had on the health and ecosystem. Currently, the biological control to remove hazards from environment is successful process due to it being a safe way to enhance a healthy environment in particular with low cost, technique and wide public acceptance to cleaning up contaminated sites. Based on previous studies, some bacteria and fungi species have the ability to degrade crude oil in contaminated soil. The data contained in this study shows that some bacterial species were capable of degrading the crude oil in varying degrees. The higher crude oil biodegradation efficiency was exhibited by *Micrococcus* sp, *Pseudomonas* sp, *Bacillus* sp and *Staphylococcus* sp compared to other species, nevertheless bacterial species isolated from contaminated soil can be exploited in the bioremediation of crude oil to remove petroleum hydrocarbon from contaminated environments as well as their consortium culture has promising potential in bioremediation of poly nuclear aromatic

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hydrocarbon polluted soil. They could also be utilized in bioremediation of used engine oil, diesel and petroleum contaminated soil.

## **Recommendation**

It is here recommended.

1. To promote further research in the determination of total organic carbon, total nitrogen and oxygen of petro-chemical polluted soil.
2. To apply our bacteria isolates on industrial scale.
3. To establish a culture collection centre of crude oil degrading microorganisms.

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## CAPITAL MARKET INDICATORS AND ECONOMIC GROWTH IN NIGERIA

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### **Abstract**

*The main objective of this paper was to empirically investigate the impact of capital market's indicators on the level of economic growth in Nigeria during the period between 1980 -2020. The study used data collated from CBN Statistical Bulletin and annual report of Nigeria Bureau of Statistics, and Nigeria Stock Exchange, while Co-integration and it's Error Correction Model (ECM) was used to analyze the data. The result of the descriptive statistics showed that GDP did not improved significantly during the period. Same was Market Capitalization but Initial Offers, Total Value Traded and All Shares Index improved significantly. The Johansen co-integration showed the evidence of long run co-integration which was also confirmed by the ECM result. The result revealed the speed of adjustment of about 73percent. The Granger causality test showed that there was unilateral causality relationship that ran from MCAP to GDP and not the reverse. This suggested that it was changes that occurred in MCAP that brought about the changes in GDP and was not the reverse. But there was no causality effect of IPOs, TVT, ASI and GDP. To determine the impact of the indicators on GDP the impulse response check test was conducted. The impulse response result revealed that one period standard deviation shock on MCAP had a positive impact on GDP. Same was IPOs, TVT, and ASI respectively, Based on the results of the findings, the paper recommended amongst others that there should be an active participation of the real sector, the Government and her Agencies in the market through the issuance of bonds, to increase Initial Offerings, Total Value Traded, All Share Index as well as market capitalization for a robust involvement of the market in the growth of the economy.*

**Keywords;** *Economic Growth, Market Capitalization, Gross Domestic Product, Real Domestic Product, Error Correction Model*

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## **Introduction**

The Nigerian stock exchange (NSE) was established in 1960 as Lagos Stock Exchange with just Nineteen (19) securities listed for trading. But it became known as the Nigerian Stock Exchange in 1977.

But as at Nov.2019, it has a total of 161 listed companies, 8 (eight) domestic companies on the Premium Board 144 companies on the main board and 9(nine) companies on the 3 alternative securities market (ASeM) Board. The NSE has 84 (eighty four) FGN Bonds, 21 states bonds, 27 (twenty seven) corporate bonds, 1 (one) supranational bond and 53(fifty three) memorandum listing in the fixed income market. With a total market capitalization of ₦28.26 trillion as at 9<sup>th</sup> January 2020 (Adolf .C. Wikipedia.org.5<sup>th</sup> May 2020). In terms of operations the Exchange has grown also, that foreign brokers are now listed as dealers in the exchange as a result of its internal connectivity known as “The Nigerian Stock Exchange (CAPNET) that allows its trading activities to be seen electronically in other trading centers. This was made easy through its Automatic Trading System (ATS) through its computer networks as well as the launching of the X-Gen trading platform that allows trading for both the retail and institutional sectors. (Adolf. 2020)

From the foregoing it is evidently clear that the Nigerian stock exchange has not only grown but has become an outlet for foreign investors as well. This has made it imperative for its activities or operations to be in conformity with best global practices in the Capital/ financial market or system. The capital market is a key player in the Nigerian financial system as well as driver of the Nation’s Economic growth and development. This is because of its financial intermediating role of channeling funds from the surplus economic units to the deficit units of the Nigerian economy.

The trading activities of buying and selling of share/stocks, bonds etc are reflected in the daily transactions or activities of the market classified as market capitalization, all-shares index, total volume and value transactions that are regarded as the indicators of the market’s performance and by implication are seen as the barometer of economic growth measurement in any economy. Hence this work is set to empirically determine the extent to which the Nigerian capital market indicators has impacted on the level of economic growth of the country.

## **Statement of the Problems**

Adamu (2008) stated that” for any meaningful economic transformation of a country to take place, the capital market must be effectively active...the economic strength of any nation is measured according to how actively and effectively the capital market is performing.” This statement attests to the importance of the capital market hence



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the need to ascertain the extent to which the Nigerian Capital Market (NCM) has contributed to the growth of the Nigerian economy for the period 1980 to 2020.

The Stock or Capital Market (CM) is an investment outlet where long term financial debt instrument like shares/stock, bonds etc are traded. Which gives investment opportunities to those with excess funds who desire to invest while at the same time affording the deficit sectors who are in need of funds to raise such funds for their businesses. It is these processes of channeling long-term investable funds between these two units that drives the growth of the economy. Another aspect of the market that stimulates growth is the operations of the secondary market where old securities are traded, which affords those who have acquired shares previously but now needs money to disinvest by selling off their shares. By this process, the market ensures a continuous flow of liquidity in the system. For these activities to be sufficiently and effectively performed in the market, it requires active participation of other sectors of the economy. But in Nigeria today the level of economic activities in the system is low, such as low capacity utilization by the manufacturing sector, power epilepsy, high level of unemployment, high inflation rate, unstable exchange rate coupled with the fact that in a country of about 180 million people the market has only about 3 million individual participants. This is a reflection of low involvement of the Nigerian populace. And amongst these three million individuals, about one third of them are not even aware of the existence of the stock market because they decorated their sitting rooms with their share certificates. In addition to these challenges is the problem of money supply where much money seem to be out of control of the monetary authority (The Central Bank of Nigeria) due to leakages in the system. Hence *in the face of these challenges the study want to examine whether the performance of the capital market has impact on economic growth in Nigeria using the market indicators as parameters* by addressing the understated research questions.

## **Objective of the Study**

These include:

- i. Determine the relationship between Market Capitalization and the Nigerian Economic Growth in Nigeria
- ii. Examine the impact of stock total Value of Transactions on Economic Growth in Nigeria.
- iii. Ascertain the effects of Initial Public Offerings on Economic Growth in Nigeria.
- iv. Examine the impact of All Share Index on Economic Growth in Nigeria.

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## **Research Questions**

These include:

- i. Is there a relationship between Market Capitalization and Economic Growth in Nigeria?
- ii. To what extent has Total Value of Transactions impacted on Economic Growth in Nigeria?
- iii. Do Initial Public Offerings have any effect on Economic Growth in Nigeria?
- iv. To what extent has All Shares Index impacted on Economic Growth in Nigeria?

## **Statement of Research Hypotheses**

Four (4) null hypotheses are formulated for the study they are stated thus;

- Ho1. There is no significant relationship between market capitalization and economic growth in Nigeria
- Ho2. Total Value of Transactions has no positive impact on Economic Growth in Nigeria.
- Ho3. Initial Public Offerings have no significant impact on economic growth in Nigeria.
- Ho4. All Shares Index has no significant impact on Economic Growth

## **Conceptual Issues**

### **Real Gross Domestic Product**

Real gross domestic (RGDP) can be seen as the monetary value of goods and services produced in a country over a period of time often a year after making allowance for inflationary effects. According to Wikipedia Real gross domestic product (r GDP) is a macroeconomic measure of the value of economic output adjusted for price changes (ie inflation or deflation). This adjustment transfers the money value into an index for quantity of total output. On the other hand gross domestic product (GDP) refers total spending, the sum of consumer spending, investment made by the industry, excess of export over import, and government spending. In cases due to inflation GDP is often increasing but does not reflect the actual growth in the economy hence gross domestic product is deflated to get the real gross domestic product growth. The GDP is sometimes referred to as nominal GDP defined as the market value of all final goods produced in a geographical region usually a country (Kenton, 2017; Fred, 2019).

### **Market Capitalization (MCAP)**

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Market Capitalization can be seen as a measure of the stock value of organization by multiplying the company's total outstanding stocks or shares by the ruling price of its stocks in the stock market. According to Investopedia.com, Market capitalization is a useful figure to examine when trying to understand a company's structure and profitability, and therefore a stock value. It can be used to determine a variety of key performance metrics, including price-to-earning and price-to-free –cash flow. It states further that market capitalization refers the total dollar market value of a company's outstanding shares...it is calculated by multiplying the total number of a company's share by the current market price. However market capitalization can be classified as micro-(capitalization) small cap, mid-cap, large cap or mega cap. These various caps are based on monetary value; while the small caps are within the neighborhood of \$250million the mega cap is on the range of \$50billion.

## **Initial Public Offerings**

This can be seen as the situation where a company directly issue shares at the primary market which is offered to the public for subscription. It is the process through or by which a new company or an existing one that is in need of fund or additional capital raised funds through the capital market from the public. However some distinctions have been made between new issues and initial public offer ((IPOs) While IPOs are seen as the real new issues debt instruments and equities are seen new issues. But in most literatures new issues and initial public offer are being used interchangeably if or when funds are being raised from the market. According to Investopedia. com, A new issue refers to a stock or bond offering that's is made for the first time. Most issues come from privately held companies that becomes public, presenting investors with the opportunities.

## **Total Value of Transactions**

According to Adolf (2020), the trade value of a share is The trade price of a stock is the value of the stock mentioned in the stock quotes... This will help them in knowing whether they should buy or sell their stocks at current market price or wait for the prices to fall or rise further. ...21<sup>st</sup> nov 2021. Hence value traded can be seen as the aggregate volume of stocks or securities traded in the stock market in their monetary terms. In order wards it is the monetary of the number of traded in a particular day and or over a period of time. It is calculated by multiplying the volume of stocks traded by the market price of the stock. Hence it is often seen as an indicator that complement s market capitalization ratio because it shows whether the market size is matched by or with the day trading activities.

## **Capital Market**

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Adamu (2008) stated ... “for any meaningful economic transformation of a country to take place, the capital market must be effectively active ..., the economic strength of any nation is measured according to how active and effectively the capital market is performing”. Alile (1997) opined that the development of capital market is made possible through some of the vital roles played, such as channeling resources, promoting reforms to modernize the financial sector; financial intermediation, capacity to link the deficit to the surplus sector ...” Dabo (2015) identify capital market as an institution that contributes to the socio economic growth and development of emerging economies. Al-faki (2016) view the capital market from the perspective of fund raising thus; “the capital market has been one of the major means through which foreign funds are injected into most economies and the tendency is a global economy ...” Speaking in the same vein Emenuga (1998) sees the capital market as the barometer for the measuring of the overall economic growth of a nation” capital market is a market for securities (debtor equity) where business enterprises (companies) and governments can raise

Long term funds - - - a market in which money is provided for periods longer than a year as the raising of short-term funds takes place at other market, which in this case is money market.

## **All Shares Index**

According to Wikipedia.org, it states that “ In finance a stock index or stock market (SMI) is an index that measures a stock market ,or a subset of that stock that helps investor to compare current stock price levels with past prices to calculate market performance. There are different types of indices and the major criteria of an index is that, an index is investable and transparent. The method of of its construction is that it is specified. Hence an investor can invest in a stock market index by buying an index fund. This is often constructed or structured as a mutual fund or an exchange trade fund. This helps to determine the difference in performance of an index fund and the index. The fund performance between them is referred to as tracking error. There are different types or forms of indices namely; Ethical stock market indices, Indices and passive investment management, indices by coverage and indices by weighing methods.

## **Theoretical and Empirical Frame Work**

From the foregoing it is clear that there are numerous economic growth theory than capital market ranging from the classical and the new growth theory of the neoclassical. From the economic growth theories there appear to be a consensus

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between both schools of thoughts as to the acceptance of gross domestic product (GDP) as the measure of the economic performance of nations developed and developing. On the capital market perspective there seem to be more attention on capital market investment theory/s than the relationship that exist between the capital market and economic growth. However, the theory of capital formation which links the capital market activities to national economic performance is adopted for this work, using the Cobb-Douglas Production Function, which is expressed thus;

$$Q=f( K, L,P,H)$$

## **Empirical Review**

Empirical review is concerned with investigating existing works as they relates to current work with a view to knowing the methodologies they adopted, nature of data collected and used, results etc in order to have either a supportive-base as well as a possible knowledge-gap that need to be filled or corrected.

Yadirichukwu and Chigbo (2014) in their work; impact of capital market on economic growth in Nigeria(1985-2012) used the multivariate co-integration and error correction method and the result showed that value of transaction and new issues were positive and statistically significant in relationship with economic growth. While market capitalization and total listing exhibited inverse but statistically significant effect with economic growth in Nigeria.

Kolapo and Adaramola (2012) investigated the impact of the Nigeria capital market on economic growth from 1990 – 2010, using Johansen Co-integration and Granger Causality. The variables used were Gross Domestic product as dependent variable while market capitalization, new issues value of transactions, total listed equities served as independent variables. The co-integration result was positive and significant, while causality test revealed a bidirectional causation between GDP and value of transaction, and a unidirectional causality effect with market capitalization and vice-versa. Okpoto (2015) in his study of the impact of capital market on GDP between 1980-2013, used the ADF, co-integration and error correction model, and the result revealed a co-integration between the variables.

Also the parsimonious results showed that, value of transactions, market capitalization and total holding of development stock though impacted on economic growth, was not significant.

Abu and Aguda (2015) in their study title “Capital Market as a Catalyst for sustainable economic development found a positive relationship between capital market and economic development”.

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Taiwoetal (2016) examined the relationship between capital market and economic growth from 1981-2014; using the vector error correction model. Their results based on the normalized co-integration series revealed that; market capitalization rate, total value of listed securities, labour force participation rate, accumulated saving and capital formation are significant in macroeconomic determination.

Yusuf and Aminu (2016), Obiakor (2016) using the OLS regression on GDP, market capitalization, listed equities for the period between 2005-2014 and 1985-2015 respectively revealed that capital market indicators impacted insignificantly on GDP.

While Obiakor (2016) result showed that 'in specifics market indexes had a heterogeneous effects on growth of the economy but aggregate capital market development significantly induced economic growth. In the same vein Muritala and Ogunji (2017) in their study of the association between capital market and economic growth 1980-2015, used the unit root test, co-integrate and the ECM approach their results showed that, total new issues, market capitalization and total listings positively impacts on the economy. Inimino et al (2018) examined the impact of capital market on Nigeria Economic Growth between 1986 -2016, adopted the ADF test and Autoregressive Distributed lag modelization had positive and significant effects on economic growth.

Abina and Lemea (2019) while examining the effect of capital market performance between 1985-2017, used Johansen Co-integration test, Error correction and Granger Causality test approach the co-integration showed a long-run positive relationship between the variables while the Granger Causality test revealed a two significant unidirectional causalities flowing from Gross Domestic product(GDP) to market capitalization and total value of new issues respectively. Acha and Akpan (2019) study the effect of capital market performance and economic growth from 1987-2014 adopted the ADF, Johansen co-integration causality test and VAR regression models used volume of transactions and listed equities, the result showed a Co-integration between the variables, the causality test revealed a unidirectional causalities relationship between economic growth and capital market and from capital market indicators to GDP.

Also Ogbebor et al (2020) applying the same regression approach as Acha and Akpan above but different variables such as real GDP, stock market development, foreign direct investments (FDI), trade openness, inflation and banking sector development. The result revealed that past values of real GDP, FDI, and trade openness promotes economic growth in the short run and long run bi-directional causalities between both the dependent and independent variables.

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## Summary of Literature Review

Empirically, the works reviewed showed conflicting results. This is however expected as the various authors used different regression methods, data and time frame. This notwithstanding results of most of the empirical finding suggested that there is positive significant relationship between capital market and economic growth in Nigeria.

## Method of Data Analysis

The paper adopted the quantitative analysis method using the Auto-regression Distributed Lag(SRD) analysis which includes the co-integration with its implied error correction mechanism, ADF unit root test, Jarque Bera normality test as well as the Cusum and CUSUMQ Residual test. (3.6).....

## Apriori Expectations

Increase in Capital Market Indicators reflects Economic Growth in the Nigerian economy.

## Model Specification

The model adopted for the study is as stated thus;  $GDP = f(MCAP, IPOs, TVT, ASI)$   
Stated linearly thus;  $GDP = \alpha_0 + \alpha_1 MCAP + \alpha_2 IPOs + \alpha_3 TVT + \alpha_4 ASI + Ue$  ..... Equation (3.1)

Rewriting the equation in an econometric form yields

$$GDP = \alpha_0 + \alpha_1 MCAP + \alpha_2 IPOs + \alpha_3 TVT + \alpha_4 ASI + Ue \text{ .....Equation (3.2)}$$

Where, GDP = Gross Domestic Product,

MCAP = Market Capitalization,

IPOs = Initial Public Offers.

ASI = All Share Index and

TVT = Total Value of Transactions

Ue = Error term,

$\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$  = constant, 1-5 are parameters.

## Results and Findings

The results of the analysis are as presented below.

## Descriptive Statistics

The results of the descriptive statistics is shown in the table below

**Table 1: Descriptive Statistics Results**



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	LGDP	LMCAP	IPOs	LASI	TVT
Mean	12.31321	14.82319	10.61478	2.583083	10.32037
Median	12.48891	15.03340	10.19711	2.829678	9.546277
Maximum	13.561130	15.80449	13.71885	3.394508	16.04616
Minimum	10.89949	13.04844	7.757940	1.791759	4.650144
Std. Dev.	0.741234	0.734958	1.841741	0.498221	3.456134
Skewness	-0.221476	-0.796234	0.217064	-0.307681	0.218242
Kurtosis	2.085850	2.718951	1.895044	1.630027	1.806215
Jarque –Bera	1.762790	4.467197	2.407718	3.853139	2.760053
Probability	0.414205	0.107142	0.300034	0.145647	0.251572

**Source: Regression Results Using E.views 9.0 (2021)**

The mean for GDP is 12:31 which is less than median of 12.48, indicates that the GDP did not improve significantly throughout the period, The maximum and minimum values for GDP are 13.56 and 10.90. The standard derivation is just 0.74 unit. The mean and median for MCAP are 14.82 and 15.03 implying that MCAP did increase marginally during the period. The highest and lowest values are 15.80 and 13.04, with a negligible standard deviation of 13.05. The IPOs with an average value of 10.20 indicates that the IPOs improved the most during the period. And the highest and the lowest value of 13.72 and 7.75 with ab standard deviation of 1.86 which is good. The ASI did not improve significantly during the period of the study. The highest and lowest value of ASI are 3.39 and 1.79. The standard deviation is 0.50. The mean and median of TVT are 10.32 and 9.45. This indicates that TVT improved during the period of the study. The highest and lowest value are 16.05 and 4.65, and standard deviation of 3.46.

## Correlation Matrix

The result of correlation matrix is shown in the table below

### LGDP Table 2. Correlation Matrix Result

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LMCAP	0.51060551838
LIPOs	0.03324928043. 0.42877899849
LASI	0.10185620315 0.51128043898 0.68727646163
LTVT	0.20921181539 0.38518166262 0.93797271955 0.68359825525

### Source: Using E. Views 9.0 (2021)

The correlation coefficient between GDP and MCAP is 0.51. The correlation coefficient between IPOs and GDP is 0.03 which is low. The correlation coefficient between ASI and GDP is 0.10 while that between TVT and GDP is 0.21. The low correlation coefficient provides the indication that there is no evidence of first order serial correlation in the model.

The result of the long run static analysis is shown below.

**Table 3. Static OLS Result. Dependent variable; LGDP**

Variable	Coefficient	Std Error	t-Statistic	Probability.
MCAP	0.142821	0.059044	2.418868	0.0206
LASI	0.386455	0.099068	3.900914	0.0004
LIPOs	0.213244	0.053660	3.9733959	0.0003
LVT	0.044486	0.028286	1.572734	0.1245
C	7.535145	0.720893	10.45251	0.0000

R<sup>2</sup>=0.93 F Stat.=715.07, D.W 2.08. The result of the R square indicates that 93 percent of the total changes in the GDP have been explained by the MCAP, ASI, TVT and IPOs taken together. This is a good fit. Since the unexplained is a mere 7 percent. Thus MCAP, ASI, TVT and IPOs have positive relationship with GDP. An increase by 1 unit of MCAP, ASI, IPOs and TVT respectively will increase GDP by 0.14, 0.39, 0.21, and 0.04 units respectively. The t-test reveal that MCAP, ASI, and IPOs with values of 2.42, 3.90, and 3.97 with probability of 0.206, 0.0004 and 0.003 respectively, with exception of TVT are statistically significant in explaining the changes in GDP in Nigeria in the period under review.

### ADF Unit Root Test Result

The Result of the unit root test is shown in the table below.

**Table 4. Summary of ADF Unit Root Test.**

Variables	Level Difference	of First Difference	Order of Integration
ASI	-1.30	-9.02*	I (1)

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TVT	-0.63	-6.60*	I (1)
IPOs	-0.01	-6.59*	I (1)
GDP	0.94	-6.51*	I (1)
MCAP	2,35	-5.46*	I (1)

**NB:\*Indicates stationary at the 1 percent level. 1 percent critical value is -3.610453.**

The result of the unit root test indicates that all the variables were not stationary at level but however became stationary after first difference was taken. The variables became stationary at 5% level. Thus allowing us to test for co-integration.

## Johansen Co-integration Test

The result of the Johansen Co-integration test is shown in the table below.

**Table 5. Summary of Johansen Co-integration Test Results**

Hypothesized	No. of CE(s)	Eigen value	Trace Statistic	0.05Critical value	Prob **
None*	0.605385	70.37075	69.81889	0.0452	0.0452
At most 1	0.309028	35.03661	47.85613	0.4461	0.4461
At Most 2	0.299256	20.98970	29.79707	0.3583	0.3583
At Most 3	0.132900	7.476402	15.49471	0.5230	0.5230
At Most 4	0.052707	2.057576	3.841466	0.151	0.151

## Hypothesized Max -Eigen 0.05

**Table 6 Summary Max-Eigen 0.05**

No. of CE(s)	Eigen value	Statistic	Critical Value	Prob **
None *	0.605385	35.33414	33.87687	0.0333
At Most 1	0.309028	14.04691	27.58434	0.8194
At Most 2	0.299256	13.51329	21.13162	0.4062
At Most 3	0.132900	5.418826	14.26460	0.6883
At Most 4	0.052707	2.057576	3.841466	0.1514

Source: Regression Result using E. view 9.0 (2021)

The results of both the trace statistic and the max-Eigen statistic indicate a one co-integration equation in each case. The result also reveal the existence of a long run equilibrium relationship between the variables. This permits the estimation of the error correction mechanism (ECM)The results of the ECM is shown in Table 6, while the over-parameterized ECM is shown in the appendix.

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**Table 7: Summary of parsimonious ECM Result. Dependent variable; LGD**

Variable	Coefficient	Std. Error	t-Statistic.	Prob.
LMCAP(-1)	0.172103	0.037884	4.542922	0.0001
LIPOs(-1)	0.228625	0.034424	6.641486	0.0000
LASI	0.060527	0.017751	3.4098355	0.00017
TVT	0.064688	0.032717	1.97722	0.0555
ECM-1	0.727053	0.113405	6.411105	0.0000
C	6.677284	0.469577	14.21979	0.0000

**R<sup>2</sup>0.91 AIC-1.06, SC-0.81, Adjusted R<sup>2</sup>0.89, F-statistic 81.33232, Prob (F-statistic) 0.0000, D.W-2.18**

**Source: Regression Results Using E. views 9.0 (2021)**

The author lagged the variables because the regression is a time series and the analysis is also time series. Also because of autocorrelation that has the characteristics of making values to correlate with its previous copies. Other benefits of the use of lag is that it helps to tell when the regression is not highly correlated and when the sample is long relative to the length of the lag distribution. It as well help in eliminating the impact of irrelevant lags or information. In addition, it is used to determine the estimating dynamic relationship of the model. A model is said to be dynamic if or when it contains lagged values of either the dependent or the explanatory variables or both, Furthermore, the use of lag could be as a result of the configuration of the regression software.

## **Parsimonious ECM Analysis/Hypothesis Testing**

The result of the parsimonious ECM with R-Square value 91percent indicate that 91 percent of the total variations in the GDP in the period under review have been explained by the MCAP, IPOs, ASI and TVT, taken together. This is good. Also the Adjusted RSquare with value of 89 percent indicate that the model is well specified. The one period lag in MCAP, IPOs, ASI, and TVT respectively have positive relationship with GDP under the period. An increase in each of these increases GDP by 0.17, 0.23, 0,06, and 0.06 units respectively. The t-statistic showed that MCAP(-1)) IPOs (-1) and ASI with value of 4.54, 6.64, and 3.41 , with probability of 0.0001, 0.0000,aand 0.0017 respectively are statistically significant in explaining the impact of the indicators on GDP growth in Nigeria during the reviewed period.

This also validates the representation of the alternative hypotheses of a significant relationship between the variables and economic growth in Nigeria in the period

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under review. However TVT is found to be statistically insignificant thereby validating the relevance of the null hypothesis. The statistical significance of the ECM suggests a satisfactory speed of adjustment. It shows that about 73 percent of the errors are corrected in each year.

## **Diagnostic Checks Result**

The results of the diagnostics checks result is presented in the table below.

**Table 9: Diagnostics Check Result**

Breusch-Godfrey Serial Correlation	F-statistic (0.55)	Probability (0.5815)
Heteroskedasticity	1.80	0.1396
Jarque-bera	1.934	0.3795

The result of the Breusch-Godfrey serial correlation LM test indicates that the residuals are not serially correlated. The result of the Heteroskedasticity test indicates that the residuals are homoskedastic which is consistent with time series data. The result of the Jarque-bera normality's test indicates that the residuals are normally distributed.

## **Summary of Findings**

The paper attempted to ascertain the impact of capital market indicators on economic growth in Nigeria. In doing this the study employed the longitudinal research design since the variables of the study utilized time series data that covered forty one (41) that is 1980 to 2020. The variables included real gross domestic product (RGDP) (which represented the dependent variable) and market capitalization, all share index, initial public offers and total value of transactions independent variables.

The findings by the study are summarized thus;

i. **Market Capitalization and economic growth in Nigeria for the period of 1980 to 2020.**

The result of the study revealed that market capitalization is positively related and has a significant positive impact on economic growth in the period of the study. Although RGDP itself did not increase significantly during the period. This is however not surprising as the period fall under the Structural Adjustment Programme of between 1983-1986 in Nigeria and the Global Financial Crisis(GFC)of2007-2009.

ii. **Initial Public Offers and economic growth in Nigeria for the same period.**

The result reveals that initial public offering taken together with the other variables were positively related to economic growth. But when assessed alone

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it showed a weak relationship and also not statistically significant in determining economic growth in Nigeria in the period under review.

iii. **Total Value of Transactions and economic growth in Nigeria between 1980 and 2020.**

The result of the study reveal that total value of transactions has positive relationship with economic growth in Nigeria in the period under review and is statistically significant in explaining the variations in performance of economic during the period.

iv. **All-Share Index and economic growth in Nigeria for the same period of 1980 to 2020.**

The findings also reveal that all share index is positively related to economic growth in Nigeria and its statistically significant with positive impact in explaining the variations in economic growth in Nigeria during the period of the study.

## **Conclusion**

The paper concluded that based on the research findings, capital market indicators represented by market capitalization, All Share Index, total value of transactions and initial public offerings with positive relationship and significant statistical impact can be instrumental to achieving the desired level of economic growth and development in Nigeria.

## **Recommendations**

The paper recommends a robust improvement in the production base of the real sector which will increase the level of participation of new firms as well as Government and her agencies participation through the issuance of bond and other debt instruments that will increase the level of activity in the market which will in turn increase not only the value of market capitalization, initial public offering, total value of transactions and all share index, but has an overall positive impact on economic growth in Nigeria.

## **Contribution to Knowledge**

Generally, the findings of this research work will be of much benefit to the general public and policy makers. But specifically to the regulatory bodies and operators of the Nigeria capital market such the Central Bank, the Nigerian Security and Exchange Commission, stock brokers, issuing houses, dealers. And others like institutional investors, financial analyst, economists, individuals and the researcher himself whose academic knowledge has further been broadened by this study.

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## BIOREMEDIATION TECHNIQUES, A SOLUTIONS TO THE DESERT ENCROACHMENT IN THE SAVANNAH REGIONS OF NIGERIA FOR ADEQUATE FOOD SECURITY BY

**BALA IBRAHIM**

*Jigawa State Polytechnic Dutse*

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### **ABSTRACT**

*The impact of desert encroachment is significant in developing countries such as Nigeria. Some northern Savannah states are affected by desert encroachment and the economy of the states is predominantly agriculture and fundamentally depends on the vagaries of weather, however, it has been difficult for Nigeria to take advantage of this environmental menace because of the lack of adequate technology to convert negative aspects of their environment to best uses, It affects people directly and indirectly via its devastating effects on the farmland which in turn causes a lot of socio-economic problems. The methodology that was used in this research work is divided into stages which include existing data and case studies. On bioremediation technique, four case studies were selected in Nigeria, for comparison and analysis, the first one was Zauro, Kebbi state, the state was now the largest state that produced rice in the country according to Federal Government report 2016, and some systems of increasing the soil fertility were through bioremediation technique using organic manure and fishing wastewater, the second case study was Kura local government of Kano state, the system of bioremediation used in the production of rice and maize in the area was, the farmers allowed the waste of the harvested crops to decay in the farm in both rain season farming and the irrigation farming, some of the farmers set fire on the waste to become ash which restores minerals to the farm, the third case study was in Birniwa and Maigatari where the people in the area uses ashes from their houses, human defecation and generated carbon, the soil in these areas restore minerals that allow good growth of plants. All methods for soil regeneration related to the case studies were adopted by incorporating bioregional planning for the study area through the central collection of major town's defecation, central town collection of ashes, evacuation of existing septic tanks and pit latrines for bioremediation, planting of economic trees, economic crops and planting of grasses along the cattle routes, the introduction of integrated farms, creation of oasis, green school initiative and massive irrigation system to enhance biodiversity for the people of the study area, this will lead to the conducive environment because the economy of the area will rapidly grow.*

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**Key Words:** *Bioremediation, Biodiversity, Desert encroachment, Landscape planning*

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## INTRODUCTION

Bioremediation is defined as the use of biological processes to degrade, break down, transform, and/or essentially remove contaminants or impairments of quality from soil and water. Bioremediation is a natural process which relies on bacteria, fungi, and plants to alter contaminants as these organisms carry out their normal life functions. Metabolic processes of these organisms are capable of using chemical contaminants as an energy source, rendering the contaminants harmless or less toxic products in most cases (Biobasics 2006). A desert is a vast land area of sand that lacks nutrients and water that are essential for plant life (Marshak 2009), and desert encroachment is a condition in which more areas of land are being turned into a condition favourable to the development of a desert. Environmental degradation according to (Yiran et al. 2012) would remain an important global issue for the 21st century because of its adverse impact on agronomic productivity, food security and quality of life. Desert encroachment is one of the most glaring of these environmental hazards, it is felt most in Africa than any other continents, this is because African landscapes are anthropogenic and are subject to constant changes due to human interferences (McCann, 1999). There is no single factor that causes desert encroachment. However, it is a combination of factors, developed under harsh and fluctuating climate, and man's activities, some of which are increased in an irreversible magnitude by weather fluctuations, especially periodic drought. Desert encroachment is one of the main problems threatening agricultural production in the Nigerian's northern state and Sudan Savannah region in general. The impact of desert encroachment is significant in developing countries such as Nigeria. Some northern states are affected by desert encroachment and the economy of the states are predominantly agriculture and fundamentally depends on the vagaries of weather (Bala., 2013). However, it has been difficult for Nigeria to take advantage of this environmental menace because of the lack of adequate technology to convert negative aspects of their environment to best uses, It affects people directly and indirectly via its devastating effects on the farmland which in turn causes a lot of socio-economic problems.

### **Ecological Regions in Nigeria**

The natural vegetative zones resulted from the interaction of climate, humidity, rainfall and soils. These factors have been modified by human activities and the man's pattern of land use (Burgess et al., 2004). Based on the above, in figure 1. Nigeria's ecological zones were classified in to:

- i. The Mangrove forest and coastal vegetation.
- ii. The Freshwater swamp forest.
- iii. The tropical high forest zone.
- iv. The derived Guinea Savannah.

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- v. The Guinea Savannah zone.
- vi. The Sudan savannah (Short grass savanna).
- vii. The Sahel savannah (Marginal Savanna).
- viii. The Montane vegetation.

## Vegetation Zones in Nigeria

Vegetation zone can be defined as the plants that can be found in a particular area. These plants are usually determined by the environmental conditions and climate of the area in question. Naturally, their characteristics spur as a response to the climate in the particular area. Figure 1 below shows the different zones available in Nigeria.



Fig. 1.: Ecological regions in Nigeria.

Source: Hadejia-Jama'are river basin, Hadejia branch office (2022).

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## **MATERIALS AND METHODS**

### **Methodology**

The methodology that was used in this research work is divided in stages which includes existing data and case studies.

### **Existing data**

Literature was obtained from published and unpublished works done on Bioremediation Dissertations, conferences and seminar papers, books of proceedings Journals, textbooks, United Nations Reports on desert encroachment and other relevant secondary data was consulted.

### **Efforts put in Place Globally to Reduce the Effects of Desert Encroachment**

Desert encroachment has been recognized as a major threat to Biodiversity. Numerous countries have developed Biodiversity Action plans to counter its effects, particularly in relation to the protection of endangered flora and fauna. A number of methods have been tried in order to reduce the rate of desert encroachment and regain lost land; however, most measures treat symptoms of sand movement and do not address the root causes of land modification such as overgrazing, unsustainable farming practices and desert encroachment. In developing countries under threat of desert encroachment, many people use trees for firewood and cooking, which has increased the problem of land degradation and often even increase their poverty. In order to gain further supplies of fuel, the local population adds more pressure to the depleted forest adding to desert encroachment process, (Mousa, 2005).

Sand dune stabilization is often done through the use of shelterbelts, woodlots and windbreaks, windbreaks are made from trees and bushes and are used to reduce soil erosion and Evapotranspiration. They were widely encouraged by development agencies from the Middle East. Another approach is the spraying of petroleum or Nano clay over semi: arid cropland. This is often done in areas where either petroleum or nano-clay is easily obtainable e.g Iran. In both cases the application of the material, coats seedlings to prevent moisture loss and stop them from being blown away (Njeru, 2008). The soil is also enriched by restoring its fertility, this is done by planting legumes, which extracts nitrogen from the air and fix it into the soil and food crops/trees, example like barley, beans and date palms are the most important.

### **Case studies**

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Case studies were conducted on indigenous bioremediation techniques used in controlling desert encroachment by the local communities in Nigeria.

## **Factors of Analysis**

Table 1 below shows the key factors that interact to sustain a given landscape are considered for effective site analysis. Each factor possesses required general characteristics that influence the actions and interacting in biological, physical and chemical terms, and in the climatic context to constitute and sustain an ecological entity called Savannah.

Table 1: Factors of Analysis

S/N	Physical factors and General characteristic	Climatic factors and General characteristic	Cultural factors, Land use and General characteristic
1	Topography	Rainfall	Agriculture
2	Vegetation	Wind	Landmark
3	Hydrology (surface water)	Temperature	Housing
4	Underground Hydrology	Humidity	Industries
5	Natural		Roads
6	drainage		Schools
	Soil		Religious place
			Markets

Source: Author's compilation, 2022.

## **RESULTS**

### **Case study selection criteria**

On bioremediation technique, four case studies were selected in Nigeria, for comparison and analysis, the first one was Zauro, Kebbi state, the state was now the largest state that produced rice in the country according to Federal Government report 2016, and the major system of increasing the soil fertility was through bioremediation technique using organic manure and fishing wastewater, the second case study was Kura local government of Kano state, the system of bioremediation was also used in the production of rice and maize in the area, the farmers allowed the waste of the harvested crops to decay in the farm in both rain season farming and the irrigation farming, some of the farmers set fire on the waste to become ash

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which restores minerals to the farm, the third case study was in the study area, where the people in the area uses ashes from their houses, human defecation and generated carbon, the soil in these areas restore minerals that allow good growth of plants.

## **An assessment of selected case studies**

The assessment was based on the following variables. A Six point weighing scale was used to rate both variables. The weighing scale ranges from level 1-6 using an assessment table 2 below;

- i. 1 represent POOR interpreted to mean 0-39%
- ii. 2 represent FAIR interpreted to mean 40-49%
- iii. 3 represent AVERAGE interpreted to mean 50-59%
- iv. 4 represent GOOD interpreted to mean 60-69%
- v. 5 represents VERY GOOD interpreted to mean 70-79%
- vi. 6 represent EXCELLENT interpreted to mean 80-100%

## **Report on field observation for case studies**

Case study one: Zauru Farmlands, Birnin Kebbi Local Government, Kebbi State.

Findings:

Organic fertilisers ensure that the farms remain fertile for many years, even though agriculture



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has been practiced there for hundreds of years as shown in the plate I and II below .



**Plate I: Zauro Village Farming and Fishing activities.**

Source: Author's compilation, 2022.



**Plate II: Zauro Village Farming using organic manure.**

Source: Author's compilation, 2022.

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Case study two: Kura Farmlands, Kura local Government Area, Kano state.



**Plate III: Kura Bioremediation Technique in Farming using Carbon Manure.**

Source: Author's compilation, 2022.



**Plate IV: Kura Bioremediation Technique in Farming Using Water Channels.**

Source: Author's compilation, 2022.

## Findings

Farming activities in Kura is very interesting, because some of the farmers uses carbon (burnt farm waste) in the above plate III and IV as organic manure to improve

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the soil fertility in the area. This can really be adopted in the prevention of desert encroachment.

Case study Three: Maigatari Farmlands, Maigatari Local Government, Jigawa state.



**PlateV: Maigatari Plant and Live System.**

Source: Author's compilation, 2022.



**Plate VI: Maigatari Desert Land.**

Source: Author's compilation, 2022.

Findings:

Bioremediation technique that was carried out by the people is through living unyielded crops to decay in the farmlands as shown in plate V and IV above, it promotes the gradual fertility of the farms.



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*Case study four: Birniwa House to Farmlands solid waste bioremediation techniques.*



**Plate VII: Birniwa Pit Latrine Evacuated, for Bioremediation to a Farm.**

Source: Author's compilation, 2022. .



**Plate VIII: Birniwa House to Farmashes for Bioremediation to a Farm.**

Source: Author's compilation, 2022.

Findings:

Plate VII above shows where people in the area evacuate pit latrine and take it to farm in order to regenerate the soil nutrients, and plate VIII shows how people generate ashes for bioremediation.

All method for soil regeneration related to the case studies were adopted by incorporating bioregional planning for the study area.

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## Summary of the result findings

Table 2: A summary of the findings for selected case studies

S/N	VARIABLES	FEATURES	Case Study 1	Case Study 2	Case Study 3	Case Study 4	Remarks
1	Rainfall	All bioremediation need a rainfall in order to be effective	3	4	3	3	
2	Surface water	Surface water helps in bioremediation technique	5	4	1	1	
3	Ground water	Groundwater helps in bioremediation technique	4	4	2	2	
4	Geology	The geology of the area also helps in bioremediation.	3	3	2	2	
5	Vegetation	Vegetation also helps in bioremediation.	4	5	3	2	
6	Soil	Soil is the most important aspect, especially when it is fertile	5	5	1	1	
7	Agriculture	Proper Agricultural practice also helps in bioremediation.	6	6	3	2	

30/6 = 5      31/6 = 5.2      15/6 = 2.5      13/6 = 2.2

Source: Author's compilation, 2022.

## Summary of findings

From table 3 above, the following findings were deduced:

The case study one which is Zauro Farmland in Kebbi state scored 5 representing good, this shows that the area has a good bioremediation technique.

The case study two which is Kura Local Government, Kano state scored 5.2 representing good, this shows that the area has a good bioremediation technique.

The case study three which is Maigatari Local Government, Jigawa state scored 2.5 representing fair, this shows that the area has a fair bioremediation technique.

The case study four which is Birniwa Local Government, Jigawa state scored 2.2 representing fair, this shows that the area has a fair bioremediation technique.

## DISCUSSION

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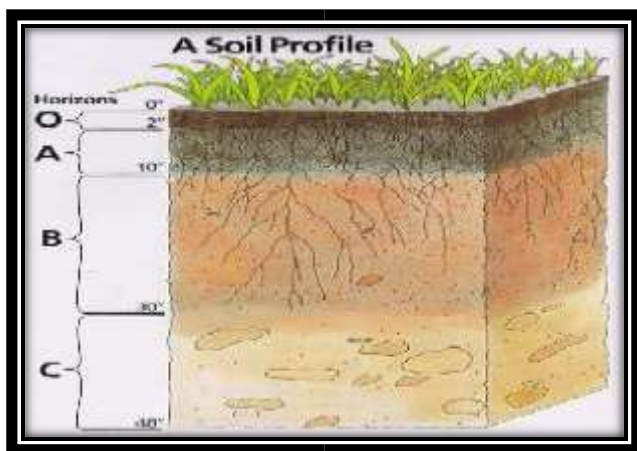
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The numerous tree planting projects embarked upon at various times by government had not succeeded in putting a halt to the menace, this study has revealed that additional strategies are needed to be employed, which is to be directed at soil improvement and a based process which include bioremediation to improve the soil fertility of the Savannah. This study focuses on the various bioremediation adopted to control desert encroachment in Nigeria. Base on the case studies conducted in Zauro local government area of Kebbi state which shows that using wastewater from the fish pound in farming increases the nutrient of soil, also the case study conducted in Kura local government of Kano state also showed how people use ashes and organic manure in regenerating the soil fertility in the area, likewise in Birniwa and Maigatari where people uses slug and unyielding plants to regenerate the soil.. Since the study has revealed that, there is numerous benefit in the use of bioremediation technique for control of desert encroachment, therefore the following recommendations were stated below in order to achieve success.

*Converting the soil to a good soil profile using bioremediation technique*

Bioremediation is defined as the use of biological processes to degrade, break down, transform, and/or essentially remove once-living things decay, the organic layer becomes rich in nutrients. As shown in figure I below.



**Figure 2: Organic Soil Profile.**

Source: Natural Resources Conservation decomposing, or rotting, away. As these Service (NRCS).

Contaminants or impairments of quality from soil and water. Bioremediation is a natural process that relies on bacteria, fungi, and plants to alter contaminants as

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these organisms carry out their normal life functions topsoil layer is called the organic layer. This layer is about an inch thick and it can be formed by spreading human defecation, spreading ashes, and wastewater from fish ponds, within this layer, living things carry on with their life activities. Also in this layer are millions of dead plant and animal organisms that are slowly

Section A in figure I above is called the upper soil layer. This is where you will find many plant roots, different types of fungus, and other very tiny living things. This soil is dark in colour because there are so many chemical reactions taking place as living things grow and die.

Section B in figure I above is the middle soil layer. It has fewer living and once-living things and less of the darker topsoil. The soil here has less air, too. Because of these characteristics, plants do not grow well here.

Section C is the lowest layer. In this layer, you will find that the soil may have an orangish or yellowish colour. It may be more sandy or have more grey clay. In this layer, you will see that there are many pebbles and rocks. This layer has the least amount of living and once-living things.

The government should provide more tractors and tankers trucks for all local government of the study area to convey the generated defecation and ashes to various individual farmlands for the bioremediation technique as shown in figure 3 and figure 4 below.



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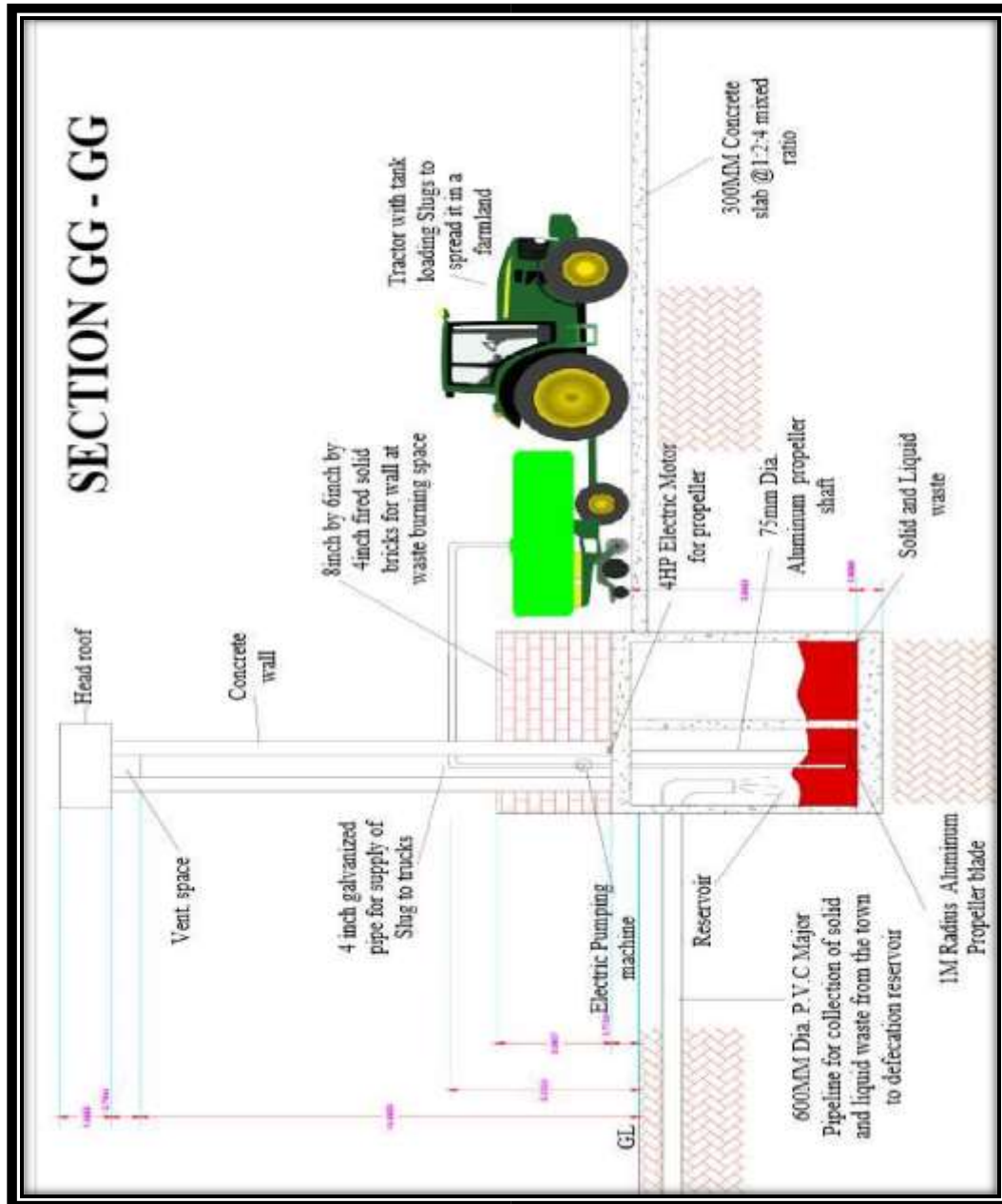


Figure 3: Section GG -GG.

Source: Author's compilation, 2022.

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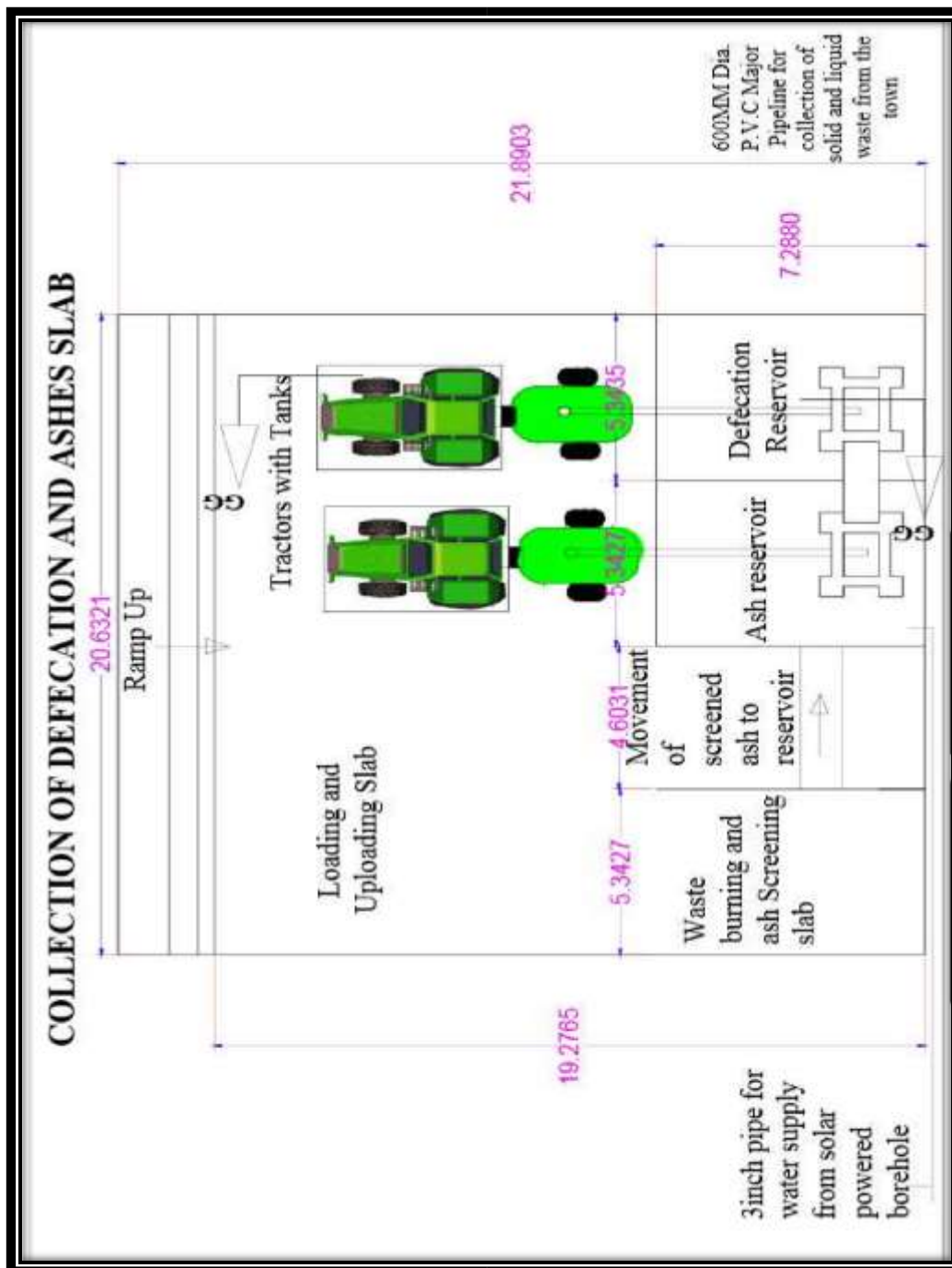


Figure 4: Slab for Collection of defecation and Ashes at Sule Tankarkar. L.G. HQ.

Source: Author's compilation, 2022.

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The spreading of the defecation or the ashes must be in sequence form so that all area will be covered with defecation or the ashes, as the process is going on for the bioremediation as shown in figure 5 below. This will change the poor fertile soil to a fertile soil.

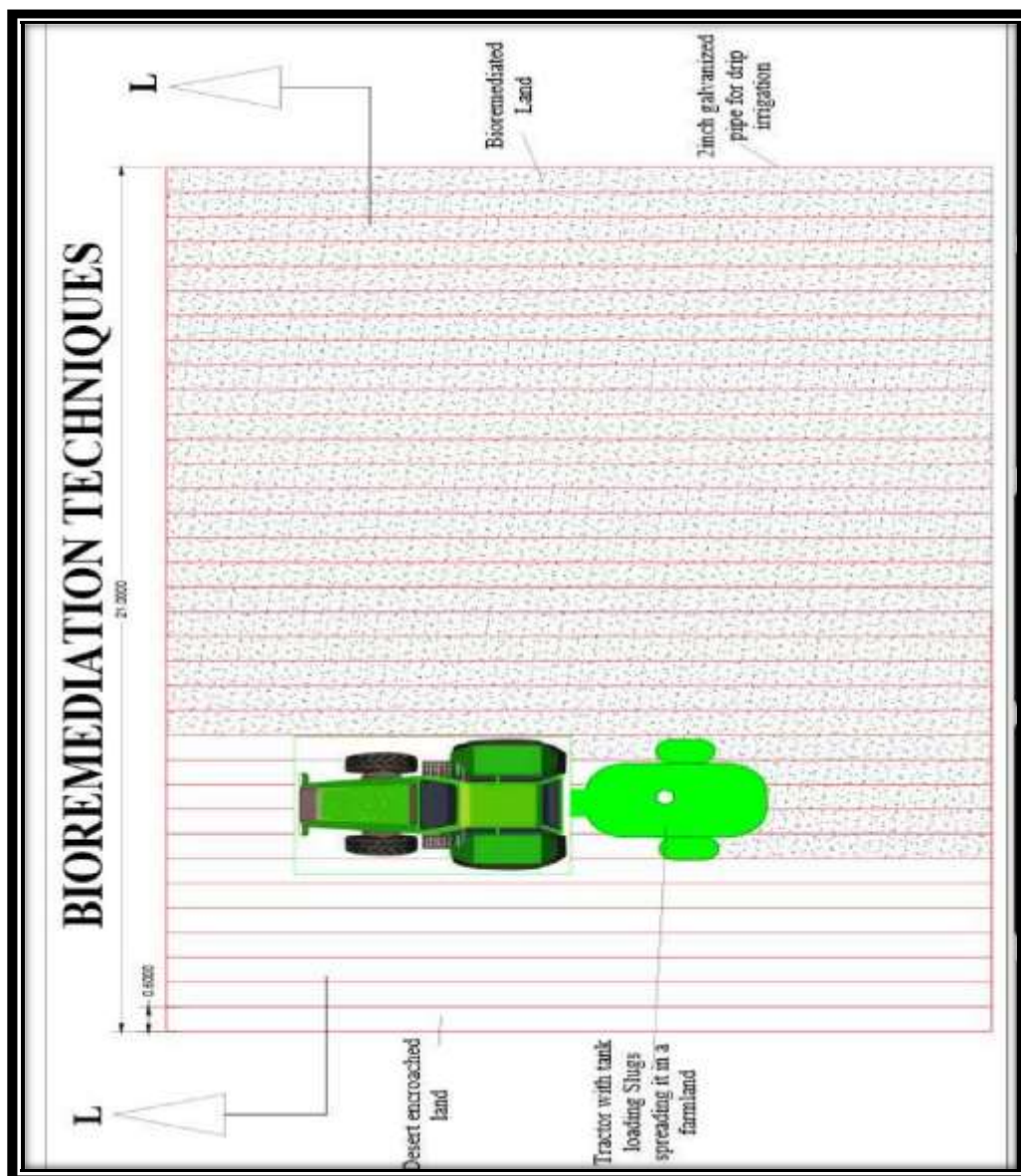


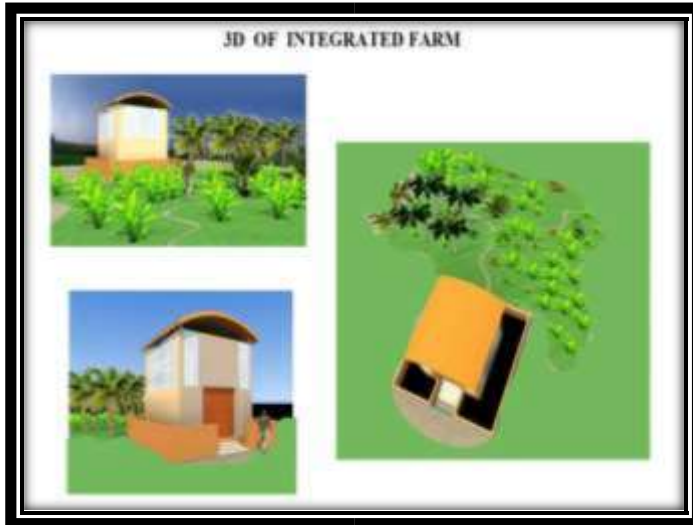
Figure 5: Bioremediation Technique.  
Source: Author's compilation, 2022.

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*Creation of an integrated farming all over the country*



**Figure 6 . An integrated farm for improving**

Integrated farming is another way of climate resilient and providing adequate food and the fertile soil will also be used for farming crops, vegetables and so on security in our country if it can be adopted by Government, Non-Governmental Organisation and other private individuals, figure II below is a sample design of 3D (three-dimensional drawing showing an integrated farm at a small scale that can be handled by common people if supported, the roof of the building was constructed in such a way that it will observe solar radiation and transformed it into electrical power, the electrical power will then be the source of motorizing water from ground level to the fishpond around the poultry building, in return the waste from the fish pond and the poultry will serve as means of regenerating our climate and food security the nutrient of the soil around the building.

Source: Authors Compilation 2022

## **Creation of Oasis all over the country**

As a result of a very high rate of flooding, we are experiencing in Nigeria which used to flood many many farmlands and communities in the country leading to loss of agricultural farm products causing a food shortage. If a lot of oases can be created by Landscape Architects in the country based on the calculations of flooding within a given environment, the oasis will accommodate more floodings and utilised it during the dry season, as shown in figure 7 below.

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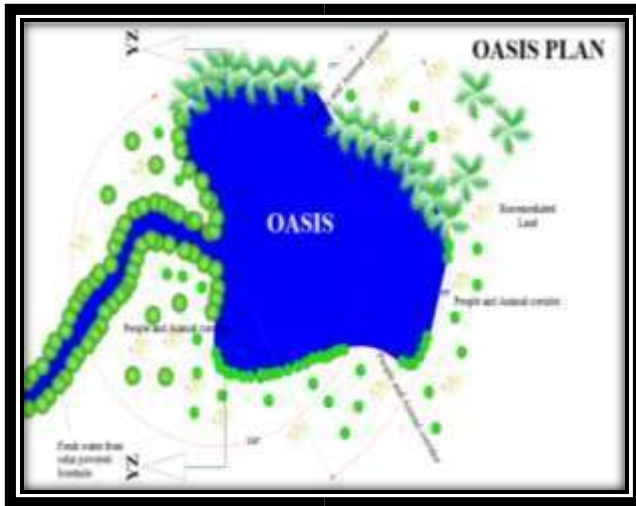


Figure 7. Floor Plan of Oasis  
Source: Authors Compilation, 2022.

## **Creation of practical fishing, animal husbandry and green initiative in our schools**

Training of our younger ones on agriculture and climate change is very vital right from their primary schools because many students are only thinking about making money in engineering, teaching and so on, leaving agriculture behind their brains, Government and other stakeholders concerned should make an effort of providing a practical aspect of agriculture for our younger ones, figure 8 below show a sample of Fishing and Animal husbandry to be introduced in our school. And figure 9 shows the school's green initiative.



Figure 8: Fishing and Animal Husbandry Laboratories  
Source: Author's compilation, 2022.



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**Figure 9: School Green Initiative.**

Source: Author's compilation, 2022.

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## **ANALYSES OF RISK COPING STRATEGIES AMONG SMALL SCALE SOYBEAN FARMERS IN KADUNA STATE, NIGERIA**

**ALIM SEMIYU ABDULRAZAQ; KURSUM OHUNENE MUHAMMAD; & ZAINAB OYIZA AUDU**

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### **ABSTRACT**

This research examined the risk management strategies among small scale soybean farmers in Kaduna State, Nigeria, with the aim of generating reliable information on the sources of risk and risk management strategies among small scale soybean farmers in Kaduna State, Nigeria. Multi-stage sampling techniques were employed in selection of 210 soybean farmers in the study Area. Descriptive statistics were used to analyse socio economic characteristics, the sources and risk management strategies of soybean farmers in the study area. Some of the important findings from research are: The result revealed that average age household heads was 42 years which means that the majority of the soybean farmers in the study area were relatively young. Soybean farmers were faced with a number of risks that militated against their production in the study area. The results revealed that the majority (43.3%) of soybean farmers in Kaduna State had their soybean affected by erratic rainfall. Social risk (economic shock), the results revealed that 36% of the soybean farmers in Kaduna State had their farms invaded by cattle. Economic risk such as insufficient supply of seed (58.6%) which resulted mostly in reduced output was a major source of economic risk. Production risk, Soybean farmers in Kaduna State rated high cost of fertilizer, untimely supply of fertilizer and poor soil as the three most important sources of production risk. Other sources were technical, policy and human risk. However, devised different risk management strategies to prevent, reduce and cope with the different sources of risk. The results revealed that risk prevention strategies were planting of other crops, planting of improved varieties, diversify to off-farming activities, farm on different land/field and insurance. In the study area, majority (70.4%) prevent risk by planting of improved varieties. Risk coping strategies refer to borrowing, savings/*Adashe*(cash contribution), off-farm income and selling assets. Overall, soybean farmers (42.8%) majority used savings/*Adashe*(cash contribution) to cope with the risk in the study area. And Risk reducing strategies were necessarily risk management tools used by most farmers. In the study area, the most important is the used of fertilizer (44.8%). The findings show that soybean farmers in the study area were facing different types of risk in soybean production. Soybean farmers

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devised management strategies to prevent risk. the problem of production risk for example, could be addressed through technology change, such as breeding for drought tolerance, resistance to pests and diseases.

**Keywords:** *sources of risk, risk management strategies and soybean farmers*

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## INTRODUCTION

Soybean (*Glycine max (L) Merril*) is one of the most valuable crops in the world due to its multiple uses as a source of livestock and aquaculture feed, protein and vegetable oil for human diet and bio-fuel. According to United State Agency International Development (USAID), (2016) Nigeria is the second-largest producer of soybean in sub-Saharan Africa, with a production of 679, 000 MT in 2014. Soybean is mainly produced in the northern parts of Nigeria, with the North Central and North West zone accounting for approximately 97% of production. The major producing States are Benue, Kaduna, Kano, Taraba and Nassarawa (USAID, 2016). The crop can be successfully grown in many States in Nigeria using low level of agricultural inputs utilization. Its cultivation in Nigeria has expanded as a result of its nutritive and economic importance and diverse domestic usage. It is also a prime source of vegetable oil for the international market. Soybean has an average protein content of 40%, more protein-rich, and a good balance of amino acid than many of the common vegetable or animal food sources found in Nigeria. Soybean seeds also contain about 20% oil on a dry matter basis, 85% unsaturated and it is cholesterol free. Soybean is good for food such as soy-milk, soy-cheeses, *daddawa*, and infant weaning food. It has therefore, tremendous potential to improve the nutritional status and welfare of resource-poor people particularly in developing countries like Nigeria. Soybean can also contribute to enhance sustainability of intensified cropping system by improving soil fertility through nitrogen fixation, permitting a longer duration of ground cover in the cropping sequence, and providing useful crop residues for feeding livestock, the haulms provide good feed for sheep and goat and control the parasitic weed (*Striga hermonthica*) as observed by International Institute of Tropical Agriculture (IITA), (2009).

## Risks in Agriculture

It is often said that agriculture production is a risky business, that is, it is subject to risk. This means that due to complexities of physical and economic systems, the outcomes of farmers' actions and production decisions are uncertain, and many possible outcomes are usually associated with a single action or production plan. The

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uncertainty concerning outcomes that involve some adversity or loss that negatively affects individual well-being is normally associated with the idea of risk. Knight, *et al.*, (2003) make the distinction between risk, that implies knowledge of numerical, objective probabilities, and uncertainty, that implies that the outcome is uncertain and the probabilities are not known. This distinction is not very operative since the probabilities are very rarely known and there is widespread acceptance of probabilities as subjective beliefs (Just 2003; Moschini and Hennessy, 2001). (Hardaker *et al.*, 2004), find a more useful distinction between uncertainty as imperfect knowledge and risk as exposure to uncertain unfavourable economic consequences. In practice both concepts are very much related and are used interchangeable, one with more emphasis on “probabilities” as the description of the environment, and the other with more emphasis on the “potential negative impact” on welfare. There is no risk without some uncertainty and most uncertainties typically imply some risk. Uncertainty is a situation in which a person does not know for sure what will happen. It is necessary for risk to occur, but uncertainty need not lead to a risky situation. Uncertainty in agriculture reflects the nature of most farm production systems, which is influenced by ever-changing economic and biophysical conditions. The natural lag between when production decisions are made and when returns to farming can be realized exposes agricultural enterprises to the variability, in the intervening period, of a range of factors that determine the value of production. These include weather, animal and plant health, change in agricultural markets and a range of macroeconomic factors. Variability in these factors result in uncertainty over key determinants of farm income like output price, yield, and input costs with implications for farmers economic welfare and effect on the technical, allocative and economic efficiencies of farm production (RERAD, 2010).

## **Sources of risk in farming**

Some risks are unique to agriculture, such as the risk of bad weather significantly reducing yields within a given year. Other risks, such as the price or institutional risks discussed below, while common to all businesses, reflect an added economic cost to the producer. If the farmer’s benefit-cost trade off favours mitigation, then he or she will attempt to lower the possibility of adverse effects (Ramaswamiet *al.*, 2003). Ramaswamiet *al.*, (2003) classified the income risks borne by producers into three kinds: production risks, price risks, and input risks. Moschini and Hennessy, (2001); and Edwin and Thomas, (2009) classified the risk into four classes- output, price, technology and policy uncertainties. According to Akinola (2014) risk sources to agribusiness enterprises generally can be grouped into social, market, institutional,

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financial, production and foreign exchange. Olarinde *et al.* (2010) observed that sources of risk can be grouped under the following headings: natural risk, economic risk, production or yield risk, technical risk, social risk.

## **Production or yield risk**

Production or yield risks arise because of two principal factors (Ramaswami *et al.*, 2003). Random uncontrolled inputs (for examples; excessive or insufficient rainfall, extreme temperatures) due to weather is the first factor. Pests and diseases constitute the second. Technology plays a key role in production risk in farming. The rapid introduction of new crop varieties and production techniques often offers the potential for improved efficiency, but may at times yield poor results, particularly in the short term. In contrast, the threat of obsolescence exists with certain practices (for example, using machinery for which parts are no longer available), which creates another, and different, kind of risk.

## **Price (market) risks**

Risks from variable prices are the second kind of risk. Because of substantial production lags in agriculture, production decisions are made far in advance of the date when output is realized. As a result, farmers need to forecast the prices that will prevail at the time of sale. Although production risks have consequences for price risks, the price risks are not just because of production risks alone. Prices can vary also because of demand shocks as well as instability in expectations formation. Also, there are input risks that occur when either there is a shortage of inputs or when their prices vary (Ramaswami *et al.*, 2003).

## **Institutional risk/policy risk**

This results from changes in policies and regulations that affect agriculture. This type of risk is generally manifested as unanticipated production constraints or price changes for inputs or for output. For example, changes in government rules regarding the use of pesticides (for crops) or drugs (for livestock) may alter the cost of production or a foreign country's decision to limit imports of a certain crop may affect that crop's price or farmers decision to produce it. Other institutional risks may arise from changes in policies affecting the disposal of animal manure, restrictions in conservation practices or land use, or changes in income tax policy or credit policy or exchange rates.

## **Human or personal risks**

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Farmers are also subject to this risk and they are common to all business operators. Disruptive changes may result from such events as death, divorce, injury, or the poor health of a principal in the firm. In addition, the changing objectives of individuals involved in the farming enterprise may have significant effects on the long run performance of the operation. *Asset risk/social risk* is also common to all businesses and involves theft, fire, or other loss or damage to equipment, buildings, and livestock. A type of risk that appears to be of growing importance is *contracting risk*, which involves opportunistic behaviour and the reliability of contracting partners.

## **Financial risk**

This differs from the business risks previously described in that it results from the way the firm's capital is obtained and financed. A farmer may be subject to fluctuations in interest rates on borrowed capital, or face cash flow difficulties if there are insufficient funds to repay creditors. The use of borrowed funds means that a share of the returns from the business must be allocated to meeting debt payments. Even when a farm is 100-percent owner financed, the operator's capital is still exposed to the probability of losing equity or net worth.

## **Risk management strategies**

There are several institutional mechanisms for reducing or managing risks, however, agricultural producers may implement on-farm strategies to manage risk. One such approach is the diversification of farm business income by redirecting investment and labour time away from the farm towards non-farm activities, especially those generating income not strongly correlated with on-farm business income. To the extent that such diversification will compete for resources (e.g. labour, time and capital) with agricultural production, it may reduce agricultural production efficiency or capacity. Diversification can also occur at farm business level, in this case rather than specialising in enterprises that given that highest rate of return, the farm business is diversified to include other enterprises where returns are not positively correlated or that are less risky. However, this will result in a lower average income and lower economic efficiency, as resources are not directed towards the most profitable farm enterprises (RERAD, 2010). The farmer is the agent that is best positioned to know the dimension, characteristics and correlations of the risks that affect his farm. He is also in the best position to evaluate the availability of different strategies to deal with this risk. It is the farmer's responsibility as manager of his own farming business to take the appropriate decisions to manage the risk associated with his economic activity farming (OCED, 2009).

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Ramaswamiet. *al.*, (2003) grouped risk management tools into two: risk reducing strategies that the farmer adopts *ex ante* and risk coping strategies that the farmer adopts after the shock. Holzmann and Jogersen (2001) grouped them into three categories: prevention strategies to reduce the probability of an adverse event occurring, mitigation strategies to reduce the potential impact of an adverse event, and coping strategies to relieve the impact of the risky event once it has occurred. Prevention and mitigation strategies focus on income smoothing, while coping strategies focus on consumption smoothing. Strategies can be based on arrangements made at different institutional levels: farm household or community arrangements, market based mechanisms and government policies. The main groups of tools and strategies available to the farmer are presented in Table 1. Summary of tools and strategies that are available can be different in different countries and for different farmers, for instance due to their size, location or availability of information, some farmers may have more difficult access to market instruments than other farmers. The farmer can choose among available instruments the combination of tools and strategies that best fits his risk exposure and his level of risk aversion.

Based on literatures reviewed, a lot of researches have been conducted in the area of agronomic practices of soybean production but not much has been done in the aspect of risk attitude of the farmers in risk management. Hence, this study is designed in an attempt to fill the research gap.

## **Problem Statement**

Nigeria's domestic production of soybean is trending upwards, but still lags behind the rapidly growing demand from the poultry industry for soybean meal and vegetable oil processors because of low yield, poor agronomic and post-harvest practices. However, soybean demand is projected to increase to 2.3 million MT by 2020, because of a steady increase in poultry sector consumption. Nigeria's installed annual soybean crushing capacity is estimated at approximately 600,000 MT. An estimated 255, 000 tons of soybeans were crushed in 2010/2011 production season, representing only 42 percent of installed processing capacity. There is a domestic annual shortfall of about 100, 000 tons for soybean meal and 300, 000 tons for vegetable oil (USIDA, 2016).

Smallholder farmers face many risks in their farming activities, depending on their ability to absorb risk and their psychological attitudes towards risk, the risk inherent in a new technology or input choice will affect farmers differently (Knight, Weir, and Woldehanna, 2003). Dercon and Christiaensen (2011) explicitly showed that Ethiopian farmers are constrained in technology adoption by risk. Furthermore,



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Boucher, Carter and Guirkingner (2008) argued theoretically that a class of farmers is risk rationed in Peru; that is, due to risk, some farmers will not try to access the formal credit market, even if it would raise their productivity and income levels. Overcoming such barriers to risk, then, could help farmers in developing countries improve their livelihoods along several dimensions. Hardaker, Huirne and Anderson (2004) define risk as uncertainty or imperfect knowledge with exposure to unfavourable consequences. To take a risk is to allow for the possibility of loss or failure in achieving one's desired objectives. In agriculture, uncertainties about yields and prices that have direct bearing on farm productivity and profitability constitute the most significant sources of risk for farmers.

Based on literatures reviewed, a lot of researches have been conducted in the area of agronomic practices of soybean production but not much has been done in respect of risk that the farmers are exposed to and the most important management/coping strategies the farmers have devised to mitigate the sources of risk. Hence, this study is designed in an attempt to fill the research gap. It is for this reason that this research is being designed to address the following research questions:-

- What are the sources of risk that affect soybean production?
- What are the risk coping strategies adopted by soybean farmers?

## **Objectives of the Study**

The broad objective of this study is to estimate the risk attitude among soybean farmers in Kaduna State, Nigeria.

The specific objectives were to:

- i. describe the sources of risk faced by soybean farmers.
- ii. describe the risk coping strategies adopted by soybean farmers.

## **METHODOLOGY**

### **The Study Area**

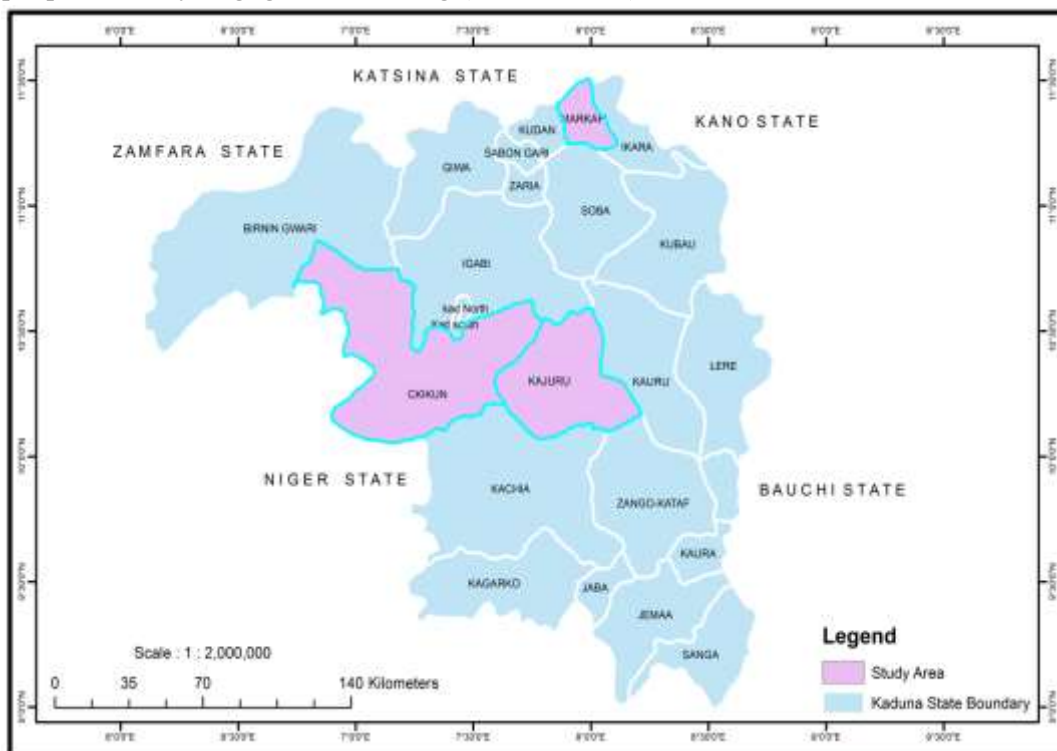
Kaduna State is located at the centre of Northern Guinea savannah. It lies between latitudes 9<sup>o</sup>.10<sup>1</sup>-11<sup>o</sup>30<sup>1</sup> north and longitude 6<sup>o</sup>.9<sup>o</sup>.10<sup>1</sup> east. It has a total area of about 67,000 square kilometres (KADP, 2007) with a population of 6,066,562 people comprising of 3, 112, 028 males and 2, 954, 534 females, the estimated population of Kaduna State as at 2015 would be 8, 252, 366 people with annual population change 2006-2015(+1.4% per year) (NPC 2016). The total arable land of the state is estimated to be about 2,148,700 hectares. There are two distinct climatic seasons in the State, namely wet and dry seasons. The wet season spans the period between April/May to September/October while the dry season spans the period between October/November



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to March/April. The average annual rainfall in the State is about 1,482.99mm. The highest mean temperature occurs between the month of March to May and the range is between 35°C to 36°C. The minimum air temperature is usually recorded during the harmattan period which occurs between November to February with the range between 18°C to 23°C. The total annual evapo- transpiration rate varies from 1.560mm in the north to 1.490mm in the south (KADP, 2007). The State shares boundaries with Niger State to the west, Zamfara, Katsina and Kano States to the north, Bauchi and Plateau States to the east and FCT Abuja and Nassarawa State to the south. The State consists of 23 local government areas as shown Figure 3. Agriculture is the main stay of the economy of Kaduna State with about 80% of the people actively engaged in farming (KADP, 2007).



**Figure 16: Map of Kaduna State Showing the Study Area.**  
**Source: Adapted from KADP (2019).**

**Sampling Techniques:** Sampling of soybean farmers was based on the list of registered soybean farmers provided by KADP in Kaduna State. Multistage sampling technique was employed. The first stage involved a purposive selection of three LGAs each from Kaduna State on the basis of their high

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concentration of soybean farmers. Igabi, Lere and Kuru LGAs were chosen from Kaduna State. In the second stage, soybean farmers were stratified into small scale on the basis of hectareage sizes, convenient and appropriate strata since there is more homogeneity in method of farming, cultural practices, overall outlook of farmers and other characteristics within small scale farmers. The third stage involved a simple random selection of 20% of each stratified small scale soybean farmers by the use of random digits (numbers). This was done in order to reduce the cost of data collection. The breakdown of sample selection showed that 73 soybean farmers from Kuru LGA, 67 soybean farmers from Igabi LGA, and 70 soybean farmers from Lere LGA in Kaduna State. Hence, the sample for the study was two hundred and ten (210) heads of soybean farm families (n = 210).The breakdown of sample procedure is given in Table 2.

**Table 2: Summary of Sample Selection**

State	LGA	Number of registered soybean farmer	of Stratified Small scale soybean farmer	Selected soybean farmers (20%)
Kaduna	Kuru	3,963	363	73
	Igabi	2,012	334	67
	Lere	2,655	348	70
Total	3	8,630	1,045	210

Source:Field survey, 2018.

**Methods of Data Collection:** The data for the study were collected from primary sources. The data were collected using structured questionnaire with the help of trained enumerators.

**Tools of Analysis:** The analytical tool used in achieving the objectives of the study wasdescriptive statistics.

## RESULTS AND DISCUSSION

### **Socio-economic Characteristics of the Soybean Farmers.**

Some important socio-economic variables considered in the study were given as follow. This was assumed to be the primary soybean production decision makers. Age, household size and years of experience of the soybean farmers in the study area were presented in Table 3.

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**Table 3: Age, Household size and Year of Experience of the Soybean Farmers**

Variable	Kaduna State
<b>Age (Year)</b>	
Minimum	22
Maximum	60
Mean	42
Standard deviation	8.24
<b>Household size (Unit number)</b>	
Minimum	2
Maximum	21
Mean	9
Standard deviation	4.19
<b>Year of experience (Years)</b>	
Minimum	1
Maximum	36
Mean	11
Standard deviation	9.12

**Source: Field survey, 2018**

## **Age of the soybean farmers**

Age is one of important socio-economic characteristics of the farmers. It refers to the number of years of the soybean farmers from the birth at the time of data collection. Results revealed that the mean age of soybean farmers in the study area found to be the 42 years with standard deviation of 8.24, 7.64 and 8.22 respectively. The result revealed that average age household heads was 42 years which means that the majority of the soybean farmers in the study area were relatively young (middle-age group) which defined by FAO, (1992) in Saliu, (2013) as economically productive age group. Hence, they are considered to be very active and may therefore accept and adopt innovations faster, *Ceteris paribus*. Overall, this implies that the mean age of the soybean farmers suggests that soybean farming is dominated by younger people in the study area. This is expected to have a significant effect on their productivity.

## **Household size of the soybean farmers**

Household size is the total number of individuals who live within and feed in the same house. Therefore, household is made up of the farmer, his wife/wives, children and any other person that lives and share food with them. Household size is the most important source of labour available to a given household for farm work. Results showed that soybean farmers in Kaduna State have 9 persons with standard

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deviation of 4.19. Considering the labour intensive nature of soybean agronomic practices like planting, fertiliser application, weeding, threshing, winnowing etc., households with large families are more likely to perform these tasks effectively and on time compared to small household size. This is in line with Olorunsanya *et al.*, (2009) that large families appeared to save more extra-cost for hiring labour than small families as indicated in Table 3.

## **Years of experience in soybean production**

The number of years of experience in farming determines farmers' ability to effectively make farm management decisions, not only in adhering to agronomic practices but also with respect to input combinations or resource allocation. Table 3 revealed that mean years of experience in farming of soybean in the study area was 11 years with standard deviation. It could be said that soybean farmers were sufficiently experienced in soybean production. This is consistent with Saliu, (2013) that the length of experience in farming is probably an indicator of a person's commitment to agriculture.

## **Sources of risk and risk Management tools as perceived by the soybean farmers.**

A Likert-type scale was presented to the soybean farmers in order to establish the important sources of risk and risk management tools of the soybean farmers. The respondents were asked to score a list of potential risk sources and risk management strategies respectively, according to their relative importance. The most important risk sources and management strategies were ranked based on the frequency and percentage distribution of the variables on the questionnaire.

## **Distribution of soybean farmers by sources of risk**

Soybean farmers were faced with a number of risks that militated against their production in the study area as indicated in Table 4 and 5.

## **Sources of natural risk**

There were drought, flood, wind/storm, diseases, pests, erratic rainfall, and excessive rainfall. The majority (43.3%) of soybean farmers in Kaduna State had their soybean affected by erratic rainfall, 5.7% by pests, 3.3% by flood, 1% by diseases, 0.5% by wind/storm, and 0.5% by excessive rainfall and none of soybean farmers perceived drought. The implication of this is that soybean yield could be low due to the negative effects of these natural occurrences. The soybean farmers in Kaduna State perceived

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erratic rainfall (43.3%), pests (5.7%) and flood (4.6%) as the three most important sources of natural risk that would obviously caused negative effects on soybean production in the study area.

## **Sources of social risk (economic shock)**

These refer to theft of produce, bush fire, invasion of farms by cattle. The results revealed that 36% of the soybean farmers in Kaduna State had their farms invaded by cattle. Also, the results further revealed that 28% were affected by theft of produce while 7.6% affected by bush fire in the study area. The results showed that most farms were invaded by cattle in the study area which is according to *a priori* expectation livestock farming is the next prominent occupation in the study area. The invasion of farms by cattle has negative effects on the crop yield because in most cases they tend to graze on raw crops consumed by human being. Olarindeet *al.*, (2010) reported similar findings.

## **Sources of economic risk**

Most incidence of sources of economic risk result in low income because sources of economic risk are viable and important components in any enterprise. The following sources of economic risk were responded to by the soybean farmers in study area. The most important was insufficient supply of seed (58.6%) which resulted mostly in reduced output. Also, the result revealed that 36.7% had their soybean production affected by producer price fluctuation (of inputs and output). This implies that low prices on soybean output and high prices on inputs (such as fertilizer, labour, agrochemical, seed etc) are unfavourable to soybean farmers because they have a negative effect on their profit. Maize producer price fluctuation was identified as most important sources of economic risk in Kaduna State (Olarindeet *al.*, 2010). Output and inputs prices have been ranked the highest sources of risk by mono-crop farmers in Kebbi State (Jirgi, 2013). Other important sources of economic risk perceived by the soybean farmers are, high cost of transportation (5.2%) and inadequate market (4.3%).

## **Sources of production risk**

These refer to poor soil, inadequacy of spraying equipment, inadequacy of agrochemical, high cost of fertilizer, untimely supply of fertilizer, inadequate farmland, loss of land/ethnic clash and insufficient work animals. Soybean farmers in Kaduna State rated high cost of fertilizer, untimely supply of fertilizer and poor soil

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as the three most important sources of production risk. These variables have a percentage rating of 48.9%, 33.4% and 18.2%, respectively. Other production risk perceived to be important to soybean farmers in the study area were inadequate farmland (3.3%), inadequate spraying equipment (0.8%), insufficient work animals (0.6%), inadequate agrochemical (0.3%), loss of land/ethnic clash (0%). The soybean farmers in Kaduna State perceived high cost of fertilizer (53.8%), untimely supply of fertilizer (41%) and poor soil (19.5%) as the three most important sources of production risk. The federal government and the various State governments have subsidised fertilizer for farmers, which is distributed to farmers through the Agricultural Development Projects (ADPs), although the supply of fertiliser by the government is inadequate and untimely (Jirgi, 2013 and Olarinde, 2010). Soybean farmers purchase fertilizer in the market at high prices. This implies that the profit could be low due to the negative effects of these production risks.

## **Sources of technical risk**

These are necessarily risk types that affect production process. These were scarcity of hired labour, insufficient family labour, insufficient credit facilities, inadequate extension services, not able to obtain loan, inadequate storage facilities and inadequate processing facilities. The soybean farmers in Kaduna State perceived insufficient credit (65.5%), not able to obtain loan (29%), scarcity of hired labour (9.5%), inadequate processing facilities (8.1%), inadequate extension services (3.3%), insufficient family labour (2.9%) and inadequate storage facilities (1.9%) as most important sources of technical risk.

## **Sources of policy and human risks**

The other sources of risk identified during the survey period are changes in government agricultural policy and illness of farming household member. On aggregate, a change in government and agricultural policy is scored as the first (86.2%) important source of risk for both soybean farmers in Kaduna State. Government policies on agricultural have been inconsistent and poorly implemented: these policies relate to fertilizer subsidy, agricultural insurance, agricultural pricing and pesticide regulation. The instability and poor implementation of government policies on agriculture are the major constraints to agricultural productivity in Nigeria (Jirgi, 2013), which pose a source of risk to the farmers. (8.3%) of soybean farmers were affected by illness of farming household member.

**Table 4: Ranking of Important Sources of Risk by the Soybean Farmers**

Sources of risk	Kaduna State
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<b>Natural risk</b>	<b>Frequency</b>	<b>Percent</b>	<b>Rank</b>
Drought	0	0	7 <sup>th</sup>
Flood	7	3.3	3 <sup>rd</sup>
Wind/storm	1	0.5	5 <sup>th</sup>
Diseases	2	1.0	4 <sup>th</sup>
Pests	12	5.7	2 <sup>nd</sup>
Erratic rainfall	91	43.3	1 <sup>st</sup>
Excessive rainfall	1	0.5	6 <sup>th</sup>
<b>Total</b>	<b>114</b>	<b>54.3</b>	
<b>Social risk</b>			
Theft	59	28.0	2 <sup>nd</sup>
Bush fire	16	7.6	3 <sup>rd</sup>
Invasion of Cattle	76	36.0	1 <sup>st</sup>
<b>Total</b>	<b>151</b>	<b>71.6</b>	
<b>Economic risk</b>			
Producer price fluctuation(of input and output)	77	36.7	2 <sup>nd</sup>
Insufficient supply of soybean seed	123	58.6	1 <sup>st</sup>
Inadequate market	9	4.3	4 <sup>th</sup>
High cost of transportation	11	5.2	3 <sup>rd</sup>
<b>Total</b>	<b>220</b>	<b>95.5</b>	

Source: Field survey, 2018

**Table 4b: Ranking of Important Sources of Risk by the Soybean Farmers (continued)**

<b>Sources of risk</b>	<b>Kaduna State (n= 210)</b>			
<b>Production risk</b>	<b>Frequency</b>	<b>Percent</b>	<b>Ranking</b>	<b>Ranking</b>
Poor soil	41	19.5	3 <sup>rd</sup>	3 <sup>rd</sup>
Inadequate of spraying equipment	0	0	5 <sup>th</sup>	5 <sup>th</sup>
Inadequate of agrochemical	0	0	5 <sup>th</sup>	7 <sup>th</sup>
High cost of fertilizer	113	53.8	1 <sup>st</sup>	1 <sup>st</sup>
Untimely supply of fertilizer	86	41.0	2 <sup>nd</sup>	2 <sup>nd</sup>
Inadequate farmland	2	1.0	4 <sup>th</sup>	4 <sup>th</sup>
Loss of land/ethnic clash	0	0	5 <sup>th</sup>	6 <sup>th</sup>



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Insufficient work animals	0	0	5 <sup>th</sup>	
<b>Total</b>	<b>242</b>			
<b>Technical risk</b>				
Scarcity of hired labour	20	9.5	3 <sup>rd</sup>	4 <sup>th</sup>
Insufficient family labour	6	2.9	6 <sup>th</sup>	5 <sup>th</sup>
Insufficient credit facilities	137	65.5	1 <sup>st</sup>	1 <sup>st</sup>
Inadequate of extension services	7	3.3	5 <sup>th</sup>	6 <sup>th</sup>
Not able to obtain loan	61	29.0	2 <sup>nd</sup>	2 <sup>nd</sup>
Inadequate storage facilities	4	1.9	7 <sup>th</sup>	7 <sup>th</sup>
Inadequate processing facilities	17	8.1	4 <sup>th</sup>	3 <sup>rd</sup>
<b>Total</b>	<b>252</b>			
<b>Policy and human risk</b>				
Change in agricultural policy	180	85.7	1 <sup>st</sup>	1 <sup>st</sup>
Illness of household member	24	11.4	2 <sup>nd</sup>	2 <sup>nd</sup>
<b>Total</b>	<b>204</b>			

**Source:** Field survey, 2018.

## **Ranking of risk management strategies among soybean farmers**

Risk sources have negative effects on farm productivity and this reduces farm income. Farmers have over the years, however, devised different measures to prevent, reduce and cope with the different sources of risk as shown in Table 4.

## **Risk prevention strategies**

These were planting of other crops, planting of improved varieties, diversify to off-farming activities, farm on different land/field and insurance. Soybean farmers in Kaduna State rated planting of improve varieties (87.1%) as number one, 9% used diversify to non-farming activities to prevent risk, 2.4% used planting of other crops, and none of the respondents used insurance and none of them insured their farm against any risk.

## **Risk reducing strategies**

These are necessarily risk management tools used by most farmers. Soybean farmers in Kaduna State used cooperative society (52.4%) and fertilizer (36.2%) as the two most important risk reducing strategies. other reducing strategies perceived to be important by soybean farmers in Kaduna State were training and education on

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farming activities (5.2%), storage programme (5.2%), spraying of diseases and pests (1.9%) and fadama cultivation (1.9%), while Kano State's results revealed that 56.6% of soybean farmers used fertilizer, 12.5% used training and education on farming activities, 10.5% used cooperative society membership, 3.9% used gathering market information, 2.3% used fadama cultivation, 1.3% used spraying diseases and pests and 1.3% used storage programme to reduce the effect of risk in the study area.

The use of storage programme is perceived as an important risk management strategy by farmers, especially the soybean farmers in Kaduna State. Farmers store their farm produce until the prices are high so as to get higher revenue. Training and education helps farmers to know the best agronomic management practices to adopt in order to enhance productivity.

From the analysis obtained for the management strategies, it can be deduced that soybean farmers in the study area prevent, cope and minimise all the different sources of risk.

## **Risk coping strategies**

These refer to borrowing, savings/*Adashe*(cash contribution), off-farm income and selling assets. Soybean farmers in Kaduna State ranked savings/*Adashe* (cash contribution) first (46.2%), followed by 42.4% off-farm income, 10% borrowed to cope with risk and 2.9% used selling of assets to cope with the risk. In Kano State 38.2% used savings/*Adashe*(cash contribution), followed by 21.7% off-farm income, 16.4% borrowed to cope with risk and 2.9% used selling of assets to cope with the risk. Savings/*Adashe* was perceived as an important coping strategy. Savings/*Adashe* has a cushion effect on farmers' finances during period of scarcity. Family members working off-farm is seen as an important coping strategy by farmers because working off-farm boosts household income. This result is consistent with the finding of Alimi and Ayanwale, (2005). Selling of assets was also seen as another important management strategy by soybean farmers in the study area. Most farmers in the study area have livestock enterprises which serve as liquid assets. The result is in line with those of Jirgi, (2013) who reported that farmers sell liquid assets as a means of managing risk.

**Table 5 : Ranking of Important Risk Coping Strategies by the Soybean Farmers**

<b>Risk management strategies</b>			
<b>Risk prevention strategies</b>	<b>Frequency</b>	<b>Percent</b>	<b>Ranking</b>
Mixture cropping	5	2.4	3 <sup>rd</sup>

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Planting of improving varieties	183	87.1	1 <sup>st</sup>
Diversify to non-farming activities	19	9.0	2 <sup>nd</sup>
Farm on different of land/field	3	1.4	4 <sup>th</sup>
Insurance	0	0	5 <sup>th</sup>
<b>Risk coping strategies</b>			
Borrowing	21	10.0	3 <sup>rd</sup>
Savings/ <i>Adashe</i> (cash contribution)	97	46.2	1 <sup>st</sup>
Off-farm income	89	42.4	2 <sup>nd</sup>
Selling of assets	6	2.9	4 <sup>th</sup>
<b>Risk reducing strategies</b>			
Fertilizer provision by government/self	76	36.2	2 <sup>nd</sup>
Training and education on farming	11	5.2	3 <sup>rd</sup>
Cooperative society	110	52.4	1 <sup>st</sup>
Gathering market information	0	0	7 <sup>th</sup>
Storage programme	11	5.2	3 <sup>rd</sup>
<i>Fadama</i> cultivation	4	1.9	5 <sup>th</sup>
Spraying for diseases and pests	4	1.9	5 <sup>th</sup>

Source: Field, survey, 2018

## Conclusion

This study has empirically examined the analysis of risk coping strategies among small scale soybean farmers in Kaduna State, Nigeria. The following conclusions were drawn based on the major findings of the study:

The findings show that soybean farmers in the study area were facing different types of risk in soybean production such as natural, social, economic, technical, production, human and policy risks. Soybean farmers devised coping strategies to prevent risk (growing of resistant varieties), reduce impact of risk (application of fertilizer) and cope with risk (savings).

## Recommendations

The following recommendations are made based on the major findings of this study. The recommendations are aimed at addressing the issues discussed on sources of risk and risk management strategies devised by the soybean farmers in Kaduna State.

- i. The problem of production risk for example, could be addressed through technology change, such as breeding for drought tolerance, resistance to pests and diseases. For social risks, institutional and policy intervention that regulate the movement of animal and authorized periods for bush fire could contribute to address issues generated by these types of social risks. For economic risks, farmers need to get better organized in order to impact on markets. For the risks that related to production process, addressing production issues from technical risks would require a combination of technological changes and policy interventions.

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- ii. The knowledge concerning the sources of risk and its management strategies should serve as a guide to formulating and implementing insurance and agricultural development policies that will improve the agricultural sector.
- iii. Nigerian Agricultural Insurance cooperation (NAIC) should be made more functional to assist the small scale farmers.

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## INCREASE IN CONSTRUCTION COST OF RESIDENTIAL REAL ESTATE INVESTMENT AND DEVELOPER'S PROFIT IN UYO.

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### **Abstract**

*This research examines the effects of increase in construction cost on developer's profit in Uyo, Akwa Ibom State. In order to achieve the stated aim, the objectives were to examine the average increase in construction cost of residential real estate investment in the study area, to analyse the developer's profit of residential real estate investment in the study area and to ascertain the effects of increase in construction cost of residential real estate investment on the developer's profit in the study area. The research work adopted the cross-sectional survey type of design. The research population comprised residential real estate investments duly appraised by Estate Surveyors and Valuers who have offered professional services in the study area. Data was obtained through questionnaire survey. The sample size was 500. Findings from the study revealed that the average construction cost in the study area increased by 28.4%. the study also found out that the 24.8% increase in the cost of construction affected the developer's profit by leading to a loss of ₦1,551,861.97. The investment information provided in this study has significant implications for both local and foreign investors desiring to invest in the Nigerian property market and it is a useful resource for Sub-Sahara African growth and development in this era.*

**Keywords:** *Construction cost, residential real estate, investment, developer's profit, Uyo*

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### **Introduction**

Increase in construction cost and developer's profit play a vital role in the physical and economic development of towns and cities all over the world. Nations and regions would be severely limited in development without construction materials, which is a



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key factor for physical and economic growth. In Uyo, most property investors consider best quality locations and other factors such as increase in demand for lettable space, supply of real property, size of the property, among others, while planning to carry out building construction (Ekpo, 2021). Little or no consideration is made concerning increase in construction cost and developer's profit. The present position concerning property development in Uyo, is that increase in construction cost has remained the key issue as it affects developers profit, due to the high inflationary trend in the country which has resulted in the irreversible increase in the prices of construction materials of which practicing Estate Surveyors and Valuers and investors are yet to fully exploit.

There is paucity of studies in the area of increase in construction cost and developer's profit. According to Wikipedia (2021), Nigeria *is ranked 16th among countries with the highest inflation rate of 16.910*. Possible effects caused by the increase in construction cost (building materials) and developer's profit have therefore elicited the interest of the researchers in this direction. It is against this background that this study was conceived.

The aim of the study is to examine the effects of increase in construction cost on developer's profit in Uyo. In order to achieve the stated aim, the following objectives have been stated:

- (i) To examine the average increase in construction cost of residential real estate investment in the study area.
- (ii) To analyse the developer's profit of residential real estate investment in the study area.
- (iii) To ascertain the effects of increase in construction cost of residential real estate investment on the developer's profit in the study area.

## **Literature Review**

Construction cost form part of the overall costs incurred during the development of a building. Construction cost can also be seen as those costs incurred by the actual construction works themselves, and on some projects may be determined by the value of the contract with the main contractor. Construction costs can be classified into two categories namely; direct construction cost and indirect construction cost.

Direct construction costs entail the costs and expenses that are accountable directly on a facility, function or product. In construction projects, the direct costs are the cost incurred on labor, material, equipment etc.

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These costs for a construction project are developed as estimates by means of detailed analysis of the contract activities, construction method, the site conditions and resources.

Different direct costs in construction projects are material costs, labor costs, sub-contractor costs and equipment costs.

Indirect construction costs entail the costs and expenses that are not directly accountable for a particular facility, product or function. Indirect costs can be either variable or fixed costs.

The main sections coming under indirect costs are personnel costs, security costs, and administration costs. These costs do not have a direct connection with the construction project.

Building material or construction material is any material that can be used for the construction of housing projects. It commonly includes steel, copper, cement, bitumen, lumber, masonry bricks/blocks, and sand among many others. The housing construction industry is one of the most important industries that underpins the economic development of a nation (Ganiyu,2016). The construction sector impacts socio-economic expansion development in the developing countries by contributing substantially to their gross domestic product (GDP) (Ofori,2012 and Chen,2017). As a result of this, it is crucial for the sector to understand the impact of the building materials cost in completing housing projects as scheduled. Building materials cost can actually comprise half (50%) of the total cost of all projects executed by a construction industry (Caldas *et al*,2015). Moreover, building materials cost, are being affected by quality, quantity, time, place, buyer, and seller during a construction production (San,2013). Other factors are currency exchange, material specification, inflation pressure, and availability of new materials in the country (Oladipo and Oni,2012). Generally, total cost of executing a housing project is hugely affected by improper material handling on the construction site, and all this impacts the quality and time scheduled for a project to be completed (Ghoddousi and Hosseini,2012). Durdysev and Hosseini (2019) conducted a survey and systematically reviewed studies on construction project delay; this revealed that the ten most common causes of this are climatic conditions, ineffective communication, deficiency in coordination and conflicts between stakeholders, improper planning, material shortages, financial problems, payment delays, equipment/plant shortage, lack required experience among project stakeholders, labour shortages, and poor site management.

According to some researchers, building materials play a vital role in building as a substantial input in the project development (Akanni,2014). In Nigeria, the incessant rising in price of building materials is a huge challenge towards the performance of

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the construction industry in delivering projects with quality and within the time scheduled. The fluctuating market value for building materials tends to cause high project risk to all stakeholders (suppliers, contractors, and clients) involved in the construction production (Doloi,2012; Ling,2010). The demand for housing of all types, coupled with inflation and tight monetary supply, has caused a big challenge to the cost of building materials in the construction industry (Esohofonie,2008). Therefore, an improved sustainable housing delivery within the budgeted time, cost, and expected quality, as well as taking into consideration the stakeholders' satisfaction and cost of building materials, is absolutely essential in the sense that it affects developer's profit.

## **Cost of Building Materials in Nigeria**

Building materials play a vital role in the construction industry as they are those materials put together in erecting buildings; construction project is not feasible without the inclusion of building materials (Akanniet *et al.*, 2014). That is, building materials play an undeniable significant role in the housing industry as it is the most substantial input in project development, without it which the developer's profit is affected. According to Adedeji (2012), about 60% of total housing expenditure is spent on building materials. Notably, Karana, Hekkert and Kandachar (2010) indicated that appropriate use of the building materials, in respect of the expertise involved in the building construction process, determines the strength, functionality and quality of the building. Building materials play a crucial role in enhancing sustainability of buildings and contributing to economic wealth of the nation. However, Donyavi and Flanagan (2011) observed that in order to reduce construction costs, and to improve productivity, quality and timely project delivery, material management effectiveness must be a main concern. The prices of building materials increase on a daily basis, due to instability of the Naira to the Dollar and general inflationary trends.

## **Effects of Increase in the Cost of Construction Materials on developer's profit.**

Much work has not been done on this particular field. However, according to Onyejiaka *et al* (2018), the effects of the increase in the cost of construction materials are thus;

- (i) **Fluctuation in cost of construction:** Substantial growth in the construction industry is subjected to price stability in materials costs as these have increased at faster rates than the expected (Windapo and Cattell 2013). Akanni *et al.* (2014), in their study to assess the implications

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of the rising cost of building materials in Nigeria, determined fluctuation in construction costs as the most significant effect of increase in the cost of building materials. The authors also identified inflation as one of the key causes of the fluctuating cost of building materials, which affects construction industry development across the nation. This is in agreement with Windapo and Cattell (2013) who found out that the key issue affecting the development of the construction industry in Nigeria, is the increase in costs of building materials which is a significant factor affecting development of the construction industry.

- (ii) **Intensifying Growth in project abandonment:** According to Nwachukwu, (2016) Project abandonment is the unplanned suspension of the work progress especially at the execution stage such as the refusal or failure to complete a contract after practical completion time. He also stated that Numerous construction projects are temporarily or even permanently abandoned, and the predominance of many uncompleted and abandoned projects resulted from finance related crises and material related factors. Ayodele and Alabi (2011) and Idoro and Jolaiya (2010) identified inflation and high cost of building materials as major factors that lead to uncompleted and sub-standard buildings. Clearly, high cost of building materials gives no room for industrial performance in the construction industry Ghoddousi and Hosseini, (2012) while inflation is seen as the cause of progressive cost increase in building materials windapo, (2012).
- (iii) **Increase in Ultimate Cost of Building Products Compared to Estimated Cost of the Building:** Cost variation can be defined as the variance between the original cost and the actual cost when the project is completed, Lukale (2018) and Ikechukwu et al. (2017). Glaeser *et al* (2005) posited that cost variation can simply be described as the amount by which the actual costs surpass the accepted costs during the contract agreement. Cost variation can be determined when the final cost of the project exceeds the original estimate cost. According to Elinwa and Buba 1993, the considered cost of materials and variation of materials prices are the key factors causing a high final cost of building products in Nigeria.

## **Methodology**

This research work adopted the cross-sectional survey type of design. Target population was investments in residential properties and data was collected from

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principal partners of firms of Estate Surveyors and Valuers in the study area. Out of the 116 registered Estate Surveyors and Valuers practicing in Uyo, fifty (50) were found to have carried out appraisal in residential real estate investment in the study area. It was also found that each of the 50 firms surveyed has about ten (10) appraised residential real estate investments in their portfolios, making the total number of appraised investments under study to be 500; thus, the sample size for this study is 500. Data was compiled on properties which have been duly appraised and managed by the firms of Estate Surveyors and Valuers under study. Copies of questionnaire were distributed to respondents to collect data for subsequent analysis. Opinions on the change in rental value, lending rate and constructions costs as well as returns were given by the principal partners of all estate firms surveyed.

## **Data Presentation and Analysis**

### **Examining the average increase in construction cost**

In this section, an attempt was made to find the average increase in construction cost by selecting mostly used building materials and as well as that of professional services for analysis.

**Table 1. The changes in the prices of major building materials in the study area**

Building materials	2018 prices	2021 prices	Percentage increase (%)
Plaster sand (7 tons)	25,000	28,000	12%
Sharp sand (20 tons)	45,000	60,000	33%
Ceramic tiles (40×40)	1,500	1750	16.7%
Cement (50kg)	2,800	3,600	28.6%
Hand mold block (6-inches)	120	130	8.3
Vibrated block (6-inches)	150	160	6.7
Timber 2×3×12	200	270	35
Timber 2×4×12	250	300	20
Timber 2×2	200	350	75
Timber 3×4	660	750	13.6
1/2 -inch obeche	3,500	3,700	5.7
3/4 -inch obeche	3,000	4,600	53.3
Aluminum roofing sheet 1 piece (0.45mm)	3,500	3,700	5.7

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Professional services	3,000,000	4,600,000	53.3
20 tons Granite (1-inch)	85,000	90,000	5.9
8mm steel rod (1)	750	850	13
3-inches nail (1 pack)	900	1,000	11
2-inches nail (1 pack)	800	900	12.5
4-inches nail (1 pack)	1,000	1,200	20

Source: Researchers' analysis, 2021

Table 1 shows the average building construction cost in the study area. it was found out that the average construction cost is in the average of 24.8%

## Analysis of the Developer's Profit before Investment Decision Period

Data from the records of the Central Bank of Nigeria showed that the average lending rate was 18% between the period of January 2018 and December 2021. The analysis in Table 4.2 represents the appraisal report prepared for detached 3-bedroom bungalows under study. It was prepared in January 2018, but due to the increase in construction cost, the development was delayed for almost two years. The average period of development (taken to complete and let) the properties under study was approximately 6 months.

**Table 2: Analysis of the Developer's Profit in the study area**

Period	Item	Net Flow (₦)	P.V. of ₦1 @ 5.6%	P. V. of Cash Inflow (₦)	P. V. of Cash Outflow (₦)
0	Land Cost	1,700,000.00	1		1,700,000.00
1		1,500,000.00	0.9469		1,420,350.00
2		1,380,000.00	0.8967		1,237,446.00
3		1,300,000.00	0.8491		1,103,830.00
4		1,120,000.00	0.8041		900,592.00
5		1,150,000.00	0.7615		875,725.00
6		1,050,000.00	0.6853		719,565.00
7	Capital Value (sales price)	1,100,000.00	@ 5% =	0.6828	15,021,600.00
		₦22,000,000.00			
<b>Total</b>				<b>15,021,600.00</b>	<b>7,957,508.00</b>
				<b>Developers profit = ₦7,064,092.00</b>	

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From Table 2, it was found that the developer's profit was ₦7,064,092.00. Current rental income of similar properties is ₦1,100,000.00 with an investment return of 5% in Uyo. It was also found out from the records of the Central bank of Nigeria, that the cost of finance before the development period was 18%, which was converted into three-months period using the formula  $(1 + i)^{1/n} - 1$ . The analysis in Table 4.1 may be referred to as the base case where references will be made in relation to changes in the construction cost in order to achieve the aim of this research work.

### Analysis of the Effect of increase in Construction Cost on Developer's profit in Uyo.

Data from the records of the firms of Estate Surveyors and Valuers showed that the average construction cost increased by 24.8% between the period of January 2018 and June 2021. The analysis is shown in Table 3. The average period of development (taken to complete and let) the properties under study is also approximately 6 months.

**Table 3: Analysis of the Effects of increase in Construction cost**

Period	Item	Net Flow (₦)	P.V. of ₦1 @ 5.6%	P. V. of Cash Inflow (₦)	P. V. of Cash Outflow (₦)
0	Land Cost	1,700,000.00	1		1,700,000.00
1		1,872,000.00	0.9469		1,772,596.80
2		1,722,240.00	0.8967		1,544,332.60
3		1,622,400.00	0.8491		1,377,579.84
4		1,397,760.00	0.8041		1,123,938.81
5		1,435,200.00	0.7615		1,092,904.80
6		1,310,400.00	0.6853		898,017.12
7	Capital Value (sales price)	1,100,000.00	@ 5%	0.6828	15,021,600.00
		₦22,000,000.00	=		
<b>Total</b>				<b>15,021,600.00</b>	<b>9,509,369.97</b>
				<b>Developers profit = ₦5,512,230.03</b>	

From Table 3, it was found that the developer's profit was ₦5,512,230.03. The construction cost in period 1 to 7 are respectively increased by 24.8%. Land cost and sale value are not affected by the increase in construction costs. From the first 3month period, there was an increased from 1,500,000 to 1,872,000, 1,380,000 to 1,722,240,



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1,300,000 to 1,622,400, 1,120,000 to 1,397,760, 1,150,000 to 1,435,200 and 1,050,000 to 1,310,400 relatively. Sensitivity indicator towards the Net Present Value is 21.9%, calculated as  $[(7,064,092.00 - 5,512,230.03) / 7,064,092.00]$ . This indicates a great effect of the change in the construction cost on the developers' profit, brought about by the increase in the prices of building materials in the study area.

## **Discussion of Findings**

The study reveals that the increase in the prices of construction cost between the year 2018 and 2021 was 24.8% as a result of high inflationary trend in the country, exchange rate, lack of local building materials and high cost of labour.

The study further revealed that the effect on increase in the construction cost by 24.8% resulted in an increase in the net flow for every 3 months from period 1 to 7, thereby causing a decrease in the developers profit from ₦7,064,092.00 to ₦5,512,230.03. This indicates a loss of ₦1,551,861.97.

## **Summary. Conclusion and Recommendations**

The study examined the effects of the increase in construction cost on developers profit in Uyo. This study was carried out as a result of the observation that most real estate developers who embarked on residential real estate investment without considering the increase in construction cost and how it affects the developers' profit. The study has shown that increase in construction cost has a negative effect on the developers' profit in residential real estate investment in Uyo. The study further reveals the importance of every real estate developer in considering the effects of the increase in construction cost on the developer's profit because every real estate investor has the aim of making profit from every investment embarked upon. Increase in the construction cost of residential property development has been linked to the economic instability in the study area.

Based on the findings from the study, it is recommended that practicing Estate Surveyors and Valuers should encourage their clients to carry out feasibility and viability studies on every investment that they (client) want to embark on. Prospective real estate investors should always allow trained professionals to guide them while making investment decision.

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## FORMAL REASONING: A PREDICTOR OF ACADEMIC ACHIEVEMENT AMONG CHEMISTRY STUDENTS IN SECONDARY SCHOOLS WITHIN KAFANCHAN METROPOLIS

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### Abstract

*The research was on formal reasoning: a predictor of academic achievement among chemistry students in secondary schools within kafanchan metropolis. The study employed co-relational survey design. The population of the study consisted of 411 students in 11 public and private senior secondary schools within Kafanchan metropolis, Kaduna state. The sample size consisted of five schools with a total of 149 SSII Chemistry students. The five schools were selected by simple random sampling technique using draw-from-the-hat method. Two research instruments were used for the study; Group Assessment of Logical Thinking (GALT) and Chemistry Achievement Score (CAS). There was positive correlation in formal reasoning ability and achievement in chemistry among SS II chemistry students. Formal reasoning ability proves to be strong predictor of achievement in chemistry. Therefore, it was recommended that the Science teachers should encourage students to develop strong reasoning ability towards science so as to perform better in natural sciences, since formal reasoning ability correlated well with achievement in chemistry. As teachers plan chemistry lessons, tests and examinations reasoning ability, skills and capabilities of the students should be put into consideration.*

**Keywords:** *Formal Reasoning, Predictor, Academic Achievement, Logical Thinking, Reasoning Ability.*

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### Introduction

The major function of education system is to provide programs that will help learners to grow holistically. This will ensure that students are provided with adequate knowledge and skills that will enable them handle classroom and real-world tasks and problems. According to United Nations Educational, Scientific, and Cultural Organization (UNESCO), the 21st century is an age of booming educational diversification and market-based education where students need to be capacitated with world class skills and knowledge.

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On the other hand, there is an apprehension that the current century made the students faced tremendous bulk of information due to information explosion. Toulmin (2000) argue that the knowledge explosion requires caution and careful information sorting with regards to relevant and fake news. Hence, he suggested that learners of this century must have reasoning skills that will allow them to sort relevant information to irrelevant ones. However, gaining reasoning skills is labor-intensive to students. It requires that students have attained the formal stage of development advocated by Piaget.

Furthermore, expectations of the outcomes of education in the 21<sup>st</sup> century increasingly focus on higher order thinking of synthesis, analysis and evaluation (Osborne, 2013), yet school science education is still dominated by lower level cognitive demands-in particular recall. Failure to transform science education for the needs of the 21<sup>st</sup> century is a consequence of a lack of a good model of scientific reasoning, scientific literacy and a body of expertise about how to asses such higher order cognitive competencies (Osborne, 2013).

Chemistry as one of the most important disciplines in the school curriculum has gained world-wide recognition in general education (Ejidike and Oyelana, 2015). Chemistry as a branch of science is a basic requirement for economic, scientific and technological development of any nation, especially in the manufacturing sector where materials, colored and attractive clothing, chemicals, plastic material and other useful household equipment are made available to man. Also chemical products such as fertilizers and herbicides, also products of chemistry, help to scale up farming activities, achieve suitable food production and reduce food importation (Bamikole, & Abiodun, 2013). Chemistry occupies a unique position in the sciences as a result of its requirement and pre-requisite to the study of courses such as pharmacy, medicine, biochemistry, agricultural science, engineering among others.

Chemistry is a branch of pure science that deals with the composition, properties and uses of matter. Chemistry has always been viewed as an abstract course which is very difficult to understand by learners. For example concepts like mole, volumetric analysis, quantitative analysis and qualitative analysis among others if not properly taught and understood by the learner may lead to various misconceptions. Special attention is required to ensure a lot of concrete examples which are used to teach students who have low formal reasoning (low reasoning ability). This is because researchers tends to show that abstract concepts can only be learnt meaningfully by students who have acquired formal reasoning ability (Sirajo, Mari and Olorukooba, 2013). This could be an indication that learning could be related to reasoning ability.

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The ability to reason logically is critical for decision makers and people in everyday life and involves the way we use given knowledge and facts to reach a conclusion. Its application is of crucial importance for advances in the sciences and mathematics, as the scientific method relies heavily on deductive reasoning (a type of logical reasoning in which a conclusion is derived from a premise) and reasoning plays a strong role in a person's ability to make informed, educated and accurate decisions (Lavins, 2011). Daily functioning and the ability to make important life decisions depend on the person's ability to accurately understand a situation, acknowledge their subjective interpretation of the situation, and reach a logical conclusion based on this supporting knowledge. However, research has consistently shown that people fail to reason logically, and they do so in systematic ways (Lavins, 2011). Logical reasoning is commonly assessed by evaluating a person's ability to employ deductive reasoning. Deductive reasoning is defined as a closed system in which an individual derives conclusions from preexisting premises and judges truthfulness of a statement through normative logic (e.g., All dogs are black. Tucker is a dog. Therefore, Tucker is black) (Blanchette, 2006). This differs from inductive reasoning, in which an individual generalizes from a specific assumption (e.g., All the birds I have seen can fly, so all birds can fly).

Students who have acquired formal reasoning ability have deep working memory that enable them solve abstract problems in logical fashion. They are also able to apply scientific thinking in solving problems such as stating and testing hypotheses, isolation-of-variables, analyzing data, and ability to keep concepts and their interrelationships in the mind while considering answers. According to developmental theory, descriptive and theoretical concepts constructions are linked to intellectual development because the process depends on reasoning patterns and also reasoning ability relies on not only maturation but also individual self-regulatory mechanisms that are known to enhance purposive and meaningful learning. This tends to suggest that concept acquisition is dependent on students' reasoning ability. Empirical study in support of this was provided by Lawson – Mari (2012) who reported that reasoning ability highly correlated with performance on concepts acquisition tasks for school Biology and Chemistry students. Bitner – Mari (2012) also showed that reasoning ability explained 62% of the variance in high school science grades.

The purpose of the present study is to investigate the formal reasoning abilities of secondary school class two (SSSII) science students in six forms of formal reasoning ability (conservation, control of variables, proportional, probabilistic, co-relational,

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and combinatorial reasoning) and to determine whether formal reasoning ability of students' contribute to the prediction of their achievement in Chemistry.

## **Statement of the problem**

Researches show that some concepts are formal or abstract in nature and can be learned meaningfully by only learners that acquired high formal reasoning ability. This tends to suggest that advancement in reasoning ability could enhance the learning of chemistry concepts. It can also be inferred that achievement in chemistry may have relationship with reasoning ability (Furio, Ascona, Guisola & Racliffe, 2000). Researches in science education have revealed that students generally perform poorly in all science subject (Olorundare; Adeyegbe, and Usman, - Sirajo, Mari and Olorukooba 2013). Researches in science education have also shown that there is a relationship between formal reasoning ability and achievement in science (Mari, 2001).

Researchers have also shown that academic achievement in science is affected by formal reasoning ability. Numerous studies support a connection between formal reasoning ability and academic achievement. Previous researches revealed formal reasoning ability as a success factor in predicting performance of students. There is no study that seems to investigate the success of reasoning ability in predicting performance of students in chemistry in kafanchan metropolis. It is in line with this that the present study sought to investigate formal scientific reasoning ability as variable in predicting the performance of students in chemistry in kafanchan metropolis. From the literature reviewed, most of the studies carried out used different study areas that are not from kafanchan metropolis. This study will therefore use different study area for a better understanding of the relationships among formal reasoning ability and achievement in chemistry among secondary school class two (SS II) science students in Kafanchan metropolis, Kaduna State-Nigeria.

## **Objectives of the Study**

The study sought to:

1. Examine the relationship among SSII students' formal reasoning ability and academic achievement in chemistry.
2. Determine the difference among SSII male and female students' formal reasoning ability and academic achievement in chemistry.



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## Research Questions

The study addressed the following questions:

1. Is there any relationship among SSII chemistry students' formal reasoning ability and academic achievement in chemistry?
2. Is there any difference between SSII male and female chemistry students' formal reasoning ability and academic achievement in chemistry?

## Null Hypotheses

To guide the study the following null hypotheses were tested at 0.05 level of significance:

**H01:** There is no significant relationship among SSII chemistry students' formal reasoning ability and academic achievement in chemistry.

**H02:** There is no significant difference between SSII male and female chemistry students' formal reasoning ability and academic achievement in chemistry.

## Methodology

The study employed co-relational survey design. Co-relational research involved the collection of data in order to determine whether and to what degree a relationship exist between two or more quantifiable variables. This research design is chosen because the study is interested in finding the relationship among the variables and in observing what has happened to the sample subjects without any attempt to control or manipulate them. The population of the study consisted of 411 students in 11 public and private senior secondary schools within Kafanchan metropolis, Kaduna state. The sample size consisted of five schools with a total of 149 SSII Chemistry students. The five schools were selected by simple random sampling technique using draw-from-the-hat method. Two research instruments were used for the study; Group Assessment of Logical Thinking (GALT) and Chemistry Achievement Score (CAS).

## Group Assessment of Logical Thinking (GALT)

To measure Reasoning Ability of the students the Group Assessment of Logical Thinking (GALT), developed by Road-Rangka, Yeang and Padilla (1982), adopted from Mari, (2001) with a reported reliability coefficient of 0.85, was adopted. The instrument consists of twelve questions testing six reasoning ability of schemata namely;

A. Conservation B. Proportional reasoning C. Controlling variables D. Probabilistic reasoning E. Correlation reasoning F. Combinational reasoning.

Items 1 and 2 deal with conservational ability, 3 and 4 proportional reasoning, 5 and 6 controlling variables, 7 and 8 probabilistic reasoning, 9 and 10 correlation reasoning and lastly 11 and 12 test combinational reasoning.

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## Chemistry Achievement Score (CAS)

Academic achievement score used in this study, measured by the students' MOCK result as their chemistry achievement assessment. The Joint Mock School Examination jointly conducted by all schools within Kafanchan zone was used for the study. The Joint Mock School Examination questions were normally taken through the basic processes of validation and reliability before they were administered. The Mock question has reliability co-efficient of 0.82. Hence, the examination questions were deemed valid and reliable.

## Result

### Research Question

1. Is there any relationship among SSII chemistry students' formal reasoning ability and academic achievement in chemistry?

**Table 1: Mean and Standard Deviation of Students in Chemistry**

	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>
<b>FRA</b>	149	4.53	1.675
<b>CAS</b>	149	47.95	8.432

Table 4.1 shows the mean formal reasoning ability and academic achievement scores of SS II students in chemistry. The mean achievement scores for formal reasoning ability and Chemistry Achievement Test were (M=4.53, SD=1.675) and (M=47.95, SD=8.432) respectively. The SSII chemistry students had a higher mean in chemistry achievement score and the least mean in reasoning ability.

2. Is there any difference between SSII male and female chemistry students' formal reasoning ability and academic achievement in chemistry?

**Table 2: mean and standard deviation of male and female students in chemistry**

	<b>N</b>	<b>Sex</b>	<b>Mean</b>	<b>Std. Deviation</b>
<b>CAS</b>	<b>99</b>	<b>1male</b>	<b>47.49</b>	<b>8.301</b>
	<b>50</b>	<b>2female</b>	<b>48.60</b>	<b>8.637</b>

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RA	99	1male	4.45	1.752
	50	Female	4.63	1.569

Table 4 shows the means and standard deviations on chemistry academic achievement and formal reasoning ability for male and female SS II students. The mean academic achievement score on Chemistry for male was (M=47.49, SD=8.301) and that of female was (M48.60, SD=8.637). The mean difference was -1.109 in favor of the female students.. The mean formal reasoning ability score on Chemistry for male was (M=4.45, SD=1.752) and that of female was (M4.63, SD=1.569). The mean difference was -0.18 in favor of the female students. This shows that there was a difference between the mean academic achievement scores and formal reasoning ability of male and female SS II students' in chemistry in favor of female students. The female students have shown a better result in academic achievement scores and formal reasoning ability than their male counterparts.

## Hypotheses

The variables of formal reasoning ability was analyzed using non-parametric test of Mann-Whitney U test, and academic achievement scores was analyzed using parametric test of independent sample t-test. The two null hypotheses formulated were tested at  $p \leq 0.05$ .

**H01:** There is no significant relationship among SSII chemistry students' formal reasoning ability and academic achievement in chemistry.

**Table 3: Summary of Pearson Correlation on Reasoning Ability and Academic Achievement of Students' in Chemistry**

Variable	N	RA	CAS	MEAN	SD
RA	149	..	.797**	4.53	1.675
CAS	149	..	..	47.95	8.432

\*\* . Correlation is significant at the 0.05 level (2-tailed).

Table 3 shows the Pearson Product Moment on formal reasoning ability and academic achievement of students in chemistry, the pairs of variables were significantly correlated. There was a strong positive correlation between formal reasoning ability and Chemistry Achievement Test scores,  $r=0.797$ ,  $p < 0.05$ . This means that students who had relatively high scores in formal reasoning ability were likely to have high scores in Chemistry Achievement Test. There was significant relationship between

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the formal reasoning ability and academic achievement scores of SS II students in chemistry. Therefore, the null hypothesis that stated no significant relationship was rejected.

**HO<sub>2</sub>:** There is no significant difference between SSII male and female chemistry students' formal reasoning ability and academic achievement in chemistry.

**Table 4: Summary of MANOVA of Academic Achievement in Chemistry by Gender**

Statistics	Value	F	Hypothesis df	Error df	P
Pillai's Trace	.010	0.380 <sup>a</sup>	4.000	147.000	0.822
Wilks' lambda	.990	0.380 <sup>a</sup>	4.000	147.000	0.822
Hotelling's Trace	.010.	0.380 <sup>a</sup>	4.000	147.000	0.822
Roy's Largest Root	.010	0.380 <sup>a</sup>	4.000	147.000	0.822

a. Exact statistics

b. Design: Intercept sex.

Table 4 shows one-way MANOVA was calculated examining the effect of gender on formal reasoning ability and academic achievement scores. No significant effect was found ((Lambda (4,147) = .380,  $p > .05$ ), the null hypothesis which stated no significant difference was retained. Formal reasoning ability and academic achievement was influenced by gender. Therefore, there is no significant difference in the mean score of male and female students in formal reasoning ability and academic achievement.

## Discussion of Results

From the results in Table 3, it was found that there was significant relationship in between formal reasoning ability and achievement in chemistry. A strong positive correlation between formal reasoning ability and Chemistry Achievement Test scores was observed among SSII Chemistry students. This findings agrees with that of Sungur (2001), Tekkaya and Yenilmez, (2006), Nasir and Mansur (2010), Oloyede (2012), Sirajo, Mari and Olorukooba (2013), Nnorom (2013) and Bhat (2016) who also found a positive significant relationship between formal reasoning ability and

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academic achievement. This shows that formal reasoning ability is a strong predictor of achievement in chemistry. Many chemistry problems required application of chemical principles and functional relationship among concepts. This implication requires the ability to apply formal reasoning and critical thinking in order to be successful in them.

Heron (1975) had suggested that chemistry courses were generally taught at a level of abstraction requiring a formal thought and critical thinking before it can be comprehended.

From Table 4, it was found that there was no significant difference between the mean academic achievement and formal reasoning ability of male and female SS II students in chemistry.

This findings agrees with that of Omoniyi (2006), Amelink (2009), Afuwape (2011) and Oludipe's (2012) who reported that there was no significant difference in science performances between male and female students. The findings disagrees with that of Amunga, Amadato and Musera (2011), Obrentz (2012), Ezeudo and Obi – Theresa (2013) whose findings showed that male students are better performers than female in chemistry; Cumberbatch (1993), Cheeseman, Simpson and Wint (2006) and Fayombo (2012) found out that there was significant gender difference in academic achievement in favour of the female. This shows that there are gender differences and similarities in academic achievement at different levels of education around the globe. Also this study agrees with Shemesh in Mari (2001), Mani (2006) Sadket (2012), who revealed that there was no significant difference in the performance of the male and female student. It disagrees with Graybill (1975), Ajagun (1998) who revealed the superiority of girls over boys. Also Graybill (1975), Good (1977) and Howe and Shayer (1981) who demonstrated that boys are superior to girls in their level of performing piagetian-like formal reasoning tasks. Also this study agrees with Wigfield, Eccles, Maclver, Reuman and Midgley (1991), Britner (2002), who observed that in the area of mathematics, boys and girls reported equal confidence during the elementary year.

## **Conclusion and Recommendations**

### **Conclusions**

Based on the findings from the analysis of the data collected for this study, the following conclusions are made:

- i. There was positive correlation in formal reasoning ability and achievement in chemistry among SS II chemistry students. A strong positive correlation between formal reasoning ability and Chemistry Achievement Test scores was observed among the students.

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- ii. Formal reasoning ability proves to be strong predictor of achievement in chemistry. That is students with high scores in formal reasoning ability performed better than those with low formal reasoning ability.
- iii. Formal reasoning ability is a strong predictor of achievement in chemistry among SSII Chemistry students. That male and female student's with high scores in formal reasoning performed better than those with low formal reasoning.
- iv. There was no difference in male and female achievement in chemistry and formal reasoning ability. That is both male and female students performed equally.

Finally, the overall result of this study revealed that there exist a positive relationship among students, formal reasoning ability and achievement in chemistry and hence, formal reasoning ability can be used to predict student's academic achievement in chemistry for both male and female. The study also revealed that, there is no significant difference between male and female students' achievement in chemistry and formal reasoning ability.

## **Recommendations**

Based on the findings of this study the following recommendations are made;

- i. Science teachers should encourage their students to develop strong reasoning ability towards science so as to perform better in natural science, since formal reasoning ability correlated well with achievement in chemistry.
- ii. As teachers plan chemistry lessons, tests and examinations reasoning ability, skills and capabilities of the students should be put into consideration.

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## HUMAN RESOURCES MANAGEMENT IN NIGERIAN SCHOOLS: THE ROLES OF SCHOOL MANAGERS

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### Abstract

*Human resources management is an integral part of overall management of the school. Therefore, this paper examines the role of school managers in the management of human resources in Nigerian schools. The paper describes the concept of management, human resources, human resources management and the needs of human resources in schools. The paper posits that staff training development, staff motivation, staff supervision, records keeping and managing conflict are among the techniques of managing human resources in schools. It also considered planning, organizing, directing, supervising and evaluation as the functions of school managers. The paper identifies the challenges of human resources management in school as management practice, finance, managing diversity, staffing and performance appraisal. This paper therefore suggests that, School managers should acquire adequate skills of management and work to the best of their knowledge without fear or favour, Government should provide adequate funds to ensure regular training, retraining of staff and building infrastructure for staff and students wellbeing also the School managers should improve human relationship; each staff understand the others better, regardless of the differences among them.*

**Keywords:** *Human Resources, School, School manager, Management*

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### Introduction

The best management in school is the one that makes both staff and students feel comfortable and have confidence that they are part and parcel of the school growth and development. In school organization all men and women, teaching and non-teaching staff from school head down to cleaner play a vital role towards actualization of educational goal. According to Wakama and Wakama (2018) human resources are the human component of the organization, the skilled and unskilled manpower that manipulate the other resources to the benefit of mankind. The quality of education children receive has direct relevance to the adequacy, quality and availability of

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human resources in school because no matter the availability of the material resources like physical facilities such as buildings and other equipment, it is the man manipulate them to work efficiently and effectively. Human resources management in school could be seen as a systematic approach towards the acquisition, motivations, development and control of the human resources in any given educational sector. (Wakama & Wakama, 2018). In the same vein Peretomode (2003) in Wakama and Wakama (2018), content that: Human Resources Management in education is not only effective utilization of persons at work but is the harnessing of the totality of people skills energies, talents capacities, social characteristics like belief to achieve educational objectives and simultaneously making the people to be part and parcel of the organization in fulfilling their life goals. It's also the systematic utilization of human potential to realize educational objectives and staff contentment. (Oladekan & Akeen, 2012). School is a place where learners and teachers always meet to interact in order to transmit knowledge, skills, norms and values that are generally acceptable in the society. The school is one of the social organization founded by the society to meet the educational needs and to maintain educational activities. (Tukkahraman, 2015) School is a social organization where people meet who are teachers and learners to share ideas methods for the benefit of the learners and the society. It is also an environment provided for educating children.

The major role of school manager is to coordinate the effort of people towards achieving the educational goals. Therefore, human resources in school organization are staff (teaching and non-teaching) and students.

## **Concept of Human Resources**

Schools are established for the purpose of teaching and learning. Human and material resources are also deployed for that purpose. The school manager plays a vital role in coordinating the effort of those people (staff and students) in the school towards achieving the central purpose of a school. In every school, staff and students are equipped with facilities for optimum productivity in teaching and learning process. The teachers' business in school is imparting knowledge to students and it takes place through interaction in conducive environment. Human resources in school are group of people working together for actualization of effective teaching and learning. Human resources refer to the human effort in rendering of services in an organization. It can be defined in terms of skills, energy, talent, abilities, or knowledge possessed by an individual (Wakama& Wakama, 2018). That is if a man can utilize his skills, energy or talent in realizing the goals of an organization, he

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becomes a resource of that organization. Therefore, the staff regardless of their level or positions and students in a school is the human resource of that school.

## **Human Resources Management in School**

The success of every school depends largely on human resources of that school. Teachers are very essential resources in implementing educational policies. The human resources in school are very important to be effectively managed for good performance. Modern management in education use the term “human resources management” to imply that both staff and students are part of the human resources in education. (Nwankwo, 2014). The poor management of human resource in school affect the effectiveness of teaching and learning. Human resources management can be seen as the design of formal system in an organization to ensure effective and efficient use of human talents to accomplish organizational goals. (Chinyere, 2014). Human resources management in school is that phase of management which deals with the effective control and use of manpower in a school setting for proper implementation of educational policies. Human resources management is a systematic process of ensuring proper workforce maintenance, mutual understanding among staff, and regular training, promotions and remuneration. The school manager must learn the best way to use his fellow human beings. The principle of human relation has enjoins the chief executive of an educational institutions to maintain accessible but respectful distance from the staff and the students. He should be easily reach by any member of the staff but should maintain no intimacy with any one of them. He should be fair to all and friend to none. (Okorie, 2012).

## **Techniques of Human Resources Management in Schools**

Human resources management in school is a process of coordinating, maintaining and integrating both teaching and non-teaching staff in order to achieve the goal of the school. Managing the human resources available in the school is most importance task of a school manager. Every year the portion of the national budget allocated to education is spend on paying the staff attached to that particular ministry and schools. There is need for proper control, motivation and coordination of activities and effort of the teaching, non-teaching staff and students for maximum output from them. Therefore, it become necessary for the school manager to understand the techniques associated with human resources management, because it will assist him/her in managing his/her school effectively and efficiently. The techniques of human resources management include the following:

## **Staff Training and Development**

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This has to do with training of staff to meet their needs which involve the development programmes or courses that are relevance to their field. According to Chinyere (2014) staff development is a process of appraising staff performance and identifying their key skills and competence that need development or training to improve their skills for better performance. Through staff training and development people improve their capabilities and become more perfect in their in their area of specialization.

## **Staff Motivation**

It is very important to motivate both staff and students to do their best under difficult circumstances. It is saying “Motivation” is WHY of behaviour. This implies that the way one behaves determine the motivation he or she received. Motivation is concerned with cause of behaviour of the people, how they act, speak or think in a particular way. There is need for every school manager to know how to motivate his people in order to improve their performances. The quality of human resources management affect the behaviour, attitudes and effort of both staff and students towards their task. In this aspect, there is need for not only the school manager but also the ministry of education and its agencies to take the issue of reward for job performance of staff and academic performance of students very serious. According to Nwankwo (2014) motivation is the drive or energy that propel a person to a specific action and a force that enable people to achieve an organizational objectives.

## **Staff supervision and discipline**

There is need for adequate supervision of all the activities in schools. The school manager needs to supervise things within school by visiting classes, talking to staff teaching and non-teaching, learners and parents. Undie (2007) sees supervision as an effort which involves the stimulating of professional growth and development of teachers. School supervision can be said to be an interaction between at least two people for the improvement of a teaching and learning.

## **Records keeping**

Records in school are the document that contains information about both human and material resources in the school. For the realization educational goals, records need to be kept for future use. Wankwo (2007) defines school records as all activities concern with the creation, storage, retrieval, retention and disposition of all information relating to what is going on in school. Human resources records are very crucial in school organization. It is through record a staff or student can be promoted,

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motivated, disciplined when need arise. Therefore, staff and students information must be stored in a proper place for easy retrieval.

## **Managing conflict**

There is no society, community or organization without conflict. Therefore, conflict is part of the life of the people. Conflict is an open disagreement between two or more people who have different goal. It involves people's feeling as well as their objectives. One way of ascertaining whether the conflict is real or merely apparent is to find out if the parties involved seek to pursue goals that are actually incompatible. Furthermore, once conflict is seen to exist, it is necessary to select the methods of dealing with it that will at much as possible, lead to productive outcomes. (Okorie, 2012)

## **Identifying Needs of Human Resources in School**

The central role of school manager is to identify the needs of his/ her school in general. Need identification is refers to what you require to enable you to perform your duty more efficiently. It is very important to identify our personal and professional needs in life. The school head can only accomplish the educational goals of his school by working hand in hand with people in the school especially the staff. Therefore, he/ she must understand the personal and professional needs of not only the staff but also himself/herself and the student. The needs are categories as follows:

### **The Needs of the School Head**

The following are the needs of school head:

1. Adequate academic and professional qualification
2. An understanding of the various section of the school community
3. An ability to provide a professional leadership to all section of the school
4. Sound knowledge about school finance
5. Mutual understanding between school and community where it is located.

### **The Needs of the Staff**

There is need to understand the needs of both new and experienced member of staff in school. These are some needs:

1. Provision of professional development and growth of all staff
2. Adequate supervision of their activities in school
3. Proper deployment of both teaching and non-teaching staff
4. Adequate supply of teaching material and infrastructure



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5. Provision of positive school climate

## **The Need of the Students**

Students too have needs which will make them very committed to their studies. The needs are as follows:

1. An adequate space for recreational activities
2. Have more learning materials and equipment
3. Giving them responsibility (school prefect)
4. Qualified and devoted teachers that will make them realize their potentialities and
5. Good examination result, which will enable them to go for further studies or get job

## **Functions of a Manager**

The school manager performs the following functions:

### **1. Planning**

Planning in management process is the first thing to be done by school manager. Here school manager need to identify the mission, goal and objective of the school. He or she also has to look at the relationship between objectives, the activities, the available resources and the expected outcomes. That will be the beginning of the planning which is refers to deciding in advance what to do, how to do it, when to do it and who is to do it. Planning as a management function is usually construed and concentrate on the high-level decision about the objectives , the activities, the mean( resources) and the expected outcomes (deliverables) of education.(Nwankwo, 2014) planning is very crucial in management because through planning process the school manager can use minimum resources to maximum result on time. Akpan (2011) defines planning as the process of examining the future and drawing up or mapping out a course of action for achieving specified goals and objectives.

### **2. Organising**

Organizing is the function of the manager which follows planning. It has to do with putting available resources in order of priority. Ochai (2013) Organising is a process of establishing formal relationship among people and resources in order to reach specific goals and objectives. According to Fayal in Ochai (2013) to organize school activities is to provide it with everything useful or its functioning that is human and material resources.

### **3. Directing**

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The school manager needs to direct the implementation of the school plan. This is done through delegation of duties and responsibilities not only to staff but also students and also motivate them towards taking their responsibilities. In field of educational management, direction is said to be those activities which are design to encourage the teacher and other staff to work effectively and efficiently. (Ochai, 2013) it is through direction the school plan can be converted in to performance because people in the school actively perform task to accomplish the goals and objectives of the school.

#### **4. Supervising**

The manager needs to ensure that activities are carried out in line with the approved policy or law and taking steps to correct problems. Undie (2007) sees supervising as an effort which involve the stimulation of professional growth and development of teachers. Supervision is one of the basic requirements of administration in schools; it brings about improvement in teaching and learning. According to Ochai (2013) Supervision is a professional activity concerned with the development, maintenance, and improvement of a school's instructional programme, especially its curriculum and teaching personnel.

#### **5. Evaluation**

The school manager assesses the performance of staff and students and compares the result with the set target or objective of the school. Through evaluation, the strengths and weaknesses of the performance of both staff and student are identified. The feedback is needed for the adjustment of future plans. According to Ochai (2013) evaluation is the structured interpretation and giving meaning to predict or actual impact of the proposal or result.

### **Challenges of Human Resources Management in Schools**

School managers are face with many constraints which affect their ability to manage human resources effectively. Some of the most frequent challenges are as follows:

#### **1. Management practice**

Many people occupying managerial positions in schools have inadequate knowledge of management process. And even those who possess the knowledge fail to put it in to practice for proper running of the school activities. The responsibility of the school manager is to take the school to greater height but unfortunately some managers are not equip with abilities, skills and knowledge required for moving the school forward. If a manager cannot explain to staff what to be done, how to do it, who is to do it in order to achieve the desired goals, it will be very difficult to get an effective

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management in school. The school manager is somebody who has the ability to plan, organize, and implement task.

## **2. Finance**

Without financial resources a school cannot survive. Human resources in school cannot be managed effectively without finance. Once the human and material resources of the school have been identified, there is need for estimates of the amount required for managing the resources. Financial provisions are necessary for organizing, coordinating, monitoring, and training of human resources in schools. Both staff and student needs to be adequately trained and that can only be possible with enough funds. Our schools today are facing challenges of inadequate financial support.

## **3. Managing Diversity**

Managing diversities in a school are team building activities which can assist to integrate the people in that school who are from different culture, religion and unite them toward collective objectives. There is no good relationship among staff even among students in a school because of their ethnic or religious differences. There is no proper smooth human relation in some school due to their differences in religion or culture.

## **4. Staffing**

There is need to have right people for the right job. Staffing is one of the function of personnel management which includes recruiting, training, developing and maintaining of staff. Most of the time schools do not follow the recruitment procedures because they just distribute the vacancies among themselves by giving their family and friends appointments without screening, testing, interviewing the applicant.

## **5. Performance Appraisal**

This has to do with judging the performance of the employee. Managers in school today are so reluctant to identify staff that is performing the assigned work satisfactorily. And also identify those who perform below expectation. There is no regular review of staff performance in schools. It is responsibility of the supervisors to evaluate the performance of staff and compare it with the school target.

## **Conclusion**

Certainly, human resources are fundamental aspect of school organization. So also the management of human resources is the integral part of the general management of school organisation. Therefore, the successes any school programme depend largely

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on how efficiently the school manager can deploy human resources to the best use of the school. The recognition of human resources management as an important element of school manager's daily activities in school has led to the increased interest in the development of both staff and student training and development. Consequently the school managers as a manager of people, it has become evidence that the techniques associated with human resources management such as: staff training, staff motivation, supervision, records keeping and management conflicts can assist the school managers in managing his/her school more efficiently.

## **Suggestions**

This paper offers the following recommendations for further action:

1. School managers should acquire adequate skills of management and work to the best of their knowledge without fear or favour.
2. Government should provide adequate funds to ensure regular training, retraining and building infrastructure for staff and students wellbeing
3. School managers should improve human relationship; each staff understands the others better, regardless of their differences.
4. School manager should establish a means of honest and good attitude towards his/her staff.
5. Government and relevance stakeholders should strictly adhere to the rule and regulations during and after selection of both staff and students.

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## **SKILL ORIENTED BUSINESS EDUCATION AND DEVELOPMENT OF ENTREPRENEURIAL SKILLS AMONG SECONDARY SCHOOL LEAVERS IN NORTHERN STATE; REMEDIES FOR YOUTH RESTIVENESS IN NIGERIA**

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### **Abstract**

*This paper focused on entrepreneurial skills acquired through business education at the secondary school level. It also examined the content of the curriculum of business and technology that relates to skills acquisition, model for business entrepreneurial education curriculum. The research recommends among others that there should be adequate sensitization campaign on skills acquisition, effective implementation of business entrepreneurship education programme at the secondary school level and provision of fund by the government to the graduating entrepreneurial students.*

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### **Introduction**

Business Education is the theory and practical method of business teaching in the curriculum. While business itself is the one in which economic literacy has been addressed head on. It can equally present this matter in several ways.

Principles of economic or economic theory, how business organize and function etc. Which attempt to establish general laws or principles to describe phenomena under study. Ivowi (2011) observed that education is the process of learning and training, which culminates in changing the perception of an individual for better. The educational process can be arranged in many ways; formal, informal or non-formal; privately or publicly. In the final analysis, knowledge in the form of skills is acquired and used to improve society through the identification and solution of problems.

Business education also is a process of acquiring business skills through a well planned and executed program. To qualify as bedrock for economic development, the skill apply to economic activities, which raise a man from one low level to another higher one. Through the business processes, man acquires business skills which he applies in his interaction with goods and services to develop his capacities for attaining and sustaining economic growth and development. The business process skills are many and they include the following; observing, classifying, measuring,

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recording, designing, practicalizing/experiments, controlling variables, manipulating, using tabulation model, interpreting data, inferring, calculating, marketing, distributing, generalizing and predicting. Some of these process skills, like observing and measuring are directly applicable to economic activities. Others calculating, designing, practicalizing and controlling variable are modified to suit the situation.

## **Business Education for job creation and sustainable development**

According to UN report in lyioha (2011), a staggering figure of 1.5 billion people of the world population, that is one third of the world working age population are either unemployed or underemployed, or world population that is one third of the world working age population are either unemployed or underemployed. As a result of the recognition of education as an instrument for job creation and development, the United Nations General Assembly declared 2005-2014 as “the UN Decade of Education for Development (<http://www.wikipedia> Education for Development). This recognition revolves around.

- Attention on the issue of literacy and acquisition of better skills
- Empowering people to participate in decision making.
- The need to appreciate changes in learning.
- Pursuits of standards that support interdisciplinary thing.
- A systematic thinking-acknowledging complexities and looking for links and synergies when trying to find solutions to problems.
- Building of partnerships through the promotion of dialogue and negotiation and people learning to work together.
- Critical thing and reflexion – learning to question our current belief-system and to recognize the assumptions underlying our knowledge, perspectives and opinions. Such critical thinking skills help people learn to examine economic environmental, social and cultural structures in the context of development.

In line with the above objectives, the United Nations observed that the Millennium Development Goals would be better attained via education for development. They emphasized that education helps individuals to acquire and develop specific skills, attitudes, knowledge, skills, character and idiosyncrasies that make them capable of making informed and sound decisions for the benefits of others, the society and the future.

## **Entrepreneurial skills and business education**

There is need for practical approach in developing entrepreneurial skills in all aspects of business discipline and technology. This will make the students or learners who



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graduate from secondary schools and are not able to go further in their educational endeavor or gain employment as a result of economic crisis, to be self-employed (Alkamu and Langkuk, 2010).

Entrepreneurial skills: These are skills and competencies that will enable an individual seek and run enterprise successfully. The entrepreneurial skills according to Langkuk and Alkamu (2010) includes;

- i. Factors combination and management of fund
- ii. Identification of investment opportunities
- iii. Business directorship
- iv. Risk bearing
- v. Choice of investment opportunities
- vi. Innovation
- vii. Decision of the form of business enterprise.

Using practical approach, business enterprise can be taught the above skills and how to apply acquisition and development of appropriate knowledge and skills. Ezenwenne (2005) observed that appropriate knowledge and skills enable an individual to maximize the resources around him within the limit of his capability. Entrepreneurial skills consist of effective utilization of ideas, information and facts that help a learner develop competences needed for firm career commitment such as setting up business, marketing services or being productive employer of themselves and others in salvaging the global economic crisis.

## **Developing entrepreneurial skills through effective implementation of business education curriculum**

Entrepreneurship in business education is that which provides appropriate training experience and skills that are suitable for entrepreneurial endeavor, Ezeudo (2008) and Omiye (2013) described entrepreneurship in business, technology and mathematics as the process of providing individual with the ability to recognize commercial opportunities, insight, self-esteem, knowledge and skills to act on them. Entrepreneurship in business, technology and mathematics thus prepares the students with entrepreneurial skills and inculcates skills that are scientifically and socially usable in business entrepreneurship.

Entrepreneurial skills are occupational survival skills, they are closely related to what are called process skills in business, technology and mathematics. These process skills are the ways or strategies adopted by business educators in order to arrive at the product of business. There are some process skills, they include; observation, classification, recording, measuring, controlling variables, manipulating, using

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practical models and interpreting data, inferring, conclusion and generalizing and predicting. The use of this process skills over a period of time will lead to accumulation of business knowledge which will be useful in the development of entrepreneurial skills.

Developing these entrepreneurial skills in business students will lead to acquisition of skills which successful entrepreneurs always use to start their business ventures.

Omiko (2014) advocated that entrepreneurship has the following merits;

- It plays a complementary in developing the occupational skills, knowledge and work experiences.
- It offers opportunities to students for job experiences and earning saving and investing money at early state of living.
- It will help students to form a base of knowledge about the formation and operation of businesses and to develop some level of familiarity and comfort with business environment such as technological change and micro enterprises.
- There will be great reduction in the rate of unemployment in our society. Self employment and business ownership will become viable.

## **Incorporating entrepreneurship into business and technology curriculum at the secondary school level**

According to the National Policy on Education (FRN, 2004) business education shall emphasize the teaching and learning of business process and principles. This will lead to fundamental and applied research in business at all level of education. The broad aim of business education include;

- Development and improve the personal and employment situation.
- To prepare students for leadership position in both public and private life.
- To enable students have career consciousness and economic understanding of the free enterprise system.
- To provide opportunity for practical job preparation or vocation studies for students in order to make them render effective and efficient in office, distributive and service occupations.
- To prepare students based on interest and aptitudes with the skills, knowledge and attitudes needed to enter into a business occupation, advance and profit in it.
- To develop in students the basic awareness of the contribution which business and office employees make to the nation's economy. Chukwu (2020) with these creativity in business education which entrepreneurship is part of the

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business policy/process can help to improve the skills in business and technology.

The National Policy on Education (2004) stated that the Senior Secondary School shall be comprehensive with a core curriculum designed to pupil's knowledge and outlook.

The students of the New Core-curriculum for the 3 years senior secondary school education in Nigeria.

Group A: core subjects: compulsory, cross cutting

Core subjects

- i. English Language
- ii. Mathematics
- iii. A major Nigerian language
- iv. One of Accounting, Economics, Commerce Short Hand.
- v. Typing or Marketing
- vi. One of Literature in English, Government, Geography or Religious Studies

## **A Vocational Subject**

This implies that all the students, irrespective of their field of study are to take the listed compulsory cross cutting core-subjects are always classified as;

- i. English Language
- ii. General Mathematics
- iii. One Trade Entrepreneurship Studies
- iv. Computer Studies/ICT
- v. Civic Education

## **Core subjects in specialized field of study in the senior secondary school curriculum**

Humanities	Science & Mathematics	Business	Technology
Nigerian Language	General Mathematics	Accounting	Auto-Mechanics
Government	Physics	Store Management	Electronics
CRS	Health Education	Office Practice	Building Construction

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Islamic Studies	Agricultural Science	Insurance	Wood work
Literature in English	Further Mathematics	Commerce	Basic Electricity
Visual Arts	Physical Education	Marketing	Technical Drawing
Music	Biology	Shorthand	General Metal Work
Economics	Chemistry	typing	Food & Nutrition
			Dashing Textile

*Source: NERDC, 2008, Lukeman and Oriawe (2010)*

Students are expected to choose from the above subjects and specialize depending on the type of job, business or profession they want to join.

The Senior Secondary School Curriculum and Entrepreneurship Skills Acquisition/Trade Subject

According to the National Policy on Education (FRN, 2004) the following constitute the entrepreneurship/trade subjects;

- i. Auto-body Repair and Painting
- ii. Marketing
- iii. Animal Husbandry
- iv. Tourism
- v. Keyboarding
- vi. Salesmanship
- vii. Auto-Electrical Work
- viii. Data Processing
- ix. GSM Maintenance
- x. Book Keeping
- xi. Short-Hand
- xii. Store-Keeping
- xiii. Textile Trade
- xiv. Dyeing and Bleaching. (Source, NERDC, 2008).

The above curriculum for entrepreneurship and skills acquisition is well articulated. Its realization shall help to produce graduates, youths or people that can make use of their brains and hands as a result of their acquired creative knowledge and self-employment skills. Lukman and Oviawe (2010) observed that such productive individuals are equipped with necessary professional abilities and rendering of services to ensure human survival and economic prosperity.

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Kourilsky in Omiko (2013) place curriculum components into three groups; opportunity recognition, the commitment of resources and creation of an operating business organization. Opportunity recognition involves the identification of unfulfilled needs in the market place and the creation of ideas for services or product that meet them. Opportunity recognition requires observation of the market, insight into customer needs, invention and innovation. Marshalling resources involves a willingness to take risks as skill in securing outside investment.

## **Skills Oriented Business Education and Development of Entrepreneurial Skills among Secondary School Leavers in Nigeria. Remedies For Youth Restiveness in Nigeria**

Entrepreneurship Fields	Job Description
ICT Works	Repair and maintenance of office information and communication equipment like the computers, handsets etc.
Baking	Production of breads, snacks and ceremonial cakes
Wholesale Transaction	This involves a specialized training or a specific or series of consumable, household or plants or machinery sales
Retail Transaction	This involves a specialized training in buying and selling of assorted or related goods, especially of general household items.

The table above shows some of business apprenticeship fields as well as entrepreneurial opportunities and descriptions in the system can be summarized, Oduma,[ 2012].

1. Development of practical skills for specific occupation.
2. Learning experiences in the various fields in unstructured
3. The system is usually without assessment, certificate or terminate examination.
4. Skills are developed through imitation, observation, personal efforts and minimum initiative and creativity.

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5. Finally, it involves in each case the carrying out of order of the master tradesman by the student to enable them develop the desired occupation or skills.

## **Strategies for successful implementation of business entrepreneurship education curriculum**

For the successful implementation of the business entrepreneurship education curriculum, the business teacher has important roles to play. Such roles include;

1. The students should be given access to libraries and community resources.
2. The use of project work, case studies, field trips and links with entrepreneurs in the community are necessary.
3. Making conscious efforts to assist students to develop self confidence, responsibility, perseverance, risk-bearing/taking and creativity.
4. Making learning activity based with opportunities for students to experience the fun, creativity and excitement that are often a part of innovative and entrepreneurial activities.
5. Increasing understanding through the use of gender balanced materials and strategies, as well as making efforts to analyze current business practices.
6. Providing physical resources that are organized in a variety of ways to enable students to work individually in small groups, or in a whole class setting, Olagunju and Akanbi (2009).
7. There must be effective supervision and close monitoring of the learning activities assigned to the students by both the teachers and the school authority.
8. The instruction can be goal achievement oriented. This may involve the use of a variety of teaching strategies and approaches that will allow students to have control over their learning activities.

The above strategies are necessary for the implementation of business entrepreneurship education curriculum which is geared towards helping the students to acquire entrepreneurial skills and competences required for self-employment and job creation.

## **Conclusion**

Skill acquisition and entrepreneurship education are essential issues in solving the problems of youth restiveness in Nigeria. Various subjects of small, medium and large

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scale business enterprises that encourage the economic landscape add up to produce the service products and system that supports the mainstream economic system. Business technology, vocational and technical education curricular should incorporate skill acquisition and entrench entrepreneurial skills. This will help the students to acquire skills that would empower them to become self-employers of labour when they graduate from the school. Omiko (2012) observed that the preparation and repositioning of the youth for better future is the solution to youth's restiveness and their attitude toward violence.

## **Recommendations**

Based on the usefulness of entrepreneurial skills in business education and its importance in the society, the following recommendations were made,

- i. Fund: This is very useful during the learning processes or stages and during the period of establishing the business enterprise. The money required during the learning process may be big or small depending on the type of training. Money is always required in purchasing materials used in the training. The fund or capital required to establish the business can be sourced from friends, family members, groups or community, cooperative societies, loans from banks, among others. The government should provide fund to help the graduates or entrepreneurs to buy all the materials they need.
- ii. Monitoring and evaluation of business entrepreneurship education programmes should be encouraged. This will help to assess the success of the link between entrepreneurship education, industries or resource centers and self-reliance, Agi (2011).
- iii. There should be adequate sensitization campaign on skill acquisition and proper implementation of business entrepreneurship.
- iv. Well trained educators in skill acquisition and entrepreneurship education programmes should be employed to help in training and retraining of the students in schools on skills acquisition which subsequently would enable the youths to be self-employed and employers of labour in their societies.
- v. The local, states and federal governments should provide materials, equipment facilities and enabling environment needed for functionality in business entrepreneurship education.

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