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The correlation between workplace design and work effectiveness of employees in the Calabar free trade zone, Nigeria

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Abstract

The purpose of this study was to examine the relationship between workplace design or layout and work effectiveness of employees. 300 workers drawn from the 25 functional manufacturing industries located in the Calabar free trade zone, Nigeria, constituted the population of the study. A sample of 200, which was representative of the various cadres of workers, was carved from the population randomly. Data was gathered with questionnaire from 200 respondents and hypothesis tested with Pearson product-moment correlation analysis at 0.05 level of significance and 118 degree of freedom. Findings indicate that most workers were dissatisfied with their offices or factories physical design, such as the circulation of gangways/walkways, the articulation and functional relationships between spaces, ventilation and the manner in which equipment/workstations are arranged and fitted. Furthermore, findings also reveal that some of the consequences of unsafe and unpleasant work environment include; stress, industrial accidents and the development of chronic diseases, which affects employees physical and mental fitness, as well as, their work effectiveness. It was recommended that organizations should provide work environments that are supportive of work effectiveness and which guarantees the health, safety and welfare of its workers.

Keywords: layout, design, workplace, work effectiveness, employees, occupational safety and health

1. Introduction

1.1 Background of the study

Design in the context of usage herein is concerned with the planning and physical structuring of office or factory buildings to facilitate the flow of work and to achieve effectiveness in work performance. Uzee (1999) defined layout as the physical configuration of departments, workstations and equipment. Office design can also be referred to as office layout; hence these two words would be interchangeably applied hereinafter.

Governments the world over, in realization of the very vital position adequate office layout plays in work performance, provides strict legal/regulatory frameworks and provisions. The legal provision specifies the physical conditions of office or factory pertaining to the health, occupation/safety and welfare of employees. (Hameed & Anyod, 2019) ^[4]

In Nigeria for example, the factories Act of 2004 which is meant to regulate and ensure the occupational safety and Health of the Nigerian worker, provides a number of benchmarks in designing office or factory buildings, summarized as follows:

1. An office building should provide exit doors for escape during emergencies.
2. The design should provide adequate lighting
3. It should provide solid construction of factory floors, stairs and passages/gangways
4. The provision of first aid Box
5. Provide fire extinguisher and other firefighting equipment
6. Adequate doors and windows to ensure that work rooms have proper ventilation
7. The adequate number of persons in a room to avoid congestion

Apart from the provisions of the factory Act of 2004; there are other technical standards to be taken into cognizance in designing an office building as noted by Stallworth and Heiner (2009) they include the following:

1. The Floor Space Design: The office space should be designed to facilitate free flow of work and employees from one section to another with ease.

2. Provision of Gangways: Walking paths should be provided in the layout of office in a manner that movement of staff or customers do not distract or impede the smooth flow of work.

3. Work Space: The design should provide enough work space for staff.

4. Arrangements of Furniture/Equipment: Desk, tables and chairs should be well arranged and equipment properly fitted in positions that do not hinder the flow of work and staff.

2. Review of Literature

2.1 Conceptual Review

2.1.1 Types of Layouts/Designs

There are various types of layouts as submitted by Jameson (1990)^[5] includes the following;

- **Process Layout:** This is the arrangement of facilities in a manner that work centre or stations are grouped according to their functional types. Distribution warehouses, buildings and job shops often use process layout.
- **Product Layout:** In a product layout, work stations and equipment are arranged in a line to facilitate specialized sequence of tasks. This is suitable when production involves the same sequence of operation from start to finish repeatedly.
- **Fixed position layout:** In this type of layout, production takes place in a stationary position and most equipment, tools and workers are conveyed over.

2.1.2 The use of models in facilitating office designs

A model is an abstraction of reality and a simplified version of a real phenomenon, (Robbetson & Huang, 2006)^[10]. Model could be helpful for managers in conjunction with architects in planning the process layout. As noted by Luthans (2009:41)^[7] "managers should engage qualified professionals to assist them in designing office or factory buildings", this of course should be in accordance with legal provisions and minimum benchmarks. There are several types of models available, but this study however is not delving into the detailed types, but rather concerns itself with the application of models, however several they may be. Computer models could provide basis for quick approximations, while on the other hand physical models such as scale methods, templates and so on, can help or enable architects depict the structure, design and the positioning of facilities in the building, such as walkways and other physical details that are an exact replica of the actual building, (Ayanade, 2010). The manager at that level is able to appreciate the design of the factory or office and make certain observations which the Architect would take into account in making alterations to bring out the final building plan, (Muchinsky, 2018)^[8].

2.1.3 The relationship between office/factory layout and work effectiveness

A poorly conceived layout may result in congestion, poor ventilation and prohibitive material-handling costs. In other words, the operating effectively of facilities and equipments is largely determined by the effectiveness of the layout (Jameson, 1990)^[5]. For instance, if the design of an office or factory does not make room for sufficient-lighting points

or for proper ventilation, chances are that the room may be dark always and employees or workers would have to struggle to see properly and possible suffocation may also occur due to the poorly ventilated structure. As noted by Leaman & Bordass (2019:28)^[6] "working in crowded and unpleasant workplaces is responsible for the high level of stress and stress related elements in industries.

Furthermore, poorly fitted factory equipment and wrongly built walkways or gangways in terms of narrowness or slipperiness, may often cause industrial accidents, hazards and distraction. Again, these as noted by Cole (2002)^[2] is a source of stress and reason why so many employees upon retirement develop several chronic diseases. In the nutshell, a poorly designed office could be deemed to be a stressor.

The objective of this study is therefore to determine the relationship or linkage between the physical design or layout of an office or factory and work effectiveness. In measurable and specific terms, the study intends to investigate how workers in the private sector view the physical conditions of their work environment in terms of stress, safety, convenience, ventilation and the flow of work and how all these conditions affect their work effectiveness.

3. Problem of the study

One of the known factors that affects employees physical and mental fitness and work effectiveness, is the physical design of the office or factory and the manner in which equipment and work stations are arranged. As observed by Ayandele, 2010 & Nwachukwu, 2000)^[1, 9] there has been a decline in work effectively and general productivity in Nigeria which has been largely traced to the absence of work environments whose physical design ensures employee safety and welfare in accordance with the provisions of the Nigeria's factories Act of 2004. The Nigeria's Factories Act of 2004 provides standard specifications of the physical design or layout of offices and factories to guarantee employee health, safety and welfare. Poorly designed offices factories and unpleasant work environments are known to be a stressor and source of diseases to employees. This certainly lowers work effectiveness and productivity.

3.1 Research questions

The following research questions were formulated for this study;

1. Are the gang ways/walkways provided in a manner that enhances work concentration and effectiveness?
2. Are the equipment/workstations properly arranged and fitted to facilitate work
3. effectiveness?
4. Are the offices/factories spacious and well ventilated?
5. Are the offices/factories properly lit?

3.2 Research hypothesis

The following null hypothesis were formulated for the study

H₀₁: There is no significant correlation between the pattern of gangways/walkways and work effectiveness

H₀₂: There is no significant correlation between equipment/work stations arrangement/fitting and work effectiveness.

H₀₃: There is no significant correlation between office/factory spaciousness/ventilation and work effectiveness.

4. Methodology

4.1 Research design

The research design adopted for the study was survey design. This was adopted to allow inferences to be made from sample and generalization drawn from the population that may have been too expensive and cumbersome to study wholly. –

4.2 Population/sample of the study

The population of this study is made up of all the employees of manufacturing companies in the Calabar free trade zone (300). This is a free trade and industrial zone located in the metropolitan city of Calabar. Calabar is the capital of Cross River State, which is one of the 36 states that constitute the Federal Republic of Nigeria.

There are about twenty five (25) functional manufacturing Industries, for export market, in Calabar free trade zone, constituting an aggregate study population of about 300, Eight (8) employees are sampled randomly from each of the 25 manufacturing industries in the zone, constituting a research sample of 200, which is representative of the various cadres or categories of employees in the various industries.

4.3 Instrumentation

A four point likert-type questionnaire was used to gather data from respondents. Section A sought demography details of respondents and section B contained items that were to actually determine the relationship between office/factory design and work effectiveness. The well structured questionnaire was validated by experts in research and recommendations of colleagues. The questionnaire required the following relative responses. Strongly Agree (SA), Agree (A), strongly disagree (AD) and Disagree (D).

4.4 Data Collection/Analysis

A total of 200 copies of questionnaire was administered to respondents, out of which 120 (60%) were returned, while 80 (40%) were not returned. Data was analyzed and hypothesis tested and validated with the aid of Pearson product-moment correlation analysis.

$$\text{Given by: } r = \frac{N\sum xy - \sum x \sum y}{\sqrt{N\sum x^2 - (\sum x)^2} \sqrt{N\sum y^2 - (\sum y)^2}}$$

Decision Rule

The obtained r must be greater than the critical r to be considered significant. In other words, if the calculated value is less than the critical table value, we do not reject the null hypothesis and if however otherwise, we reject the null

and accept the alternative. The level of significance is 0.05 and degree of freedom of 118 (N-2).

5. Presentation of Results

Hypothesis 1: There is no significant correlation between the pattern of gangways/walkways and work effectiveness. The analysis/test was done with the aid of Pearson product-moment correlation analysis and presented on table 1 below.

Table 1: Computation of responses on the relationship between pattern of gangways/walkway and work effectiveness.

Variable	$\sum x$ $\sum y$	$\sum x$ $\sum y^2$	$\sum y$	R
Pattern of gangway/walkways	5920	20008970		
			4322402	0.81
Work effectiveness	3008	607728		

Source: Field Survey (Questionnaire, 2019)
P<0.05, df = 118, t = 1.98

The table above reveals a calculated r value of 0.81 which is less than the critical value of 1.98 at 0.05 level of significance with 118 degree of freedom. Therefore in accordance with decision rule, the null hypothesis is not rejected.

Hypothesis II: There is significant correlation between equipment/workstations arrangement/fitting and work effectiveness.

Pearson product-moment correlation analysis was employed in testing the hypothesis and result is personated below.

Table 2: Computation of response on the relationship between equipment/workstation arrangement and work effectiveness

Variable	$\sum X$ $\sum y$	$\sum X$ $\sum y^2$	$\sum Xy$	R
Equipment/work station arrangement	66714	21082084	4722313	0.66
Work effectiveness	3508	607728		

Source: Field survey (Questionnaire, 2019)
P<0.05, Df = 118, T = 1.98

The table above shows a calculated r value of 0.66 which is less than the critical value of 1.98 at 0.05 level of significance with 118 degree of freedom. In accordance with decision rule, the null hypothesis is therefore not rejected.

Hypothesis 3: There is no significant correlation between office/factory spaciousness/ventilation and work effectiveness. The hypothesis was tested with the aid of pearson product moment correlation analysis. The result is presented below.

Table 3: Computation of responses on the correlation between office/factory spaciousness/ventilation and work effectiveness.

Variable	$\sum X$ $\sum y$	$\sum x^2$ $\sum y^2$	$\sum Xy$	R
Office/factory spaciousness/ventilation	5288	1628400	3498290	0.99
Work effectiveness	1890	490180		

Source: Field Survey (Questionnaire, 2019)
P<0.05, D = 118, T=1.98

The Table above shows a calculated r value of 0.99, which is less them critical value of 1.98 at 0.05 significance level

and 118 degree of freedom. The null hypothesis, in line with decision rule the null hypothesis is therefore not rejected.

5.1 Discussion of findings

The sum of empirical finding emanating from the analysis revealed that most employees were dissatisfied with the patterns of gangways and walkways in their offices and factory hence hinders work effectiveness.

Findings also indicate that a good number of employees and factory workers were not satisfied with the manner in which equipment and workstations are arranged and fitted in their various organizations. When equipment/workstations are not properly fitted, industrial accident and distress are bound to occur, all of these do not facilitate work effectiveness. This finding is consonant with the study of Jameson (1990)^[5] and Uzee (1999)^[12] who both opined that an unpleasant work environment reduces employees physical and mental fitness.

Finally, findings further revealed that the spaciousness and ventilation in most of the companies within the zone is poor, as expressed by their employees. These they emphasized, affects their work effectiveness and productivity. This also aptly agrees with Cole (2002)^[2] who discovered that an unspacious, crowded and stuffy work environment is a stressor and stress of course negatively impacts on work effectiveness.

5.2 Conclusion/Summary

This study has indeed proved the position of the national productivity workshop right, that one of the factors hindering national productivity is the lack of conducive work environment, which promotes employee health, safety and welfare as provided for in the Nigeria factories Act of 2004. Upon retirement, quite a good number of retirees develop strange diseases which they may have acquired or developed over the years of working in an unconducive and unpleasant environment.

Wrongly fitted equipments and workstations are a source of industrial accidents and stress, both taking their toll on work effectiveness and productivity. Neither does an over crowded, congested, poorly lit and ventilated office or factory enhance work effectiveness. In conclusion, therefore, we can authoritatively state that for work effectiveness to be achieved in the Nigerian industrial sector, issues bordering on the physical design and employee health, safety and welfare must be taken seriously and strict adherence to the Nigeria's factories Act of 2004 must be ensured.

5.3 Recommendations

The following recommendations are advanced:

1. Industries and factories should ensure the construction of gangways/walkways that enhance the safety, health and work effectiveness of their employees.
2. Offices and factories should be designed to create enough space for work flow and ensure that they are properly ventilated.
3. Equipment and workstations should be properly arranged and fitted to eliminate or reduce industrial accidents and stress.
4. Offices and factories should be properly lit to enhance work effectiveness.

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