

## A REVIEW OF LITERATURE ON THE IMPLEMENTATION OF INTERNATIONAL LAW ON REDUCTION OF AVIATION EMISSION IN NIGERIA\*

### **Abstract**

*The increase in the volume of aviation emission being discharged on the earth surface worldwide has been observed to have severe global pollution impact on human lives and climate change effects on the environment. The United Nations having received series of academic and scientific research reports on the need to regulate aviation emission, carried out programmes on global regulation of aviation emission with a view to reducing its volume and devastating impact. This paper reviews scholarly literature on the impact of aviation emission on the environment and the need to implement the international regulations on reduction of aviation emission in Nigeria. A doctrinal research method is used with information from quality journals and books on international regulation of aviation emission. It is however observed that all the literature reviewed do not examine implementation of international regulations on reduction of aviation emission in Nigeria. The review concludes that the above gap in knowledge will be filled by focusing study on implementation of international regulations on reduction of aviation emission in Nigeria.*

**Keywords:** Literature Review, Implementation, International Law, Aviation Emission

### **1. Introduction**

Aviation emission is referred to as the discharge of carbon dioxide and other gases into the atmosphere by aircraft. Also, aviation emission is described as the smoke pollutants or gases from aircraft which originate from fuel burnt in aircraft engines. All over the world, aviation transportation is noted to be increasing steadily largely because of globalization of world economy and economic growth which have made air transportation affordable for a large number of populations in the world.<sup>1</sup> The increase in growth of air transportation has led to increase in volume of aviation emission being discharged on the earth surface. This emission however, caused severe consequences on the global environment in form of pollution of the atmosphere, stratosphere and lithosphere with high level of greenhouse gases like carbon dioxide, carbon monoxide, nitrogen oxide and others.<sup>2</sup> It has been observed that aviation emission constitutes the fastest growing source of anthropogenic greenhouse emission. This is because aviation emission from annex 1 countries rose by 67% between 1991 and 2005 and is estimated to rise by as much as 90% when aviation emissions from non- annex 1 countries are included for the period.<sup>3</sup> It has also been observed that about 3% of both the United States and European Union's (EU) total greenhouse gas emission are from aviation emission. The E.U has forecasted that current growth in trend of emission from international flights using E.U's airports will increase by over 150% over 1990 level.<sup>4</sup> Further, it has been observed that the share of aviation to total global transportation emission is larger if non carbon dioxide emissions are added. The overall impact of aviation emission is however; potentially double in the case of aircraft in the air because aircrafts emit greenhouse gases directly into the atmosphere.<sup>5</sup>

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<sup>1</sup>David Freestone and Charlotte Streck, *The Legal Aspect of Carbon Trading, Kyoto, Copenhagen and beyond*, Oxford University press, 2009, 27.

<sup>2</sup> Ibid.

<sup>3</sup> Ibid, 28.

<sup>4</sup>David, L. Mc Collum, Gregory Gould and David L Greene, 'Greenhouse gas Emission from Aviation and Marine Transportation: Mitigation Potential and Policies,' Institute of Transportation Studies, University of California, 2010, 5.

<sup>5</sup>Ibid

On the environment, the impact of aviation emission is said to be more evident in correlation between increase in carbon dioxide (CO<sub>2</sub>) emission and increase in average temperature observed over entire planets. Since the beginning of industrial era in 1860 to the present, the average temperature on the surface of the earth has increased by 0.8<sup>o</sup>c. The unexpected rise in average temperature since the start of industrial era, is observed abnormal compared with trends, both in view of its relative amplitude and the speed of change on geological time scale.<sup>6</sup> Based on the above, scientific studies have suggested that reducing global emission by 50 to 80 percent below 1990 levels by year 2050 is necessary in order to stabilize the climate and avoid most destructive impacts of climate change.<sup>7</sup> Realising the need to reduce the increasing volume and impact of aviation emission on the environment, the international community responded to the adverse atmospheric effects of aircraft engine emission in two ways: One approach was to control aviation emission through ratification of international conventions and protocols by member states. The notable convention and protocol for this are the United Nations Framework Convention on climate change, UNFCCC (1992) and the Kyoto protocol to the UNFCCC (1977).<sup>8</sup> However, the convention and protocol are to be signed, ratified and domesticated by member states to become implemented as part of the domestic Acts of a state according to Public International Law principle.<sup>9</sup> The other method involves tackling reduction in aviation emission directly from aircraft engines through the regulatory regime of International Civil Aviation Organization (ICAO). The regime include the Standard Recommended Practices on air craft engines (SARPs) and other regulations contained in annex 16 volume II of the Chicago convention 1944. The ICAO regulations equally need adoption into national regulations for the purpose of implementation by member states.

Despite the introduction of international conventions and regulations on reduction of aviation emission above, it is observed that the problem of increase in discharge of aviation emission has continued with its attendant global impact. However, there has been series of suggestions among scholars, that there is need for effective implementation of international regulations on reduction of aviation emission in the respective countries of member states if aviation emission is to be globally reduced. This paper, therefore, reviews various scholarly literature of on the environmental impact of aviation emission and the implementation of international regulations on reduction of aviation emission in Nigeria. The work is also carried out in order to add to the body of literature on implementation of regulations for reduction of aviation emission in Nigeria.

## **2. Literature Review**

Anu Vedantham and Michael Oppenheimer have written about the impact of aircraft emission on the global atmosphere and called for effective international regulations to check it. According to them, aircraft and their potential effects have become subject of intensive studies by scientists and are now drawing interest of government .They observed that global consumption of aviation fuel has risen much faster for aviation sector than other energy sector and future aircraft emission may not only affect global warming but also affect stratosphere Ozone layer.<sup>10</sup> Their report describes long term scenarios for emissions from aviation emission in order to provide a basis for assessing their potential environmental impact throughout the 21<sup>st</sup> century. They however suggest that the growth of CO<sub>2</sub> emission should be restrained as part of developing national plan under UNFCCC, they also suggest adoption of policies such as flexible carbon trading programme integrating aviation into the existing national and international frame work.<sup>11</sup> The writers suggest that ICAO should continue to play dominant role in reduction of aviation emission and issues of responsibility over

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<sup>6</sup>Ibid.

<sup>7</sup>Ibid. 6.

<sup>8</sup>Mankata Nyanpong Y.O. Regulation of Air craft engine emission from International Civil Aviation, (LLM thesis, Institute of Air Space Law. Faculty of Law, MC Gill University, Montreal Canada 2005), 3.

<sup>9</sup>AbdulGafur, H. *Public International Law: A practical Approach* (3rdEdn) Malaysia, Sweet and Maxwell Asia (2011), 78.

<sup>10</sup>Vedantham and Oppenheimer, 'Aircraft Emissions and the Global Atmosphere,' Environmental Defense Fund, New York, 1994,5.

<sup>11</sup>Ibid.

allocation of emission from international flights should be resolved. However, it is observed that the above report mainly concerns the issue of global increase in volume of aviation emission and its effect on the global environment, it does not contain a detail examination of environmental effects of aviation emission on a particular country like Nigeria. It does not also contain a detail policy and regulations for limiting emission from aviation. Therefore, the gap in the above literature is that it does not cover the environmental impact of aviation emission in Nigeria. Therefore a review of literature on the environmental impact and regulation of aviation emission in Nigeria will defer from what is discussed by the writers above, as it will entail detail analysis of the international regulations for aviation emission and the effects of aviation emission on the environment in Nigeria.

Heather L. Miller,<sup>12</sup> Jin Liu<sup>13</sup> and Ruwantisa Abbey Ratney<sup>14</sup> are another set of writers who discussed about on the importance of using sectoral approach of ICAO for reduction of aviation emission more than relying on the use of convention and protocol. Heather Miller posits that emission of greenhouse gases from civil Aviation Organization is better handled by the International Civil Aviation Organization than the UNFCCC and Kyoto Protocol. Jin Liu discussed the role of ICAO on reduction of aviation emission, he submits that ICAO provides annual environmental reports for the purpose of reducing the harmful impact of aviation emission on climate and ecosystem, while Ruwantissa Abbey Ratney commented that ICAO was founded as an international organization which has universality in term of wide participation of countries around the world and that this quality distinguishes ICAO as the appropriate body for reduction of aviation emission. Also, Martinez Romera and H. Van Asselt's<sup>15</sup> articles show how International Civil Aviation Authority struggled to manage differential peculiarities between the developed and underdeveloped countries on regulation of aviation emission. However, the works of these authors only focus on ICAO as a global body for managing reduction in aviation emission, it does not discuss about implementation of international regulations on reduction of aviation emission in Nigeria. This missing gap left in the above literature will be filled by ensuring that this study focuses on implementation of international regulation of aviation emission in Nigeria.

Another work which advocates for effective compliance with international regulations for reducing aviation emission is that of Doaa Abdel Motaal. He noted that the two industries that were exempted from climate change mitigation efforts are International civil Aviation sector and International Maritime sector. He said that aviation industry is a global industry that sought to cater for regulations of its carbon dioxide emission at the global level until it was faced with unilateral imposition by European Union Emission Trading scheme on both domestic and international flights. According to him, the EU scheme favoured some countries while it disfavoured some. He said the rushed responses to combat EU scheme through the use of International Civil Aviation Organization (ICAO) have not yielded fruits because ICAO's principles will distort inter industry competition without necessarily fixing the environmental problem.<sup>16</sup> He advised that the global industry should actively pursue the global solution to aviation emission through effective compliance with the international regulations. However, the writer's work focused generally on global aviation reduction regulations and does not specifically relate to Nigeria. The difference from the above is that this study will specifically relate to compliance with international regulations in Nigeria.

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<sup>12</sup> Heather L. Miller, 'Civil Aircraft Emission and International Treaty Law', Vol. 63(1988), *Journal of Air Law and Commerce*, 763.

<sup>13</sup> Jin Liu, 'The Role of ICAO in Regulating Greenhouse Gas Emission from Aircraft Carbon and Climate Change' Vol 5, (2004) *Carbon and Climate Change Law Review*.

<sup>14</sup> Ruwantissa Abbey Ratney, 'The Legal Effect of ICAO's Decision and Empowerment of ICAO by Contracting States, Annual Review of Air and Space Law, Vol 32 (2009), 57.

<sup>15</sup> Martinez Romera B and H Van Asselt, 'The International Regulation of Aviation Emission' (2015) *Journal of Environmental Law*.

<sup>16</sup> Doaa Abdel Motaal, 'Curbing CO2 Emissions from Aviation: Is the Airline Industry Headed for Defeat?', *Climate Law* 3, no. 1 (2012): 1.

A report which calls for implementation of effective international regulations of reduction of aviation emission is that of Government Accountability Office by the United States of America.<sup>17</sup> The report stated that aviation emission is expected to grow but technological and operational improvement as well as government policies can help to control aviation emission. The report agreed with the forecast of Intercontinental Panel on Climate Change (IPCC) that by 2050, the global aviation industry will emit 3% of the global carbon dioxide emission and 5% of all human generated emission. The report agreed that joint effort by other sector and the aviation industry to stop the growth in aviation emission is the only way to record low emission. The report further agreed that while the range of technological improvements such as use of fuel efficient engine, use of advanced air frame and incentive to conduct research embarked upon by airlines to reduce aviation emission will help to reduce, emission, the above measures may still not be totally adequate, as some policy options are also available to government on reduction of aviation emission. Such measures which include market based measure, the cap and trade programme and application of emission standard on engines will help a lot to reduce aviation emission. However, this report is found to be too general in its approach on how to reduce aviation emission in the global aviation industry it does not refer to a specific country like Nigeria.

Other scholars who show concern about the increasing volume and impact of aviation emission on the environment and the tendency for increase in volume of aviation emission to continue if not checked include Brian, Kershi, Simon, Hangen Schmitzle, Doney and Rockner. These writers posited that a sudden rise in average temperature since the start of industrial era seems abnormal compared with past trends, both in amplitude and the speed on geological time scale. By and large, carbon dioxide (CO<sub>2</sub>) methane, nitrous oxide and ozone which are massively emitted into the atmosphere behave like greenhouse gases. These gases produced by human activities contribute to warming up of the earth surface and thermal imbalance of the earth, therefore, there must be a deliberate check on gas emission.<sup>18</sup> The above explanation on how increase in anthropogenic emissions has led to rise in temperature of the earth surface and the need to stop this, does not disclose the percentage of rise in temperature, it does not disclose the actual effects of the thermal imbalance on the environment and does not relate to Nigeria.<sup>19</sup> A study on Nigeria shall however be different from the above in the sense that it will discuss about the percentage increase in aviation emission and the real effect of aviation emission on the environment.

Ensuring provision of effective legal regime to regulate the high volume of aviation emission being released into the atmosphere has been suggested as one of the ways of ensuring reduction in aviation emission globally. The scholarly work of Claybourne Forxe Clark and Thiago Chagas explains that aviation emissions are the fastest growing source of anthropogenic greenhouse gas emissions which presently constitutes 3% of both the United States and European Union's (EU) total greenhouse gas emission and which has also been projected to be on the increase.<sup>20</sup> The work explains that exemption of international bunker fuel and designation of International Civil Aviation Authority (ICAO) as the body for developing measures to reduce international aviation emission has exempted the aviation sector from emission reduction commitment period of Kyoto protocol. It is said that ICAO has found it difficult to achieve agreement on reduction of aviation emission among its contracting states and reconciling its fundamental objectives with that of UNFCCC despite pledge. Further, it has been stated that and even if ICAO embarks on an aggressive plan of action, greater involvement of United Nations Frame Work Conference On Climate Change (UNFCCC) in

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<sup>17</sup>'Aviation and Climate Change: Aircraft Emissions Expected to Grow, but Technological and Operational Improvements and Government Policies Can Help Control Emissions,' *United States Government Accountability Office*, 1, accessed March 17, 2016, <http://www.gao.gov/assets/300/290594.pdf>.

<sup>18</sup>Ibid.

<sup>19</sup>Kofo A Aderogba, 'Greenhouse Gas Emissions and Sustainability in Lagos Metropolis, Nigeria,' *International Journal of Learning and Development* 1, no. 2 (2011): 46–61.

<sup>20</sup>Bourne, Clerk, and Chagas, 'Aviation And Climate Change Regulation,' 606.

developing measures for the sector would be desired. This is said to be necessary if ICAO would maintain its control on the process of developing measures to address aviation emission over the U.S and the EU, who are more supportive of reduction targets internationally and domestically. Making use of a sectoral approach that requires aircraft operators to be directly responsible for emissions has been suggested by the above work as a preferable measure preferable for development of post 2012 aviation measures.<sup>21</sup> Another writer, Paul S. Dempsey comments on lack of compliance and enforcement of Article 38 of Standards And Recommended Practices of ICAO on member states as part of the limitations of ICAO and is of the view that this should be improved upon.

Significantly, all the works above do not give detail analysis of what constitutes sectoral approach method. Also and they do not discuss about reduction of aviation emission in Nigeria. The missing gap to be filled in the above work and this study is that this study shall discuss extensively on regulations for reduction of aviation emission in Nigeria. Daniel Bodansky, Allen Pein Jan and Annek Petsonk<sup>22</sup> are scholars of International Law who have expressed their views that the UNFCCC as an international convention has contributed to achievement of global reduction in aviation emission. According to them, the UNFCCC is generally considered to be an adequate convention for addressing reduction in general emissions. This is because even though UNFCCC is not primarily meant to address the issue of reduction of aviation emission, it is believed to be a major step in the efforts of International Community to combat serious environmental challenge of climate change which aviation emission also belongs. According to Daniel Bodansky, the emergence of United Nations Framework Convention on Climate Change makes the issue of climate change to be given global importance.<sup>23</sup> Allen Pein Jan states that the UNFCCC is the only convention on climate change that provides an all embracing regulatory frame work for negotiation on reduction of emissions. Annek Petsonk observed that apart from the fact that the UNFCCC focused mainly on reduction of greenhouses gases that cause climate change, the convention should not be misconstrued for law or a binding agreement but should be seen as a framework that is meant to serve as a guide or provide general guide lines to member states for actions to be taken on reduction of general emissions that cause climate change. The scholars contend that the issue of using non-binding compliance among member states to judge its adequacy may not arise since it is not meant for that purpose. However, the views of these writers do not reflect on implementation of international regulations on reduction of aviation emission in Nigeria.

A group of writers who write on regulation of aviation emission in Nigeria include; H.I. Saadu, I .A. Mustapha and K. O. Akanbi. These writers reflect on the impact of aviation emission on the environment and call for implementation of effective regulations on reduction of aviation emission in Nigeria. They observed that aircraft emission is one of the major contributors to climate change, because aircraft engines emit large volume of particulates and gases into the atmosphere which in no small measure lead to global warming and climate change.<sup>24</sup> They also observed that as a result of negative impact of aviation emission on the climate in Nigeria , the Federal Government of Nigeria, through national and international enactments sought to reduce aircraft engine emission, but the efforts were not successful as the challenges facing the aviation sector in Nigeria in relation to aircraft emission reduction persists. They further observed that the claimed reliance of the Nigerian Civil Aviation authority on the principles, rules and regulations of International Civil Aviation Organization (ICAO) has not been successful and that there is no clear

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<sup>21</sup>Ibid.

<sup>22</sup> Daniel Bodansky is a scholar on International Law and Climate Change and the author of the Article titled, The United Nations Framework Convention on Climate Change: A Commentary, while Allen Pein Jan and Annek Petsonk are also scholars of International Law and the writers of the Article titled, The Skies and Airline Base System for Limiting Green House Gas Emission From International Civil Aviation.

<sup>23</sup> See Daniel Bodansky, 'The United Nations Framework Convention on Climate Change: A Commentary,' Vol 18 (1983) Yale Journal of International Law, 460.

<sup>24</sup>Hafsat, Adua, and Khairat, 'Climate Change: Legal Response to Aviation Emission in Nigeria,' 291..

enactment relating to aviation pollution in Nigeria.<sup>25</sup> They however, concluded by recommending for a more effective collaboration between National and international regulations and also called upon Nigeria to specifically provide regulations on reduction of aircraft emission.

The above work which reveals the poor position of regulations on reduction of aviation emission in Nigeria, however appears not detail, as it does not contain a detail discussion on the impact of aviation emission in Nigeria. Also, it does not tell much about the process of implementation of other aspects of ICAO regulations on reduction of aviation emission. The lacuna discovered in the above work shall be effectively addressed with a research on regulation of aviation emission in Nigeria. K. Aderogba is another Nigerian author who advocated for effective regulations on emission. According to him, air travels have increased tremendously to over 50% in the last 20 years.<sup>26</sup> He contends that Greenhouse gases are increasing day by day and there must be checks on gas emission from aviation industry. He further remarked that the world is not at rest to arrest the effects of climate change and global warming and Nigerian government, Nigerians and research institutions should be part of the efforts. However, it is observed that this work does not discuss about implementation of the regulations for checking greenhouse gas emission. Besides, the scope of this work does not specifically focus on aviation emission but generally focus on greenhouse gases in Nigeria. The gap created in the above work and the topic of study will be filled as this study will strictly focus on aviation emission and its regulations in Nigeria.

Joanne Scot and Lavanaya Rajaman constitutes a group of writers who saw the policy to include aviation emission in EU's Emission Trading Scheme (ETS) as unilateral in the sense that the EU did not give adequate weight to the principle of common but different responsibilities and respective capabilities (CBDRBC).<sup>27</sup> Having described the implication of the principle as unclear, they requested that developed countries should take the lead in addressing causes and effects of climate change and that aviation policy should be adjusted. These writers focused more on developed countries in their work, however, this research shall be different, it shall focus on regulation of aviation emission in Nigeria which is a developing country.

An author who has written on regulation of carbon emission and the Clean Air Act in America is Nathan Richardson. According to him aircrafts emit two to three percent of the total Green House Gas Emission per year. This amount which he said to be small when compared with emission from other sector like ground transportation and electricity power is very significant because aviation emission is growing fast as it is projected to increase between 290% to 667% by 2050.<sup>28</sup> He further explained that there is evidence that high altitude aircraft contribute disproportionately to climate change and that until recently, the global emission sector has faced no limit on its emission. He said that Environmental protection Agency (EPA) is the agency in charge or regulation of emissions in the United States of America for federal level through the authority of Clean Air Act and has since 2009 embarked on various regulatory programmes using the tools of Clean Air Act to regulate emission from various sources including regulation of pollution from air craft. According to the writer, EPA Has been regulating aviation emission since 1982, closely following the standard set by the International Civil Aviation Organization (ICAO) .He said EPA has shown relatively little desire to use its authority to regulate aviation emission independent of ICAO despite petition and law suit to do so.<sup>29</sup> He is however of the opinion that EPA has to use its power more smartly for a more effective regulation of aviation emission in America. However, this study will be unique from that of the above writer in the sense that it will focus on regulation of aviation in Nigeria.

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<sup>25</sup>Ibid.

<sup>26</sup>Aderogba, 'Greenhouse Gas Emissions and Sustainability in Lagos Metropolis, Nigeria,' 1.

<sup>27</sup>Joanne Scott and Lavanya Rajamani, 'EU Climate Change Unilateralism,' *European Journal of International Law* 23, no. 2 (2012): 4.

<sup>28</sup>Nathan Richardson, 'Aviation, Carbon, and the Clean Air Act,' *Colum. J. Envtl. L.* 38 (2013): 68.

<sup>29</sup>Ibid., 113.

Nicholas Simone is an author that calls for development of a rapid global aircraft emission estimation tool. According to him, aircraft emission impact the environment by changing the radiative balance of the atmosphere and impact human health by adversely affecting the air quality. The writer said that many tools used to quantify air craft emission are not open source and in most cases computationally expensive and this limits their usefulness for study of uncertainty qualification and assessment of many policy options. He therefore called for more involvement in the research for development of rapid global air craft emission estimation tool so achieve effective reduction on global impact of aviation on the environment. The above work however, focused on tool for measurement of aviation emission. This research will be different from the work in the sense that it will focus on implementation of international regulations on aviation emission.

A writer, whose work on the impact of aviation emission and assessment of international regulations for reduction of aviation emission transcends more than one country, is Mankata Y.O. According to him, aircraft engine emission from civil aviation caused several adverse effects to the atmospheric environment which also served as one of the major contributors to changes in atmospheric chemistry and global warming.<sup>30</sup> He noted that one of the two ways in which the international community responded to reduction in aviation emission was through the adoption of international protocols and conventions and the second approach was adoption of specific industry international regulations for controlling aircraft emission through the International Civil Aviation Organisation (ICAO) and in this respect, the international community through the law making functions of ICAO, adopted mechanisms of standard recommended practices aimed at reduction of aircraft engine emission. According to his assessment, ICAO performed up to standard by exercising its law making power under Article 37 of Chicago Convention Annex 16 vol. II on prevention of international venting of raw oil into the atmosphere, engine certification process, and establishment of standard for air craft engine emission control and technical process for measuring emission control.<sup>31</sup> Commenting on the inter boundary implementation of ICAO regulations, he noted that ICAO's recommended standard practices on reduction of aviation emission were effectively implemented in the EU states and the United States of America but poorly implemented in Ghana.<sup>32</sup> However, this work is rather too casual on analysis on Ghana, it does not give an in depth analysis on the implementation of ICAO's regulations in Ghana and the reasons for poor implementation. Also, the work has been silent about the reluctant attitude of ICAO towards adoption of Kyoto Protocol's directive on emission allocation on international flights among the contracting states. More importantly, the work does not focus on impact and implementation of aviation emission in Nigeria. This research will be will different from the above work in the sense that it will focus on Nigeria and all the observed gaps in the above work shall be properly addressed.

A group of writers: MC Collin David, Gregory Gould and David Green have observed that the potential for reducing greenhouse gas emission from aircraft and marine vessels is considerable and this can be achieved by more than fifty percent level by 2050, but for this reduction to be realised, effective international and domestic legal policy intervention is required.<sup>33</sup> These writers who give an overview of greenhouse gas emission from aviation and marine transportation and various mitigation options to reduce emission by 50 to 80% below 1990 level by 2050, said that scientific studies suggested that reductions are necessary to stabilize the climate and avoid most destructive impact of climate change.<sup>34</sup> On the issue of regulation of emission from aviation and marine transportation, the writers observed that globally, majority of greenhouse gas emission from aviation and marine transportation are still unregulated. They state that while some

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<sup>30</sup>Nyampong, 'The Regulation of Aircraft Engine Emissions from International Civil Aviation,' 1.

<sup>31</sup>Ibid.

<sup>32</sup>Ibid., 3.

<sup>33</sup>McCollum, Gould, and Greene, 'Greenhouse Gas Emissions from Aviation and Marine Transportation: Mitigation Potential and Policies,' 3.

<sup>34</sup>McCollum, Gould, and Greene, 'Greenhouse Gas Emissions from Aviation and Marine Transportation: Mitigation Potential and Policies.'

countries have enacted domestic policies, some have not. Countries like New Zealand, Australia and European Union states were said to have already taken steps to include aviation emission in their domestic greenhouse gas emission reduction programme while the United States is yet to actively regulate greenhouse gas emission at the national level through the U.S Environmental Protection Agency.<sup>35</sup> The writers observed that adoption of a meaningful policy remains both a challenge and a good opportunity for achieving a considerable reduction in emission from aviation and marine transportation. The above work however, does not provide any detail on the legal frame work to be used for achieving reduction in aviation and shipping transportation. Also the work did not disclose the reasons why greenhouse gas emission has remained unregulated in many countries. This research shall be different from the writer's work in the sense that it shall discuss extensively on the international and national legal frame work for reduction of aviation emission in Nigeria.

As a contribution to the need for having effective regulations on greenhouse gas emission, the International Energy Agency in its 2012 edition, gave detail estimates of carbon dioxide emission from fuel combustion in aviation and marine transportation. The work gave latest information on the level and growth of carbon dioxide (CO<sub>2</sub>) emissions, the source and geographical distribution. It also comprised of estimates of emission by country, emission from international marine and aviation bunkers and other relevant information. The report named ten top emitting countries in the world as China, US, India, Russia, Japan, Germany, Canada, Iran and United Kingdom.<sup>36</sup> The significance of this report which comes up as a follow up to the Conference of Parties to Climate Change (COP 17) for the UN Climate change negotiation in Doha Qatar in Dec 2012 is that it assisted to put most current information on the level of emission in the hands of participating countries in the process of reduction of carbon dioxide emission.<sup>37</sup> Also, the report assisted to point out that significance difference existed between its report and that provided by United Nations Frame work Convention on Climate Change. However, the report does not discuss about the legal frame work for reduction of emission from aviation and marine bunkers. The difference to be made in this research and the above work, is that this research shall focus mainly on aviation emission and shall discuss very well on the legal regime for reduction of aviation emission in Nigeria.

The work of another scholar Rypdal Kristin, provides a good frame work for good practice for estimating and reporting emission from aviation. This is because relevant activities on emission are often not made directly available and this makes carbon dioxide emission estimates from aviation quite uncertain in many countries. The paper observes that the main difficulty and uncertainty lie in distribution of fuel between domestic and international use as only domestic use is to be included in the national total when reporting to The United Nation Frame Work Convention on Climate Change (UNFCCC).<sup>38</sup> The work however observes that emission of nitricoxide and methane (CH<sub>4</sub>) from aviation are highly uncertain and do not contribute much to national total. This work is useful to this research in the sense that consequently, good practice methodologies are needed in order to collect relevant and accurate data on domestic fuel use for aviation, but the work does not discuss about the legal frame work on regulation of aviation emission which shall be the focus of this research. Making a robust discussion on the implementation of the regulations for reduction of aviation emission in Nigeria shall be the difference which this research shall contribute.

Olugbenga Oke Samuel and Olubayo Oluduro have written on the need to invent environmental governance towards effective emission control in Nigeria and South Africa. According to them, South Africa and Nigeria

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<sup>35</sup>Ibid., 2.

<sup>36</sup>International Energy Agency 2012 Annual Report,' accessed March 17, 2016, [https://www.iea.org/publications/freepublications/publication/IEA\\_Annual\\_Report\\_publicversion.pdf](https://www.iea.org/publications/freepublications/publication/IEA_Annual_Report_publicversion.pdf).

<sup>37</sup>Ibid.

<sup>38</sup>Kristin Rypdal, 'Aircraft Emissions,' in *IPCC Good Practices Guidance and Uncertainly Management in National Greenhouse Gas Inventories*, 2000, 2.



are developing countries and leading economies in sub-Saharan Africa that require effective management of environment in their countries for achieving reduction in emission and for improvement in the health of their people. They said Nigeria is however notorious for prevalence of emissions, while South Africa is also known for industrial settlements with a lot of emissions.<sup>39</sup> They also remarked that while Nigerian government welcome the idea of protection of environment and reduction of emission through in different conferences and policy initiatives at global level, these have not translated into effective governance of the environment in particular, controlling gas emission and other emissions remains illusion to be to be pursued. They observed that different measures have been put in place in Nigeria towards reduction of emissions but the question is the adequacy of these in terms of legislations or rules. They are of the opinion that Nigeria and South Africa could reduce their emissions if they could put in place, effective legal frame work, efficient institutional capacity, strong political will to implement and domesticate international laws and policies towards emission reduction. However, these writers failed to make specific reference to aviation emission in their work but discussed emission generally. This research will be unique from the above because, it will specifically focus on regulations for reduction of aviation emission in Nigeria.

Opeyemi Adekeye, writes on the global effects of climate change and gas emission and the need for effective regulations to curb the effects. According to him, the world is a global village over which the atmosphere has no boundary, human activity driven by the combustion of fossil fuel and deforestation have changed the climate of the hearth with most significant impact on the eco system, economic and human wellbeing in the developing and industrialised nations alike. He submitted that developing countries will suffer more than others as their lack of resources will not make them overcome the emission problem. The writer observes that Nigeria is already experiencing the impact of global warming resulting in unprecedented rain fall and flood throughout the country and called for effective regulations to address the problem,<sup>40</sup> through Nigeria's participation in Kyoto protocol. However, the writer does not discuss about implementation of international regulations on reduction of aviation emission regulations in Nigeria but concentrated mainly on Kyoto protocol and climate change. This study shall be different from the above in the sense that it shall focus mainly on aviation emission and shall extensively discuss about the implementation of international regulations on reduction of aviation emission in Nigeria.

### 3. Conclusion

From all the above, it is hereby found that all the available scholarly literature reviewed do not examine implementation of international legal regime on reduction of aviation emission in Nigeria. Most of the authors generally discussed about the growing rate of aviation emission, how to determine the level of aviation emission, the impact of aviation emission on the environment and the need for regulations to curb aviation emission. Having concluded that the existing gap in knowledge from the review of scholarly literature above is lack of literature on international regulation of aviation emission in Nigeria, it is hereby recommended that a study that will focus on implementation of international regulations on reduction of aviation in Nigeria be carried out. In this respect, such study will focus very much on the laws regulating aviation emission in Nigeria and importantly, how the provisions of international conventions and regulatory standards have been implemented to ensure reduction of aviation emission in Nigeria. Further, the study will contribute new idea in a different form to the issue of reduction of aviation emission and global warming while aviation transportation thrives in Nigeria.

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<sup>39</sup>Olugbenga Oke-Samuel and Olubayo Oluduro, 'Re-Inventing Environmental Governance towards Effective Emission Control in South Africa and Nigeria,' *Journal of Sustainable Development in Africa* 14, no. 3 (2012): 16.

<sup>40</sup>Adekeye A. O, 'Nigeria's Participation in Kyoto Protocol' (University of Ilorin, 2009), 6.