

EFFECTS OF CLIMATE CHANGE ON COMMERCIAL PROPERTIES IN LAGOS STATE, NIGERIA

Timothy Tunde Oladokun¹

Department of Estate Management, Obafemi Awolowo University, Ile Ife, Nigeria

Abstract: The purpose of this paper is to identify climate change related building defects and examine the effects of climate change on commercial properties in Lagos State. The methodology involved the analysis of primary data collected from the two hundred and seventy practicing Estate Surveying firms in the study area. Proportion method was used to determine the defects that are related to climate change and establish the effects of climate change on commercial buildings. The result shows that 'joint failure' is a major defect because of climate change. Other defects in their perceived order of importance include the growth of algae, wearing and tearing as well as roof leakages. These defects are workmanship and materials related issues, which apparently were either too weak or poor to withstand the seemingly harsh weather that came with climate change. The results in respect of the effects of climate change on commercial properties in the order of the perceived effects are health hazards, infrastructure damage, and high rate of deterioration, reduction in property value, increase in maintenance cost and loss of income. This paper concludes by noting that there was a need to stimulate the interest of other researchers in conducting similar research in other geo-political zones of the country as well as in respect of other categories of properties.

Author keywords: climate change, commercial property, commercial property management, global warming, Nigeria

INTRODUCTION

The changing climatic environment, as it is being currently experienced, is not only capturing the attention of the international community in an unprecedented manner, but also a major cause of concern at the global level and thus the greatest environmental challenge facing the entire world (Barring, 1993). As such, there is a growing societal concern about climate change, given its potential impacts of associated sea level rises, flooding, and altered risks of other natural hazards (Gurran et al, 2008; Burton et al, 2006; Bryne et al, 2009; Hastings and Childs, 2009; Newman et.al, 2009; Bajracharya, Childs and Hastings, 2011, Mahli, Che-Ani, Abd-Razak and Tawil, 2012, Ali, Keong, Zakaria, Zolkafli and Akashah (2013).

As a global phenomenon, climate change is attributable to factors such as oceanic processes (such as oceanic circulation), biotic processes and variation in solar radiation received by the earth plate tectonics and volcanic eruptions

¹ tundeoladokun@yahoo.com

(Imbrei, 1971). Human-induced alterations of natural world might have also contributed to the current global warning that seems to have posed a challenge of survival and continuity to the existence of human race. Individuals and decision makers across widely diverse sectors—from energy to transportation, to natural resource management—are increasingly asking the National Oceanic and Atmospheric Administration (NOAA) for information about climate change in order to make the best choices for their families, communities, and businesses (Lubchenco, 2010).

Climate change is one of the most serious environmental and human threats undermining the achievements of the millennium development goals (MDGs) and the global efforts at reducing poverty with negative consequences on agricultural and natural resources management in countries such as Africa, Asia and Latin Africa (Speranica, 2010). From 1984 to 2003, climate change related losses as a percent of national income were three times higher in low- and lower-middle-income countries, with 80 percent of the world's population, than in higher-income countries (Burton et al. 2006). Its potential to affect natural and man-made resources, especially in developing countries like Nigeria, which is said to account for about 1/6 of worldwide gas flaring (Aluko, et al. 2008), poses a threat to human development and survival, especially with increased gas and emissions from buildings which is said to have negative impact on the natural environment (EPA, 2004).

As a global phenomenon, African countries might not be immune from climate change. The recent flooding in some parts of Nigeria like Nasarawa and Ibadan, Nigeria are likely experiences of climate change in the country. In addition, the fact that the Niger delta region is reported to have over 122 gas flaring sites, which makes the country one of the highest emitters of greenhouses gases in Africa, is an indication that the country could be vulnerable to climate change. Among others, households and real estate will likely be affected by climate change. Heat waves will make houses uncomfortable while more frequent and severe flooding and reduced water availability may expose properties and their occupants to greater risks (Vanguard News, 2012).

Commercial properties can be said to be conceived and built large. Occupied and used for trading and other office uses, the sector is often the focus of large scale and foreign investors whose purpose is to take the benefits of stream of income from its use and occupation. As a 'tool' used to accommodate and sustain commercial activities of a country, its sustained and guaranteed use are essential for beneficial impacts. However, different aspects of a house and construction procedures have the tendency of being affected by climate change (Mahli, et al., 2012 and Ali et al, 2013). Where the effects are negative and substantial, investors' fund in such properties might not be realizable. In addition to the loss of investors' fund, substantial disruptions to commercial activities can lead to the collapse of the economy of a country. Lastly, since commercial properties are likely built with borrowed fund, any failure to meet up with periodic repayment could affect the financial system of the country, with its resultant large-scale effects on the entire country. The question that is likely to agitate the minds of foreign investors, institutional investors and

large scale developers who are currently attracted into the country is, ‘what effects does climate change has on the commercial property asset which might affect the regularity of expected income from them as well as result in disruptions of business activities that are accommodated in them’? An answer to this will strengthen commercial property investment drive and engender economic growth in African regions.

The paper is structured as follows. Following Section one which provides the introduction and the specific aim of the paper is section two which provides a brief review of extant literature and some related past studies in the area of property management and climate change. The third section discusses the study methodology and data requirements. While section 4 contains the discussions of the result, the concluding remark for the study provides the way forward.

LITERATURE REVIEW

Several studies exist in respect of the causes of climate change and its effects on the environment but with no direct focus on commercial buildings. Whereas, building are generally known to be subjects to defects which usually occur to building parts such as roofs, walls, floors, ceiling, toilets, doors and windows (Mydin, Agus Salim, Tan, Tawil, and Md Ulang, 2014 and Tan, 2008), an examination of how climate change has contributed to building defects is yet to be done in African countries like Nigeria. In addition to categorizing property defects into structural and non-structural defects, the study of Bakri and Mydin (2013) found regular building defects to consists of wall crack, peeling paint, dampness, timber decay, fungi and small plant attack, sagging or deformation, erosion of mortar joint, defective plaster rendering, insect or termite attack, roof defect, and also unstable foundation and services, but did not link any of them to climate change. Chiong and Low (2006) examined failure mechanism that caused design related latent defects and the design parameters that could prevent those defects. In a 9-month survey on 74 buildings, the study which identified defects to include: plaster crack, strain, water seepage, paint peeling and blister, paint and plaster patching, chipped, concrete ad tiles crack, and tiles falling/propping, found that the 3 most important design related failure causes were whether impacts, impact from occupants and load and moisture from wet areas. In Malaysia, the work of Ali, et al. (2013) was limited to identifying building elements with design defects. The study which found that common design defects are building façade and missing slot underneath the floor slab did not show those defects that could be related to climate change especially in respect to commercial buildings.

Few studies exist on the effects of climate change on buildings especially in the advanced countries. Stansall (1999) examined the implications of climate change for commercial property in the UK. The study which found climate change effects on buildings to include increasing temperature variation on building interiors and exteriors; higher winter rainfall and increasing summer drought, affecting weather penetration; more frequent flooding; and

more frequent storms and severe winds causing structural damage, necessitates a study in African countries like Nigeria to reflect the peculiarities of the region. Using a case study approach, Pareek and Trivedi (2011) examined how climatic factors relating to cloud formation, lightening, wind direction, rains, drought, disaster prediction, response, mitigation, and effects of weather on crops are perceived by the tribal peoples of Rajasthan, India. Limiting the focus of the study to crop shows the need to evaluate how people perceive that climate change has affected commercial properties in Nigeria. However, the authors documented management strategies adopted to curb natural disasters and extreme weather events in the study area.

Li (2009) studied the monthly property transactions data from Hong Kong's Statistical Department and monthly data of temperature, humidity etc from Hong Kong Observatory in 1997-2006. The study which documented a negative and significant relationship between property prices and temperature did not show the actual effects of climate on properties. The study of Egbe, Yaro, Okon, and Bisong (2014) assessed the perception of rural people to climate change in selected communities in Cross River State, Nigeria. The analysis of the data collected from 120 rural dwellers in four (4) communities showed that majority are aware of climate change arising from natural causes with some occurrences as a result of human activities. The effects of climate change identified in the study included poor crop yields, reduced soil fertility, increase flood poverty and food shortage thus making it necessary to evaluate what effects, in respect of commercial, properties people perceive are attributable to climate change in Nigeria.

Hoveka, Bezeng, Yessoufou, Boatwright and Van der Bank (2015) reconstructed predictive models for the five most damaging aquatic alien plants of freshwater systems in South Africa as solutions to the findings of an earlier study which suggest that a changing climate that becomes warmer may result in currently non-invasive alien plants becoming invasive in the future. The result that some dams currently vulnerable to invasion are becoming resilient while others that are currently resilient may become vulnerable due to climate change are developed for monitoring aquatic ecosystems but not with focus on commercial properties.

In Nigeria, an examination of the way indigenous people in Jema'a Local Government Area of Kaduna State, perceived climate change and their adaptation strategies to climate change was the focus of Ishaya and Abaje (2008). The result of the data obtained from 200 respondents from five settlements within the study area revealed that the respondents attributed climate change largely to human activities and that the effects of climate change is more pronounced on health, food supply, biodiversity lost and fuelwood availability than on businesses. The study which further revealed that lack of improved seeds, lack of access to water for irrigation, lack of current knowledge of modern adaptation strategies, lack of capital, lack of awareness and knowledge of climate change scenarios are the hindering factors to the adoption of modern techniques of combating climate changes in the area, was focused on Agricultural practices.

Otegbulu, Osagie and Afe (2011) investigated how building related and household activities had contributed to global warming, climate change and environmental pollution in Lagos, Nigeria. The result of the analysis of data from 120 households and 30 practicing estate surveyors in Lagos metropolis indicated that household activities triggered environmental problems like global warming and climate change. The recommendation of improvement in power supply and better energy efficient practices amongst households left a gap of the effects on building yet to be filled.

The study of Akpodiogaga and Odjugo (2009) was limited to an assessment of the cost of wind and rainstorm hazards climate change in Nigeria with special emphasis on building and infrastructures between 1992 and 2007. What the people perceived as climate change related effects on buildings is yet to be examined. The results of the study, which relied on climate data (air temperature, rainfall, wind speed), and cost of wind/rainstorm damage collected from 12 out of the 36 states in Nigeria however showed evidence of climate change with increasing temperature and decreasing rainfall.

In the study of Chukwu and Okeke (2015), meteorological data obtained from the Agro-meteorological unit of National Root Crops Research Institute (NRCRI) Umudike, Abia State, Nigeria was used to assess the effects of climate change on solar radiation, relative humidity and temperature in southeastern Nigeria. The absence of a study that will show climate change related defects as well as the effects of climate change on commercial properties in Lagos State, Nigeria lay credence to the desirability of this study. Therefore, this study will evaluate, from the perceptive of the managers of commercial properties, what buildings defects and effects were considered resulted from climate change.

RESEARCH METHODS

The study of the effects of climate change on commercial properties was carried out in Lagos State, Nigeria. As the commercial nerve of the country, the state houses mostly large commercial properties and can be said to be the focus of large and foreign investors. In addition, about 70% of the estate firms, that are legally recognized to oversee the management and maintenance of buildings in the country, are said to have their head offices in Lagos State (NIESV Directory, 2015). Hence, an assurance of data collection is guaranteed. The justification for choosing estate firms who are responsible for managing commercial properties, is borne out of the conviction that they, by virtue of their training and experience, would be able to appreciate the degree to which climate change has contributed to defects in buildings. Questionnaire was distributed to the 270 estate surveying firms in the study area. With a success rate of 64%, the study adopted the descriptive method of analysis of frequency count, mean and proportion method.

From review of literature, a number of defects were identified as potentially arising from climate change. These possible factors were measured by asking the respondents to rank the requirements based on their perception on a five-point ordinal scale. The analysis involved the selection of likely factors that

are perceived as building defects as well as possible effects of climate change from a list of identified factors. This involved data reduction and could therefore be appropriately analysed by techniques such as proportion, relative importance index and chi-square (χ^2) test (Ojo, 2005). The technique of analysis adopted in this paper is the proportion method. Proportion method is a statistical means of representing the significance of a variable relative to all other variables under consideration. Statistically, it is represented by the total score of the variable divided by the overall sum of scores of all variables being considered and it is usually expressed in percentage. Proportion is useful in depicting at a glance, variables, which are very significant, and those, which are not significant. The technique is very apt when the task involves ranking of variables in order of significance (Ojo, 2005). Questions relating to the involvement of respondents were earlier analyzed with the descriptive method of analysis of frequency count and mean.

RESULTS AND DISCUSSIONS

Socio-economic characteristics of the respondents

The result of this first part of the analysis is presented below. In order to know the status of the respondent's staff within the firm, questions were asked as to their designations. Preliminary questions focused on the background of the respondents. The summary of the analysis are as follows: In response to the questions on the gender of respondents' staff, 84.4% are male while 15.6% are female. The distribution of respondents' profile revealed that 73.3% of the firms have been in operations for 10 years while 26.7% have about 16 years of experience. Of the respondents, 82.2% of them have up to 10 branches while the remaining 17.8% maintain more than 10 branches. In response to questions about their numbers of staff, 63.7% have about 20 employees while others have between 21 and 50 staff members. The respondents are all generally graduates of estate management with only 56.7% holding the position of Senior Managers. Nevertheless, 70% of the respondents have up to 5 years' post-qualification experience while other 30% have between 6 to 10 years of experience. In the same way, the response reveals that 40% of the respondents' firms have at least one (1) registered estate surveyors in its employment, 43.3 have between 5 and 10 registered surveyors in their employment with the remaining 16.7% indicating more than 10 registered surveyors. The picture indicated here is that the practising firms in the study area have substantially been in operations, sufficiently enough to be able to observe and report on likely effects of climate change on commercial properties. In addition, the responses in respect of the professional practice of the respondents revealed that all the firms are involved in the traditional real estate management functions of property management, property agency, property development and valuation; with 96.7% firms indicating high level of involvement in all of the activities.

The result in respect of the level of participation of the firms in commercial property management practice revealed that majority (86.6%) of the firms participate highly in property management apparently as one of the regular activities that the firms in the country engage in to keep the office running.

The remaining 13.3% who do little about commercial property management are the big firms who have a well-diversified practice engaging in other areas of the practice like property valuation, agency and development.

Table 1: Involvement in commercial property management practice

Variable	Frequency	Percentage
Low	23	13.4
High	150	86.6
Total	173	100.0

Source: Field Survey, 2015.

The result in respect of the category of properties that the firms manage indicates that majority (53.3%) of the firms manage purpose built open planned office complex. Other responses are that while 22.3% of the firms manage high rise buildings/ properties, the remaining 24.4% manage shopping complexes. As such, a total of 77.7% purpose built open planned office complex and shopping complexes. This can be attributed to the recent development where property management activities of high rise buildings are being taken over by facility management professionals who are currently gaining more patronage by large scale investors and multi-national companies.

Table 2: Category of commercial properties managed

Category of Property	Frequency	Percentage
High rise commercial buildings	39	22.3
Purpose built open planned office complex	92	53.3
Shopping Complexes/centres	42	24.4
Total	173	100.0

Source: Field Survey, 2015.

Aspects of commercial buildings maintained by the firms

The respondents were asked to indicate the aspects of the buildings that they are responsible for maintaining in the course of commercial properties management. The responses are contained in Table 3.

In managing commercial properties, majority of the firms maintain both the internal and external parts of the buildings. This is contained in the responses of 57.8% of the respondents. The responses of the 33.3% of the respondents who maintain only the external part of the buildings represent those firms who majorly handle tenancy relationship on internal repairing lease basis.

Table 3: Aspects of commercial buildings maintained by the firms

Aspects of Building	Frequency	Percentage
Interior	15	8.9
Exterior	58	33.3
Both	100	57.8
Total	173	100.0

Source: Field Survey, 2015.

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Level of awareness of climate change

Table 4 contains responses on the question, ‘what is your level of awareness of climate change?’

Table 4: Level of awareness of climate change

Level of Awareness	Frequency	Percentage
Low awareness	26	57.8
Very much aware	12	26.7
Highly aware	7	15.6
Total	45	100.0

Source: Field Survey, 2015.

The results are that the level of awareness of majority (57.8%) of the practitioners about climate change is low. Despite climate change being a global phenomenon, Nigerian practitioners appeared being more focused on local happenings, apparently because many of the owners of the firms have little knowledge of global occurrences. The remaining 42.3% of the respondents whose level of awareness is high are those who probably by participating in both local and international conferences could have acquired knowledge about contemporary happenings and practice.

Ranking of building defects by means of proportion method

The respondents were asked to indicate, on a 5-point Likert scale, various defects which they perceive, are more prevalent in commercial buildings since the phenomenon of climate change have been on the increase in the country. Table 5 contains the responses on perception of the building defects caused by climate change by means of proportion method.

The result of the analysis from Table 5 shows, in rank order, that the perception of the respondents were that commercial properties in the study area had recorded more ‘joint failure’ due to climate change. The factor was the highest rated factor with a mean figure of 4.17. The second highest rated factor was the growth of algae on the building having a mean figure of 3.78. The factor, ‘wearing and tearing’ as well as ‘roof leakages’ with corresponding

mean figures of 3.73 and 3.72 respectively were rated third and fourth while the factor failure of mortal joint was rated fifth.

Table 5: Ranking of building defects by means of proportion method

Building Defects	Mean	Ranking
Joint Failure	4.17	1
Growth of Algae	3.78	2
Wearing and Tearing	3.73	3
Leakages	3.72	4
Failure of Mortal joint	3.61	5
Dampness	3.56	6
Rusting	3.55	7
Dampness Penetration	3.53	8
Peeling of Paint	3.51	9
Deflection	3.50	10
Drain Blockage	3.50	10
Crack (Asbestos)	3.47	12
Crack	3.29	13
Bleeding of Paint	3.29	13
Building Collapse	3.28	15
Fading of Paint	3.27	16
Blistering of paint	3.25	17
Chalking of Paint	3.23	18
Exposure of reinforcement	3.23	18
Removal of roofing sheet	3.16	20
Shrinking	3.16	20
Different settlement	3.12	22
Decay of Timber	3.09	23
Growth of Fungi	2.77	24

Source: Field Survey, 2015.

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The five highest ranked factors are workmanship and materials related issues, which apparently were either too weak or poor to withstand the seemingly harsh weather that came with climate change.

The mid-ranked factors are: dampness (3.56), rusting (3.55), dampness penetration (3.53), peeling of pains (3.51), deflection (3.50) and drain blockage (3.50). The mid ranked factors are largely water related defects. It could be said that the various commercial buildings were developed without expecting the volume of water from rainfall in the last couple of years. With heavy

downpour raising the already high water level of Lagos State and with the fact that many of the buildings were built on low foundation, water related defects were inevitable.

The least ranked factors were removal of roofing sheet (3.16), shrinking (3.16), differential settlement (3.12), decay of timber (3.09) and growth of fungi (2.77). Ranking these factors as the least suggested that though these defects occurred and were being experienced the respondents did not see them as arising from climate change. The least ranked factors are the day-to-day defects that are peculiar to long use and age of the building fabrics.

Effects of climate change

The respondents were asked to indicate what they perceived were the effects of climate change on commercial properties and its users in the study area. The results of their ranking of the factors are contained in Table 6.

Table 6: Perception of the effects of climate change

Effects of Climate Change	Mean	Ranking
Health Hazard	3.93	1
Infrastructural Damage	3.9070	2
Deterioration	3.8333	3
Reduction in property life span	3.7857	4
Increase in maintenance Cost	3.6279	5
Obsolescence	3.5789	6
Loss of income	3.4762	7
Decline in Property value	3.4286	8
Change in Market Demand	3.4000	9

Source: Field Survey, 2015.

The result is that the respondents perceived that climate change has a number of effects on commercial properties in the study area. The respondents rated health hazards with a mean figure of 3.93 as the greatest effects of climate change. This result suggested the possibility that property users and/or managers could have been victims of defects related accidents because of poor workmanship and/or low quality building materials for construction. This is in line with the findings of Natural Resources Defence Council (2015) and Ishaya and Abaje (2008) that climate change is changing not only the economy, but the health and communities in diverse ways. The second rated factor was infrastructure damage (3.90). Other factors in the order of importance were high rate of deterioration (3.83), reduction in property value (3.78), increase in maintenance cost (3.62) and loss of income (3.47).

The result suggested that the respondents have suffered loss of income because of increased maintenance costs, frequent damages of infrastructure as well as high rate of deterioration owing to climate change. This is in line with the argument of Burton et al. (2006) that climate change events can cause significant economic setbacks.

The least rated factor was change in market demand with a mean factor of 3.40. While the factor appeared not too significant, it suggests a minor record of few clients whose demand could have shifted to 'green' features as a way of overcoming the problems arising from climate change.

CONCLUSION

The study has provided insight into the effects of climate change on commercial properties in Lagos State. Findings in respect of the analysis of data obtained from the estate surveyors and valuers, who are responsible for the management of land and buildings in Nigeria revealed that a large proportion of these practitioners manage low and middle rise commercial properties as large scale investors and developers who own the high rise buildings give them to facility managers who they perceive are more appropriate providers. The study also revealed that majority of the practitioners had little knowledge about climate change as they are not largely exposed to national and global happenings.

The findings in respect of climate change related building defects showed that materials and workmanship related defects are more pronounced followed by water related defects. Emanating from this is the fact that, with climate change, users and manages of commercial buildings have recorded more health related and financial loss effects in the recent past. The implication is the need for a national policy on the standard of materials and workmanship necessary for sustainable commercial property management that will not be unnecessarily inimical to people's health.

A major conclusion is that climate change is responsible for high level of deterioration of building materials and/or components, resulting in frequent maintenance and as such loss of income to commercial property owners. There is therefore the need for the estate surveyors and valuers as well as other members of the built environment, to get themselves familiar with the reality of climate change and its effects on commercial real estate. Efforts should be made by practitioners to acquire knowledge as to how to mitigate the effects of climate on commercial properties. There is also the need for the government to regulate the materials and workmanship used for property development. It might not be out of place to include the standards of materials and workmanship for commercial property development in the proposed building code with appropriate sanctions for defaulters.

REFERENCES

- Akpodiogaga, P. and Odjugo, O. (2009), Quantifying the Cost of Climate Change Impact in Nigeria: Emphasis on Wind and Rainstorms, *Journal of Human Ecology*, 28(2): 93-101.
- Ali, A.S. Keong, K.C., Zakaria, N., Zolkafli, U., and Akashah, F. (2013), The effect of design on maintenance for school buildings in Penang, Malaysia, *Structural Survey*, Vol. 31 Iss: 3, pp.194 - 201

- Bajracharya, B., Childs, I. and Hastings, P (2011), Climate change adaptation through land use planning and disaster management: Local government perspectives from Queensland, 17th Pacific Rim Real Estate Society Conference Climate change and property: Its impact now and later, 16 -19 January 2011, Gold Coast.
- Bakri, N. N. O and Mydin, M. A. O. (2013), European Journal of Technology and Design, 2014, Vol. (3), №
- Burton, I., Diringer, E. and Smith, J. (2006), Adaptation to climate change: International policy options. PEW Centre on Global Climate Change, Arlington, VA
- Bryne, J., Gleeson, B., Howes, M., and Steel W, (2009) Climate change and Australian Urban Resilience: The limits of Ecological Modernization as an Adaptive Strategy, in S. Davoudi, J. Crawford and A. Mehmood (eds.) Planning for Climate Change, London: Earthscan.
- Childs, I.R.W., Hastings, P.A., Bajracharya, B., and Godber, A. (2010) Adoption of Hazard Mitigation Measure by Local Government in Queensland, Institute for Sustainable Resources, Queensland University of Technology, Brisbane, Australia, ISBN 978-0-9808518-0-9.
- Chiong, Wai-Kiong and Low, Sui-Phena (2006), Latent Building Defects: Causes and Design Strategies to Prevent Them, Journal of Performance Constructed facilities, August, pp 213 http://www.fep.up.pt/disciplinas/PGI914/Ref_topico1/LatentBuilding%20Defects.pdf
- Chukwu, G.U. & Okeke, C.T., Assessment of the Effects of Climate Change on Solar Radiation, Relative Humidity and Temperature in Southeastern Nigeria, International Journal of Innovative Scientific & Engineering Technologies Research, 3(1):27-41, 2015.
- Egbe, C. A.; Yaro, Margaret A.; Okon, A. E. & Bisong, F. E., (2014), Rural Peoples' Perception to Climate Variability/Change in Cross River State-Nigeria, Journal of Sustainable Development; 7 (2), 25-36.
- EPA, 2004. Buildings and the Environment: A Statistical Summary. U.S. Environmental Protection Agency Green Building Workgroup December 20, 2004.
- EPA (2010), Climate change Science Facts, Available online at: http://www3.epa.gov/climatechange/downloads/Climate_Change_Science_Facts.pdf accessed 20/12/15
- Gurran, N., Hamlin, E. and Norman B. (2008) Planning for climate change: Leading Practice Principles and Models for Sea Change Communities in Coastal Australia., Report no 3 for the National Sea Change Taskforce July 2008.
- Hoveka, L.N., Bezeng, B.S., Yessoufou, K., Boatwright, J.S. and M. Van der Bank (2015), Effects of climate change on the future distributions of the top five freshwater invasive plants in South Africa, South African Journal of Botany 30, xxx-xxx
- Li, Rita Yi Man (2009), The impact of climate change on residential transactions in Hong Kong, The Built and Human Environment Review, 2 (1), 2009.

- Li, Rita Yi Man (2012), A Review on 10 Countries' Sustainable Housing Policies to Combat Climate Change, 18th Annual Pacific-Rim Real Estate Society Conference, Adelaide, Australia, 15-18 January 2012.
- Lubchenco, J. (2010), Adapting to Climate Change: A Planning Guide for State Coastal Managers, Available online at: <http://coastalmanagement.noaa.gov/climate/docs/adaptationguide.pdf> accessed 25/05/15.
- Mahli, M., A.I. Che-Ani, M.Z. Abd-Razak and N.M. Tawil (2012), School Age and Building Defects: Analysis Using Condition Survey Protocol (CSP) 1 Matrix, *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 6 (7), 1830-1831.
- Mydin, M.A. Othuman, Agus Salim, N.A., Tan, S.W., Tawil, N.M. and N. Md Ulang (2014), Assessment of Significant Causes to School Building Defects, Emerging Technology for Sustainable Development Congress (ETSDC 2014); Available online: http://www.e3s-conferences.org/articles/e3sconf/pdf/2014/02/e3sconf_etsdc2014_01002.pdf
- Newman, M., P. D. Sardeshmukh, and C. Penland (2009), How important is air-sea coupling in ENSO and MJO evolution? *Journal of Climate*, 22 (11), pp. 2958–2977.
- Natural Resources Defence Council (2015), An Introduction to Climate Change: What it could mean to you and your family, Available online at: <http://www.nrdc.org/globalwarming/climatebasics.asp>, accessed 20/12/15
- Otegbulu, A.C., Osagie, J.U., Afe, Y.O. (2011), The Built Environment Perspective of Climate Change- A Focus on Household Activities in Lagos Metropolis, *Journal of Sustainable Development* 4 (5), 174-187.
- Pareek, A. and Trivedi, P.C (2011), Cultural values and indigenous knowledge of climate change and disaster prediction in Rajasthan, India, *Indian Journal of Traditional Knowledge*, 10 (1), 183-189.
- Stansall, P. (1999), The implications of climate change for commercial Property, *Property Management*, Vol. 17 Iss: 2.
- Tan, Wei Cheun (2008), Building defects on School Buildings,
- Solomon, Amy and Newman, Matthew (2012), Reconciling disparate twentieth-century Indo-Pacific Ocean temperature trends in the instrumental record, *Nature Climate Change* 2, 691–699.