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A Review of the Effects of Sick Building Syndrome on Property and the Occupants

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Abstract: Sick Building Syndrome (SBS) is a situation where occupiers of a particular building complain of severe health problems or discomfort and get relieved shortly after leaving such a building. It is an issue that has been on for almost four decades now and has implications on the value of a building as well as its occupants. In this study, a comprehensive systematic review of paper published in journals and conference proceedings in the area of sick building syndrome was carried out. This was done to harmonise and also provide a comprehensive literature review of the previous research efforts on the types, causes, effects and remedies to issues relating to sick building as it affects the occupants and property value. The review concluded that many have health issues as a result of the building they occupy either as an office or residence. Likewise any building tagged 'sick' may not recover from the stigma, even after remediation.

Keywords: Sick Building, Syndrome, Property, Occupants, Health Problem, Discomfort

1. Introduction

According to Rostron (2008), "Sick building syndrome (SBS) is recognised by the World Health Organization as 'a syndrome of complaints covering nonspecific feelings of malaise, the onset of which is associated with occupancy of certain modern buildings".

In the early 1980's, the term 'Sick Building Syndrome (SBS) was introduced as "building sickness" by a Canadian tobacco consultant named Theodor D Sterling. "Tight building syndrome" was used to describe the same phenomenon by his counterparts. It was believed that sick building syndrome was not caused by smoking, but inadequate ventilation. This may

be close to the truth as the energy conservation of the 1970's resulted in sealing up of buildings to reduce energy consumption, reduction of air flow into the buildings, increased use of chemicals in carpet and paint, poor lighting, increased use of computers, including high level of stress in the workplace (Edmund, 2017). Sick building syndrome became a household name in 1985, when it was associated with Legionnaire's Disease (a form of pneumonia which was first noticed in an air conditioning system in an hotel in Philadelphia during a conference). Gray Robertson and associates at Air Conditioning and Ventilation associates (ACVA) which was later renamed Healthy Buildings International (HBI) identified bacteria in an air conditioning system. This gave rise to the term "Sick Building Syndrome" in order to support the false impression about the effects cigarette smoke on secondary smokers. The effects of volatile organic compounds in artificial rugs, photocopier emission and so on were overstated because the experiment and the publications were financed by the cigarette industries. The air conditioning companies sponsored the ACVA mission as they promote their product by recommending very expensive air conditioning system in offices and popularised "Sick Building Syndrome" (Sourcewatch, 2017). It has been used interchangeably with other terms like 'Indoor Air Quality Syndrome', 'Closed Building Syndrome' and 'Tight Building Syndrome'. Sick building does not necessarily mean that the building is diagnosed for a particular ailment, but a situation where occupiers of a particular building complain of severe health problems or discomfort and get relieved shortly after leaving such a building. There is no particular source of the ailment or traceable cause. Most of the time the effects of sick building is short-lived, but some symptoms can persist. The symptoms may be peculiar to an apartment or region, or may be predominant in a building. On the contrary, when the ailment is diagnosable and the signs are acknowledged, it is referred to as "Building Related Illness" (BRI) (United States Environmental Protection Agencies, 1991). The major contaminants/ pollutants resulting in sick building syndrome are: formaldehydes, dust mites, cigarette smoke, VOCs (Volatile Organic Compounds), mold and pollen (Edward, 2015). The common symptoms are: nausea, itching eyes, watery nose, nose bleeding, weakness, fatigue and so on.

According to the report of a World Health Organization Committee (1984), it was discovered that globally, three out of ten new and renovated buildings may likely have issues of indoor air quality (IAQ). It can be associated with poor maintenance, conversion of building from the original plans, poor design or sometimes indoor air problems as a result of activities in the building (Seltzer, 1994). Another essential aspect likely to be affected by sick building is the occupants' health and the property value. Investors in real estate always seek to maximize profit while minimizing risk. Investment in real estate is capital intensive,

therefore, investors as well as the property managers must guaranty that the investment is in good condition in order to achieve investment objectives which are to: preserve capital, enhance capital value and secure maximum returns (Emoh, 2004). Hence, property managers should ensure that investment in property continues to command value and at the same time, the occupants must have value for their money. It is based on this foregoing that this study seeks to investigate the effect of sick building syndrome on occupants' health and property.

2. Literature Review

Sick Building Syndrome has been an issue for almost four decades. It was as a result of energy conservation that led to closing up of buildings to prevent energy loss and reduce cost of energy consumption in addition to intensive use of upholstery, computers, photocopiers, air conditioners, carpets and wallpapers (Fotoula, 2011). There has been few research efforts conducted on Sick Building Syndrome /Building Related Illness around the world, even moreso in Nigeria where there exist a paucity of research. For instance, the work of Joshi (2008) identified problems associated with sick building syndrome in 206 buildings. It was discovered that 18 % were toxic element from indoor of the office space; these elements include; methyl alcohol from an old photocopy machine, methacrylate from a copier, sulfur dioxide from a heating system, amines used in a humidification system, chlordane used as a pesticide. 10% of the buildings got exposed to pollutants from outdoors such as dust, exhaust. 3% of the buildings were contaminated as a result of the type of building materials used (formaldehyde, fiberglass), while 48% suffered symptoms as a result of poor ventilation and 3% experienced problems due to the biological contaminants in the environments.

In Malaysia, Yau, Chew and Shaifulla (2012) researched on four pharmaceutical companies to determine workers` comfortability in such laboratories. It was discovered that two out of four laboratories had high levels of Volatile Organic Compounds (VOC) which can impair health of the workers in such buildings, while the air conditioning systems provide thermal comfort to the occupants.

Ogunde, Amusan, Tunji-Olayeni, Obembe, Adekeye (2015) carried out a collaborative research as a building technologist with Micro Biologists to examine the stains on the wall. The purpose of the research is to determine whether micro-organisms are present in wall stains. The researchers collected samples from the affected walls which were taken for analysis. It was revealed that active microbes such as staphylococcus aurens, Bacillus spp, and Pseudomonas spp (bacteria), Aspergillus Flavus, Mucor, Penicillium spp, and Cladosporium spp (fungi) were present in the samples. These microorganisms were found growing on cracks in the walls and wooden parts of the building and the researchers concluded that these microbes are injurious to the health of the occupants and are responsible for sick building syndrome.

According to the World Health Organisation (2009), three out of ten newly-built or redeveloped buildings suffer Sick Building Syndrome or Building Related Illness (BRI) as the case may be. This determines productivity, absenteeism and general well-being of workers, invariably reduce productivity of an organization and as such incur more cost (Burge, 2004). According to the National Institute for Occupational Safety and Health, SBS is better referred to as 'Indoor Air Quality', and is was said to occur if two out of ten workers in an office space report symptoms like watering eyes, hoarseness and headaches. Other symptoms include dry itchy skin; dizziness; nausea; heart palpitations; miscarriages; shortness of breath; nosebleeds; chronic fatigue; mental fogginess; tremors; swelling of legs or ankles; and cancer. Provided the symptoms subside when they are away from the building, Joshi (2008). Meanwhile human beings react to stimulus differently, while in some the symptoms disappear immediately, after leaving such building, while this linger in others. Hence, this makes it difficult to determine the cause of the symptoms. (Sarafisa, SotIrIadoub, Dallasc, Stavrakakisd, Chalarise, 2010).

2.1 Types/Categories of Sick Building Syndrome (SBS)

Building associated disease can broadly be categorized into two, namely Sick Building Syndrome (SBS) or Tight Building Syndrome (Non -specific) and Building-related Illness (specific).

2.1.1 Sick Building Syndrome (SBS) or Tight Building Syndrome (Non - specific)

The term Sick Building Syndrome (SBS) does not connote a building diagnosed of an ailment but a phenomenon used to describe a situation where the occupiers of a particular building experience ill health or acute discomfort that subside sooner or later after leaving the premises (Burge, 2004; Abdul-Wahab, 2011). The symptoms can be limited to a particular section of a building, the whole building or a particular zone. It is a universal problem and occurs more frequently in, but is not limited to air conditioned environments, public places (hospitals, schools, departmental stores, library etc.), residential buildings and factories with heavy equipment (Molina, Pickering, Valbjbrn and DE Bortoli, 1989). It is reported that on the average human beings spend hours indoors daily. The common symptoms are: headache, skin rashes, running nose, watery eye, lethargy, tiredness and so on. It is referred to as sick building syndrome / Indoor air tight when symptoms is not traceable to any causal factor.

2.1.2 Building-related Illness (specific)

This is when the symptoms of a diagnosable illness are identified and attributed directly to airborne building contaminants (Seltzer, 1994; Purusottam, 2001; Abigail, 2018). According to Seltzer (1994), building-related illnesses refers to reasonably well characterized human illnesses caused by indoor environmental factors that can be related to the

clinical and laboratory findings in those building.

2.2 Causes of Sick Building Syndrome

Several researchers have worked on the subject of 'Sick Building Syndrome' and associated factors are identified.

A. Poor Ventilation

This occurs when the quantity of fresh air from outdoors allowed indoor is inadequate to neutralize the indoor polluted air. It could also be as a result of poor air circulation of heating, ventilation and air conditioning systems (HVAC).This can be as a result of energy conservation, poor design or change of use of a building (Joshi, 2017). Poor ventilation in air-related problems in buildings such as headache, running nose, dizziness, fatigue, shortness of breath, cough, irritation (nose, eyes, throat, Skin) and sometimes nausea (EPA, 2012).

B. Chemical Contaminants from Indoor Sources

This is as a result of exposure of the building occupants to some chemicals or materials containing volatile organic compounds (VOCs), smoke either from tobacco or incomplete combustion of fuel (from sources such as kerosene stove, gas stove, wood stove) or other toxic compounds. Examples are pesticides, carpeting, paints, cleaning agent, upholstery and so on.

Chemical Contaminants from Outdoor Sources; - Incomplete combustion of fuel from vehicular exhaust or generators, nearby factories and so on.

C. Biological Pollutants

Presence of stagnant water in the air conditioning duct, humidifier, drain pans or blocked drainage could give room for breeding of pathogens such as bacteria, molds, pollen, viruses and animal dungs from pet or domestic animals (EPA, 2010, Joshi, 2017).

Biological pollutants cause fever, joint pain, cough, panting and allergic symptoms. Contagious diseases spread easily and faster in a confined environment such as Legionnaire's disease caused by legionella microbes (Breiman, 1992).

D. Electromagnetic Radiation

Appliances such as microwaves, televisions and computers emit electromagnetic radiation, which ionizes the air. Extensive wiring without proper grounding also creates high magnetic fields, which have been linked to cancer.

E. Psychological Factors

i. Frustration, poor interpersonal relationships and poor communication are often seen to be associated with SBS.
ii. Poor and inappropriate lighting with absence of sunlight, bad acoustics, poor ergonomics and humidity may also contribute to SBS.
iii. The nature of particular jobs also can be associated with SBS. Low cadre workers or people with menial job are more susceptible, (Redlish, 1997)
iv. Gender can be another factor. 'Females experience the SBS symptoms more than their male counterparts', this may be as a result of their sensitivity to contaminants.

v. SBS is more pronounced in confined buildings than in public places (Finnegan, Pickering, Burge)

Many people have abandoned their property, left their job, and destroyed their properties as a result of SBS or Building Related Illness, (Shayla, 2018). It is therefore imperative to educate people especially real estate investors, tenants, property developers, Estate surveyors and valuers, facility managers, property agents and the public on the causes of SBS or BRI, its effects and the remedies.

F. Lighting

There is a generally accepted indoor lighting standard according to the Chartered Institution of Building Services Engineering (1994). The importance of indoor lighting is to provide illumination that enables safe movement, aid productivity and enhance appearance. Excess or inadequate lighting could result in eye itching, eye discomfort, eye strain and tiredness (Rostron, 2008).

2.3 Effects of SBS on the Occupants and the Property

G. Hygrothermal Factor

These include temperature, humidity and air flow. The interactive effect of these elements produces Indoor Air Quality. Thermal effect of naturally ventilated spaces produces better satisfaction than air conditioned rooms (Rostron, 2008).

2.3 Effects of SBS on the Occupants and the Property

The effect of SBS has been a serious issue especially to the affected people and has serious repercussions. This includes:

1. Reduction of productivity - According to Tong (as cited in Rostron, 2008), most of the people affected report that their productivity level has reduced to 80%.
2. Increased absenteeism.
3. Increased cost on the part of employer in case of litigation against them from the sufferer.
4. Lack of dedication and commitment on the part of employees.
5. Replacement of building elements that require remediation - such as air conditioning system ceiling, walls, windows, fittings and fixtures may require serious remediation attract additional cost.
6. Demolition may be the only option to correct the effect of SBS (Goldman as cited in Rostron, 2008). For instance, The Inland Revenue gave up 19-storey building for demolition in Bootle, Merseyside in 1995 as a result of 1,000 staff suffering from SBS in the space of five years.

2.4 Remedies/ Preventions

Facilities managers play a dual role in prevention of SBS as the agent of both the property own and the occupants. According to (Redman, Hailton, Malloch and Kleymann, 2010). ……"Treatment of SBS involves both attention to the people….and the building itself. Both of these aspects……., are all too often ignored by managers"

According to the EPA (1991), Rideout (1995), Rostron (2008) and Fotoula (2011), the following are the ways

through which Sick Building Syndrome can be controlled or prevented:

1. Removal or amendment of the source of contamination. For instance, periodic cleaning of HVAC (Heating, Ventilation Air Conditioning) systems or replacement of old filters.
2. Stained ceiling and carpet as a result of leakages should be replaced.
3. Smoking should be restricted to a designated area.
4. Noxious odours from indoor should be expelled outside through vents.
5. Chemicals such as paints, adhesives, solvents, and pesticides should be kept in a well-ventilated area.
6. Chemicals with low VOC should be encouraged or use of chemicals should be done during void period.
7. New or refurbished buildings should not be occupied immediately to allow contaminated gas to escape from the building.
8. Increase in air circulation and distribution to local standards should be encouraged.
9. HVAC systems should be operated to designed standards and to ASHRAE Standard 62-1989 if possible.
10. Local exhaust ventilation is an option in removal of contaminant gases in specific areas such as rest rooms, copy rooms, and printing facilities.
11. Ventilation and particles control could be aided with the use of air cleaning, this can require additional cost in order to be applied effectively.
12. Education and communication are important elements in both remedial and preventive indoor air quality management programs. When building occupants, management, and maintenance personnel fully communicate and understand the causes and consequences of IAQ problems, they can work more effectively together to prevent problems from occurring, or to solve them if they do.
13. HVAC systems must be properly maintained regularly.
14. Adequate ventilation must be ensured to allow free air flow from outdoor to neutralize the contaminated air indoor.
15. Use of chemicals indoor should be minimized and where necessary, there must be adequate air supply.
16. Products with low content of Volatile Organic Compound should be adopted e.g. carpet, furniture, paint etc.
17. Sources of indoor air should be located far from contaminants.
18. Estate managers must ensure routine inspection and prompt repairs where necessary, such as leaking roof.
19. The installation of building elements such as air conditioning systems should be done to encourage easy cleaning and maintenance.
20. Systems should be installed properly to avoid early break down.

2.5 Implications of Sick Building Syndrome on the Property and the Occupants

- Litigation: Selling a property with mold may attract a serious penalty, therefore it should not be handled with levity.
- Drop in property value: Mold problem in a property reduces its market value. It is obvious that most times, mere sight of mold in a building is enough to drive away prospective buyers even with promises of remediation. This reduces marketability of such property and prolongs void period in rental properties.
- Cost Implication: Any property with sick building syndrome attracts additional cost of repairs and maintenance. This in a way reduces the income on such investment.
- Total loss: Many home owners have abandoned their properties, while many quit their job as a result of sick building syndrome to recover from the symptoms.
- Health Issues: The effect of sick building syndrome may impact the health of the occupants negatively which they may live with for the rest of their life, (Bill, 2013, Abdul-Wahab, 2011, Rostron, 2008).

3.0 Recommendations

Based on the findings from literature, the following recommendations were made:

- Routine inspection and proper maintenance culture must be imbibed by the property owner or the real estate agent to reduce rate of depreciation of a property and to preserve property value.
- There should be orientation about sick building, as most human activities result in sick building syndrome such as: smoking of cigarette, inappropriate use of chemicals, and use of materials with high VOCs.
- Materials with low VOCs should be encouraged such as rug, paint, upholstery and so on.
- Natural air is more preferable to conditioned air, therefore indoor ventilation should be standard especially in offices

4.0 Conclusion

It is obvious that sick building is not just a phenomenon but its effects are glaring and proven by researchers globally. The effects of SBS is not limited to discomfort of the sufferer, reduced productivity, increase in absenteeism, wasting of productive time and resources in attending to issues relating to complaints of the affected staff. Moreso, any building tagged 'sick' may not recover from the stigma, even after remediation (Tong, 1991; Rostron, 2008).

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