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EMPIRICAL ANALYSIS OF OFFICE ERGONOMICS AND EMPLOYEES' HEALTH AND SAFETY IN NIGERIAN UNIVERSITIES

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Abstract

Employees' health and safety are affected by workplace layout and design, physical conditions, and office environment which have serious consequences on their productivity. Employees' optimum performance is a function of the state of their health. Thus, this study examines the influence of office ergonomics on employees' health and safety in Nigerian universities. Mixed methods of research were used and a survey design was adopted for the study. Primary data was used to elicit information from the respondents through the administration of a structured questionnaire. The study focused on Nigerian second generation federal universities with particular reference to the university in the North-central geo-political zone. A multi-stage sampling technique was used to select sampled respondents. Data collected were analyzed using the partial least square structural equation model using SMART PLS3 software. The findings revealed that office layout and design and office atmosphere and environment are statistically significant in predicting workforce health and safety. The study concluded that office ergonomics influence employees' health and safety. The study recommended that office layout and design, office environments and atmosphere should be appealing for the work process to ensure workforce health and safety. While office temperature and lighting should be improved to enhance optimum productivity.

Keywords: Employees' health and safety, Nigerian Universities, office ergonomics, office environment, workplace

1.0 Introduction

The most indispensable resources of any organization is human-being as all other organizational resources depend on human capital for their functionality (Falck & Rosenqvist, 2012). Irrespective of the nature of the organization whether capital or labour intensive, man will still play a major role as a machine cannot operate itself. These realities form the basis for the focus of the need for this vital machine of any organization. Employees must be healthy to perform their assigned tasks and most of the inhibiting factors to employee's health and safety emanated from their workstations (Ahmed & Shaukat, 2018). In addressing this issues, organizational psychologists redirected their attention in creating a flexible and conducive work environment to instil work value in their employees and to ensure that their health and safety are paramount in achieving the desired performance (Hedge & Puleio, 2014). Employees regarded their workplace as an extrinsic factor of motivation to enhance productivity (Chim, 2014). This necessitates the need for a conducive work environment embedded in the concept of office ergonomics.

Office ergonomics emphasis the significance of office elements that can enhance employees' productivity in fitting to the job such as spatial arrangement, air quality, lighting, colour schemes, noise level, space for free movement, adequate temperature and good ventilation (Dul & Ceylan, 2011). The main purpose of office ergonomics is ensuring that employees are fit to the workstations to promote a good work process and enjoy a healthy stay in the office while performance is optimal. The focus is on office layout, design, environment, and structure (Michaels, 2011). The adequate, conducive and accessible office represents the dignity and values the firms placed on their staff and it also signifies the organizational strategic goals to both internal and external stakeholder. Office ergonomics emphasis great significance to structured

workstations, conducive environment and good interior décor (Falek & Rosenqvist, 2012). All these elements are directly or indirectly influence employees' health and safety, performance, and productivity.

Office ergonomics affect employee's efficiency, effectiveness, competence, and commitment to work as the long-run effect of inadequate ergonomics features is capable of causing physical and mental health and psychological disorder if not properly manage (Chim, 2014). Office ergonomics enhance work performance and reduces work hazard by adapting the work to fit the person instead of forcing the person to adapt to the work. The implication is that it encourages employees to work more effectively, efficiently, and productively at their jobs (Naeini & Mosaddad, 2013).

Employees in Nigerian Universities engage in a multi-faceted assignment and stay long at work (Ikeuchi & Motohashi, 2017). Thus, most of the chairs currently in use at Nigerian universities offices are without adjustable or ergonomic features. It is, therefore, feared that due to long and poor sitting posture, a number of the employees may have suffered various degrees of back, spine, neck and stress-related ailments (Michaels, 2011). Besides, some offices continue to use noisy window unit air-conditioners in fairly illuminated offices which have the capacity of affecting the cognitive abilities and health, and overall productivity of the users of the facility. During these challenges at the workplace, management, however, still expects employees of all categories to put up their best performance in the attainment of organizational goals and objectives. The typical Nigerian worker often finds themselves in a workplace environment that, to a large extent lacks the congenial atmosphere that safeguards their safety and overall interests. Thus, this study examined the influence of office ergonomics on employees' health and safety in Nigerian Universities.

2.0 Literature Review

Concepts of Ergonomics

Ergonomics entails the layout and design of the work environment to facilitate a smooth work process to enhance workforce performance (Naeini & Mosaddad, 2013). Ergonomics is defined as the scientific study of human work. This concept encompasses the psychological effect of the officeholder based on the interaction with the work process and the environment of work (Hedge & Puleio, 2014). Proper office with ergonomics features reduces the hazard and risks involves in day to day activities at work, promote workplace safety, reduces workplace injuries, reduces health care visit, minimizes illness and enhance the healthy workplace. Most workplace hazard occurs as a result of the fact that substantial time of the employees in a day to day is spent in the office. The accumulated stress, strain and sprains can lead to cumulative trauma disorders (CTDs) (Carlson et al., 2019; Chim, 2014). For instance, a work position that requires an employee to be on one spot or posture for long may result in some discomfort and as such cause some illness, harm or affect employee's health, nerves, and muscular disorders (Health and Safety Executive, 2011). Branches of ergonomics include; office ergonomics, macro ergonomics, engineering ergonomics, physical ergonomics, cognitive ergonomics, organizational ergonomics and the likes.

Office Ergonomics

An office is regarded as a point where business and professional activities are being carried out. Clerical and administrative duties are usually carried out in the office (Baydur et al., 2016). It is a building facility or in a contemporary term, a point where a business or professional transaction are performed. It may be a permanent or temporary location for business activities (Dul & Ceylan, 2011). However, the functionality of an office depends largely on human capital to get work done (Robertson et al., 2016). Thus, the essence of office ergonomics is centre on the human factor as the fundamental element of an office with the belief that a healthy workforce is the lifeblood of every organization by fixing office to the people (Suddin et al., 2015). The human focus and nature of office layout have to do with the attributes of the office occupant such as preferences, believes, capabilities and dimensions (Chim, 2014). The variables of office

ergonomics used for this study are office layout and design, office atmosphere and environment, and office components.

Office Lay-Out and Design: The design and layout of the office have a positive effect on the way work is being carried out and subsequently on performance (Naeini & Mosaddad, 2013). Organizations that failed to take cognizance of their work environment will not get the best from their employee (Hedge & Puleio, 2014). Conducive office design serves as a motivating factor to the existing employee and it may also be a source of attraction to a potential employee. It brings some sense of satisfaction and retention to some employee. Workplace layout and design affect the psychological effect of the employee in assimilating and skills development and knowledge. It brings out the creative and innovative abilities of the employee and also improves the way they respond to contingency problems. In contrast, unsuitable layout and design discourage the employee and affect their level of reasoning (Falck & Rosenqvist, 2012). The contemporary organizational managers now recognize the need for a good and conducive office layout and design which has made the concept of office ergonomics more popular in appealing to the emotion and physical needs of the employee to enhance productivity (Ikeuchi & Motohashi, 2017). One of the essentials productivity enhancers is a good work design. The proxies used for the office layout and design in this study based on the extant literature are accessibility to the needed materials, adequate space for free movement of man and materials, and spatial arrangement within the workplace to reduce hazard and promote safety.

Office Atmosphere and environment: The office environment plays a significant role in affecting employee health and safety at work. Works need to be arranged efficiently to facilitate a smooth flow of work (Dul & Ceylan, 2011). The concept of work environment encompasses the workplace surroundings and physical location of the work stations which is expected to be neat, secure, healthy, and hygienic for an effective work process (Falck & Rosenqvist, 2012). Typically, it also encompasses other conditions relating to work employment and factors relating to noise level or pollution, adequate ventilation and air quality and the likes. Besides, these also include other benefits relating to childcare, secure parking space and provision of lunch. The proxies used for office atmosphere and the environment in this study are the location of equipment and classrooms, noise level, and office temperature and adequate ventilation for employees' safety.

Office Components and physical conditions: A suitable office in the workplace is expected to be convenient to facilitate optimum productivity (Chim, 2014). There are basic tools expected in the office for the effective smooth running of both clerical and administrative functions. Lighting is perhaps one of the most important of office physical conditions (Carlson et al., 2019). Likewise, the furniture, adjustable seating position, interior décor, colour and the likes posed mental and psychological health issues to the employees which in turn affect their productivity at work. Poorly illuminated offices have a serious effect on employee sight, poor sitting position lead to spine-related problems and inadequate furniture and cabinet make the keeping of document strenuous (Hedge & Puleio, 2014). The proxies used for office components and physical conditions in this study are adequate lighting, adjustable seat and suitable furniture and cabinet for the proper keeping of document.

Employees' Health and Safety

Health is wealth and the key determinant of employees' productivity and performance in a workplace is a healthy life (Naeini & Mosaddad, 2013). It is only a safe and healthy workforce that can achieve the target or surpass organizational goals and objectives. Employees' health and safety are important to reduce medical cost, hospital visits, absenteeism rate, increase concentration and commitment, healthy stay at work, prevention of hazard, longevity and the likes to increase employees' productivity and performance (Dul & Ceylan, 2011). Office ergonomics such as office layout, environment and physical conditions play a key role in employees' health and safety (Chim, 2014). A neat, clean, hygienic and attractive office make the employees be at ease, comfort and guarantee employees wellbeing for optimum performance. The

proxies used for employees' health and safety are hazard prevention and control, healthy stay at the workplace and employees safety assurance.

Workplace Ergonomics and Employees' Health And Safety: A Link

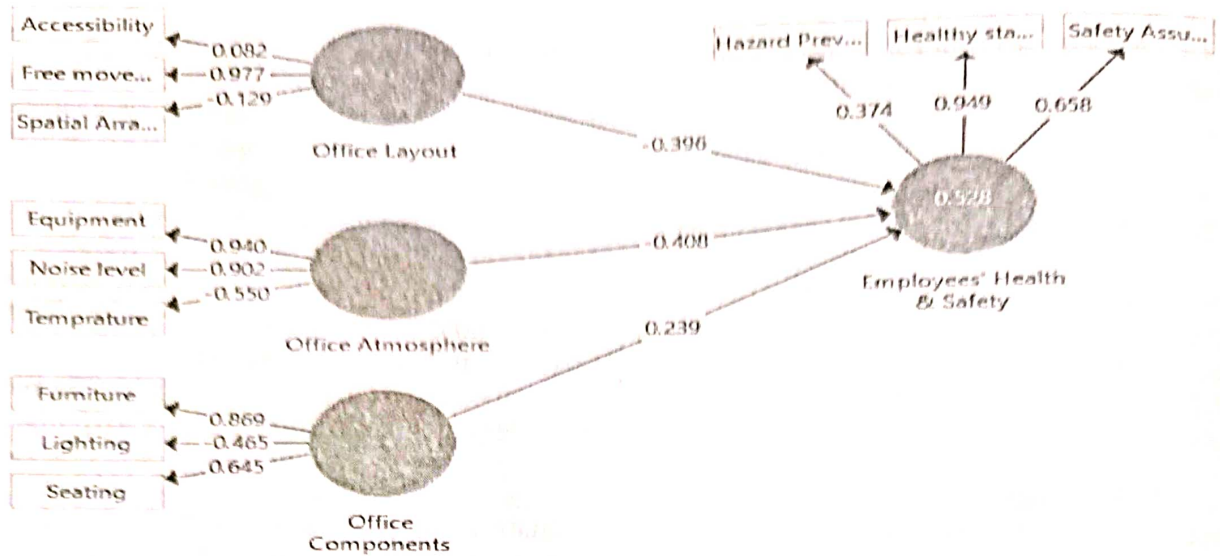
The eventual goal of office ergonomics is to enhance employees' health and safety to improve productivity. Besides, there are other inherent advantages associated with employees having a suitable workstation as it reduces healthcare visit, increases attendance, reduces health care cost, promotes healthy stay at work, increases employees commitment and job involvement in the workplace (Hedge & Puleio, 2014). These numerous benefits accrued to organizations necessitate the need for the development of office ergonomics. The work environment is helpful to facilitate a safer, healthy and conducive atmosphere for an employee. However, Ikeuchi and Motohashi, (2017) emphasize that physical conditions of the workplace influence employees safety at work which induce a positive perception about their work and have a serious effect on their commitment to the organizational goals and objectives. In the same vein, Michaels, (2011) study also revealed that an improved work environment usually results in employee's commitment which is noticeable from increase attendance, deep interest in organizational goals and objectives and enhance performance.

3.0 Methodology

The study adopted a mixed-method which comprises qualitative and quantitative methods. A survey design was used through the administration of a questionnaire to respondents. The area of study is the Nigerian Universities with emphasis on the second generation of federal universities. These universities were established by the military government within 1975-1980 and some of the buildings, offices and facilities are not ergonomics in nature. The seven universities are the Universities of Maiduguri, Ilorin, Jos, Calabar, Port Harcourt, Sokoto, and Ado Bayero University, Kano. Multi-stage sampling techniques were adopted for the study which comprises purposive (focusing on Nigerian federal universities), judgmental (second generation universities), stratified (focusing on the universities in the North-central geo-political zone) and simple random sampling. The research instrument was administered at the University of Ilorin which represents the only second-generation universities in the North-central geo-political zones of Nigeria. The population of staff in the selected university was about 4, 324 which comprises both academic and non-academic staff. Taro Yamane sample size determination was used to arrive at 367. A structured and validated questionnaire was used to elicit information from the respondents with a 7-point Likert scale. The study's variables are office layout and design (spatial arrangement, free movement & accessibility), office atmosphere and environment (noise level, temperature & equipment), office components and physical conditions (seating, furniture & lighting), and employees' health and safety (hazard prevention, safety assurance & healthy stay in office). Collated data were scrutinized and analyzed with a structural equation model using partial least square with SMART PLS 3 software.

4.0 Results and Discussion

Data obtained were evaluated and scrutinized to determine their usability. 95% of the returned copies of the questionnaire were found usable for the study i.e. 349 out 367. The variables of the study were presented in the path model as shown below:



Source: Researcher's Path Model, 2021

Figure 1: Office Ergonomics and Employees' health and safety path model

The path model analysis in figure 1 shows the influence of office ergonomics metrics on Employees' health and safety. Office ergonomics metrics adopted for the study was Office layout – proxied by accessibility, free movement and spatial arrangement; Office atmosphere – proxied by the noise level, temperature and equipment; and Office components – proxied by lighting, furniture and seating. These variables were checked against the Employees' health and safety proxied by hazard prevention and control, healthy stay in office and safety assurance. Figure 1 presents a relational effect where more than single variables contribute to the latent variables.

Table 1: PLS Path Coefficients

	Employees' Health & Safety	Office Atmosphere	Office Components	Office Layout
Office Atmosphere	-0.408			
Office Components	0.239			
Office Layout	-0.396			

Source: SMART PLS Output, 2021

The path coefficients in table 1 revealed a given standardization of weight and the closeness of the weight to absolute 1 show the strongest paths while zero weight indicate the weakest path. Two of the office ergonomics' metrics measured shows a negative contribution to the latent variable. Office components show the weakest paths coefficients followed by office atmosphere and the strongest path are office layout. The negatives coefficients depict a negative contribution to the employees' health and safety. The absolute magnitude of the office atmosphere gives a better coefficient to other identified variables. This implies that office layout, atmosphere and components are good models for the prediction of employees' hazard

prevention and control, healthy stay at work and safety assurance. The identified variables contribute significantly to the prediction of workforce health and safety in the sampled area.

Table 2: Outer Loading

	Employees' Health & Safety	Office Atmosphere	Office Components	Office Layout
Accessibility				0.082
Equipment		0.940		
Free movement				0.977
Furniture			0.869	
Hazard Prevent & control	0.374			
Healthy stay in Office	0.949			
Lighting			-0.465	
Noise level		0.902		
Safety Assurance	0.658			
Seating			0.645	
Spatial Arrangement				-0.129
Temperature		-0.550		

Source: SMART PLS Output, 2021

The outer model shows the indicators' contribution to the definition of the latent variables. Though, the closer the loading to 1 the better, the convention of the well-fitting reflective model states that the path loading must be above 70% (criterion for minimum measurement loading) which explained 0.5 percent of the variation in the indicator which is expected to be greater than error variance. From the result outputs, spatial arrangement, accessibility, hazard prevention and control and lighting could have been dropped but dropping the indicators did not improve composite reliability. The outer weight model varies from zero to an absolute maximum lower than 1, it has been established that as predictors for a latent variable increase, the lower the outer weight for each variable. The results of outer model weights justify why the weak loading could not be dropped as all the loading weights were greater than 0.50 except accessibility. Also, these variables were major constituents of the latent variables from the office ergonomics and employees' health and safety literature.

Table 3: R Square

	R ²	Adjusted R ²
Employees' Health & Safety	0.528	0.513

Source: SMART PLS Output, 2021

The common effect size measure in the path shows the R square of 0.528 which implies that 52.8% of the variance in employees' health and safety can be explained by the joint model of office ergonomics metrics proxied by office layout, atmosphere and components. This is a moderate effect as the identified variables influence employees' health and safety which implies that the residual 47.2% is accountable for by other exogenous variables not taken into account by the model. This implies that the identified variables

influence employees' health and safety which have a strong effect on their performance. Though R-square greater than 80% suggests a possible multicollinearity problem ($\text{Tolerance} = 1 - R^2$) in this case, there is no multicollinearity problem as tolerance in this data set is greater than 0.25 at the extreme. However, R^2 can increase with the addition of predictors to the regression model. The adjusted R-square is 0.513. The adjusted R^2 is close to the unadjusted R square in this model as a result of a restricted number of variables considered.

Table 4: f Square

	Employees' Health & Safety	Office Atmosphere	Office Components	Office Layout
Employees' Health & Safety				
Office Atmosphere	0.240			
Office Components	0.082			
Office Layout	0.329			

Source: SMART PLS Output, 2021

The weights of these variables are shown in the f square table where the changes in contributions of office ergonomics metrics were revealed according to their importance. The f square result revealed the strength of the path in the change effect. The contribution changes of office ergonomics metrics are 0.240, 0.082 and 0.329 to the latent variable (Office ergonomics). The variance in the change effect of sampled respondents on office ergonomics metrics are wide apart and ranges from insignificant to significant effect. With this, the change effect of office components (lighting, furniture and seating), office atmosphere (proxied by the noise level, temperature and equipment) and office layout (proxied by the spatial arrangement, free movement and accessibility) on employees' health and safety have significant change effect in the study area. There is a need to improve these components to enhance employees health and safety which in turn improve their productivity at work. Otherwise, it can increase health maintenance cost, hospital visits, absenteeism rate and the likes. F square change effect shows that office layout variables are stronger than office components metrics. The implication of this is that spatial arrangement, free movement within the office and accessibility to the needed equipment and other materials contribute most significantly to the change effect of employees' health and safety in terms of hazard prevention and control, healthy stay at work and safety assurance. Thus, the government and management of the sampled university need to take these variables seriously to promote a healthy workforce and enhance productivity.

Table 5: Bootstrapping Path Coefficients

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Office Atmosphere -> Employees' Health & Safety	-0.408	-0.388	0.128	3.198	0.001
Office Components -> Employees' Health & Safety	0.239	0.242	0.168	1.419	0.157
Office Layout -> Employees' Health & Safety	-0.396	-0.370	0.159	2.496	0.013

Source: SMART PLS Output, 2021

The PLS bootstrapping output showing the t and p-value revealed that any t value above ± 1.96 will be significant at a 95% confidence interval and 5% significance level. From the output result, it was observed that office layout and office atmosphere indices were significant in the prediction of employees' health and safety at the 0.05 probability level while office component proxies' are insignificant. This implies that the office layout and office atmosphere posed a serious threat to employees' health and safety. Though, the identified variables of the study were capable of predicting employees' health and safety in the study area.

The output of the analysis revealed that for the sampled respondents to be healthy and safe in their work to achieve optimum productivity, there is a need for a good and conducive work environment not devoid of adequate facilities such as spatial arrangement, noiseless environment to carry out their research, spacious office space to facilitate free movement, accessibility to the material needed in the office without hindrances, equipment should be within reach, and good office temperature with adequate ventilation to keep the workforce in good health and safety for optimum productivity. A good work environment facilitates the smooth day to day activities of the employee, reduces medical cost, reduces hospital visits, reduce absenteeism rate, reduces occupational hazard and the likes which improve performance. It was also revealed that the loading weight of employees' health and safety in terms of hazard prevention and control and safety assurance were also below the 0.70 cut off suggested for the loading weight. Safety assurance and hazard prevention and control are likely to increase if spatial arrangement, accessibility, office temperature and lighting are enhanced. However, office ergonomics metrics influence employees' health and safety in Nigerian universities.

Discussion of Findings

The study revealed that the office layout has a significant influence on employees' health and safety. These findings are in agreement with the study of Hedge and Pulcio, (2014); Ikeuchi and Motohashi, (2017); Robertson et al., (2016) whose study revealed that office layout and design have a serious effect on employees' productivity which can only be a guarantee if the workforce is healthy and safe. Also, it was revealed that conducive office environment influence employees safety and healthy living which conforms to the findings of Dul and Ceylan, (2011); Falck and Rosenqvist, (2012) who stressed that lack of a conducive work environment was a major inhibitor of employee wellbeing which affect their performance. Besides, the study revealed that office components and physical distribution are insignificant in predicting employees' health and safety. This result negate the findings of Carlson et al., (2019); Chim, (2014); Naeini and Mosaddad, (2013) whose different studies revealed that lighting and sitting position has a serious effect on employees performance. The reasons for this divergence view may be as a result of the sampled area of the study which is Nigerian universities where there are subvention and other sources of fund such as Tertiary Education Trust Fund (TETFUND), Internally Generated Revenue (IGR), NEEDS assessment and the likes for maintenance and procurement of needed furniture and seats. Also, night duty is not required in the study area.

5.0 Conclusion and Recommendations

Organizational productivity depends largely on workforce input which is also a function of employee's wellbeing. Employees' health and safety are highly connected to the work environment, office layout and components. Office ergonomics is an important strategy used in fixing employees in the work process by providing suitable and conducive office facilities to enhance optimum productivity. It is only a healthy workforce that can guarantee sustainable organizational performance. Therefore, there is a need for ergonomics standard office to boost employees' health, safety, commitment and performance. The study concluded that office layout and atmosphere have a significant impact on employees' health and safety. Interior decoration, noise level, inadequate cross ventilation and temperature level, equipment, spatial arrangement and office spacing are considered to be having a significant effect on the workforce health and safety which improve the productivity of employees. Thus, office ergonomics influence employees' health and safety in Nigerian universities. This study focused on office ergonomics, there is a need for other

studies to examine the influence of other ergonomics branches such as macro ergonomics, engineering ergonomics, physical ergonomics, cognitive ergonomics, organizational ergonomics etc. on employees' health and safety. In line with the findings and conclusion, the study's recommends the following;

- i. Office layout and design features such as accessibility, spacing and free movement, and interior decor should be made to attract, motivate, and satisfy employees and be made to look appealing to them to affect performance positively. Also, a spatial arrangement should be adequate for employees' safety and wellbeing.
- ii. Office environments and atmosphere should be appealing to the work process. Office safety, security, hygiene, sanitation, quality of air, noise level, and arrangement of office equipment to enhance employees' health and safety towards optimum productivity.
- iii. To enhance employees' safety assurance, hazard prevention and control, there is a need to improve office temperature and lighting in the study area to foster performance.

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