

# Workplace Design and Employee's Performance and Health in Software Industry of Pakistan

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**Abstract**—Factors like colour, light, air quality, environmental conditions, and noise has a great effect on the Health and Performance of office employees. All these factors have the impact on employee's performance and are the reasons to improve or reduce the level of employee's working quality and health. The office design, computer usage, and sitting postures affect the muscles, eyes and other body parts. Availability of better office environment and design improve the performance and health of employees to achieve much better and productive outcome from the employees. Following empirical study has investigated the relationship between office workplace design and employee's health and performance. We conducted a survey on the employees working in the software industry of Pakistan, collected the data from employees through questionnaire. We used Linear Regression for the analysis of the study. The results concluded that workplace design has a significant impact on employee's health, and have a negative relationship with the employee discomfort level. Results also showed that workplace design has statistically significant impact on employee's performance.

**Keywords**—Ergonomics; Office work design; Employee's health; Employee's performance; User friendly design; Accessibility

## I. INTRODUCTION

In very industry, the dynamic of work is always different, work pressure and stress may vary in different industries. The level of stress is very critical in IT field as compared to other fields. The business world is modelling new ways of doing work and the systems to enrich the innovation and improve the performance of employees, and one of the key entities is office environment (Management Today magazine in a survey 2003). According to stats, almost above 95% people feel valued because of working environment (ibid).

There is rapid change in features of the working environment in the last few years because of diversity in social and technological aspect of new scientific world [2]. Various studies have concluded that performance of employees is greatly affected by working conditions of the employees [3]. Better working conditions lead to better performance of the employees [4]. Performance of an employee can be affected by a number of factors like colours around, lights combination and sitting arrangement [5]. Ergonomics is a science concerned with the 'fit' between people and their work. It puts people first, taking account of their capabilities and

limitations. Ergonomics aims to make sure that tasks, equipment, information and the environment fit each worker [6].

Office ergonomics is a major factor for improving the performance of the employees [7]. The level of motivation of an employee is correlated with working environment and the commitment towards his job [8]. On the other hand, low standard of environment not only decreases the productivity and performance but also demotivates the employees [9] [10].

Ergonomics and balance of its factors like noise reduction, furniture setting and layout of hardware, lighting, air and room space also ensures the productivity and better performance of the employees [11]. Sustainability of performance of an employee can be achieved by providing a good ergonomics design [8]. In the places where people have to work indoor the mental stress and fatigue effect the performance and ability to do job better [12].

Moreover, in software industry the employees have to work on computers most of the time, it is considered as a major risk factor that can cause musculoskeletal and visual discomfort [13] [14]. The usage of computers and ergonomics factors has a wide impact on musculoskeletal and visual uneasiness of the employees [15]. There are a number of factors that can cause visual and musculoskeletal discomforts such as workplace design, workplace area, and number of hours working on computers and lightening of workplace [16] [17].

Section 1 has covered a brief introduction of workplace design and its perception in the software industry of Pakistan. Section 2 and 3 includes a detailed literature review, hypothesis development and research framework. Section 4 covers the research methodology for this study and Section 5 covers a detailed discussion of results and Section 6 includes study's limitations and future recommendations.

## II. LITRATURE REVIEW

Ergonomics is a major factor in the performance of an employee and has been validated by many studies. According to [18], ergonomics shows a significant part of the prosperity of a worker and in the reduction of errors, especially in the design of office, its environment, and tools. The same concept has been confirmed by [19] [20] that ergonomics can be a major KPI about the performance.

### A. Workplace Design

The optimised layout is an important for better performance, which includes ergonomics factors and course of workflow [21].

A study has conducted that by analysing various responses of employees about workplace and results indicated that most prominent (90%) of employee believed that their attitude toward the work is most affected by working environment [22]. Another study stated that unsatisfied employees and low standard of workplace plus physical conditions of the environment are one of the major impact factors of productivity [23] [24].

The more innovative environment requires more comfortable and optimised environment for the job, and then the higher productivity can be achieved; on the other hand, lower these standards and it will introduce the higher rate of un-satisfaction and stress [25] [26].

The environment of a workplace includes some things and the most relevant are the layouts of office design and furniture, lighting, and configuration of the floor [27]. Another study's findings suggested that the physical environment plays a vital role in the network and relationship development of the workplace [26]. In the better physical environment, an employee experiences less stresses while doing their jobs [28].

### B. Key Elements in the Office Environment

Health and Performance of office employees affected by the different factors like colours, light, air quality, environmental conditions, noise, mouse, keyboard, monitor, sitting chairs, desk, ergonomic conditions and lack of privacy, etc. All above factors are the reasons to improve and reduce the level of employee's working quality and Health. Furniture, noise, lighting, communication, temperature and air quality are the Integral parts of workplace environment [3].

#### 1) Furniture

In organisations, where workplace situations are monotonous and arduous, the major problem that employee experience is their health condition specially neck, shoulder, backbone and hands [29]. Sitting arrangement or comfortable furniture for a workplace has serious impact on health of user [28]. A study was conducted on school children and findings indicated that where risk of musculoskeletal pain was observed 1.59 times more due to seat depth and length similarity in reference to the furniture [30]. The neck stress seems to be significantly reduced by engaging the use of forearm support, this arrangement was also observed to be good for shoulders [31].

#### 2) Noise

There have been a number of researches on the noise and its impact on the performance of employees and its impact on employee welfare. The level of noise greater than 85dB has negative impact on the performance and is proved to be strategic indicator for performance improvement [31] [60]. Rate and accuracy of work are two different aspects and according to [32] noise seems to have a negative effect on the rate of work. The impact of noise also depends on gender. The

female employees seem to be more affected by the noise as compared to their male counterparts [33].

The noise also affects the personality of a person [34]. The people working in very noisy environment feel distracted with sense of low privacy along with difficulty of concentration on the work [35]. Environment with inappropriate noise conditions significantly affects the health of employee negatively [36]. The increased level of noise increases the level of stress and irritation along with dwindling of productivity [37].

#### 3) Temperature

People are working in a number of different climate conditions; by increasing the temperature, the performance of any task can negatively reduce [37]. The health of an employee will also be affected negatively as there is an increase in cardiovascular stress because of temperature it also affects the performance [38]. Duration of a task and how long an employee experiences the temperature, are important factors too but hot condition (above than 900F) and cold condition (less than 500F) have bad effect on performance.

#### 4) Light

Intensity of light causes eyes strain, which affects the patterns of sleep [39] and visual sensitivity significantly affect the performance [40] [41]. Light with respect to its intensity and shades, like yellow light or white light differently affect the eyes, the nervous system, and level of tiredness and activity of brain [42] [43]. To build a comfortable work place design, lightening play a critical role. It can affect the performance of employees depending upon the condition [44].

### C. Physical Work Environment and Employee's Performance

Achieving good performance is one of the key dynamic of today's business world. Organisations are engaging resources for improving the performance by adding value in workplace design and making it more comfortable and innovative. Workplace performance as explained by [45] is that all the means given to an employee by its organisation/ business helps the business to grow.

The Employee's feelings toward his workplace design actually play a role in his/her performance [46] [58] and the not being feel comfortable usually caused by lighting, noise, ventilation system [47]. Comfort of an employee is defined as, in a given workplace environment, the level in which an employee gives its performance to a certain job [48]. Performance of an employee also depends on their willingness to perform certain task with concern [49] [50].

Another variable suggested by [51] was noise that can be reason of discomfort and have negative impact on the performance. Satisfaction of an employee leads to better performance and it can be achieved by a better workplace [45] [52].

### D. Employee's Health

There are some factors that can cause visual and musculoskeletal discomforts like workplace design, workplace area, the number of hours working on computers, lightening of

workplace, etc. [53] [59]. Work by [54] has suggested that a systematic and well-designed office is required to provide a safe workspace for employees. In the article “Home Office Ergonomics” [54] author concluded that we cannot ignore proper implementation of ergonomics as stress and affects the health in so many ways, and all the part of the human being can be significantly affected like arms, hand, legs, etc.

### 1) Eyes and Neck

The wrong sitting position of a person in-front computer causes eyes stress and pain in the neck, a 30-degree angle is best if its starts from the top of your eye level and descends [54]. The rule of thumb is appropriate positioning for sitting in front of the computer.

### 2) Wrists and Arms

The most favourable position for using keyboard and mouse which engages the wrist and arms of human is that the both hardware should be at the same level [54][56].

### 3) Back and Hips & Legs and Knees

Some rules for furniture were introduced by [54], which explains why the ergonomic is important in the workplace and poor implementation will lead to stress, illness, and fatigue which result in bad performance. These rules are as follows:

Sitting position for the back, hip, legs, and knees are very significant, and right positioning of sitting will reduce pressure from 20 to 30% from the back. The design of a seat should be something that ensures the depth of seat, 17 to 19 inches with lower back support. When someone sits, feet should touch the floor nicely along with 90-degree angle for the legs.

## III. HYPOTHESIS DEVELOPMENT

Literature review on the impact of workplace design on Employee’s health and performance shows how scholars have penetrated these ideas for different situations. Thus, it delivers a basis for the hypothesis development and research framework of the current study. Figure 1 describes the research framework and the hypothesis is mentioned below:

**H<sub>1</sub>**; Workplace design has significant bad effect on employee’s discomfort.

**H<sub>1a</sub>**; Furniture has significant bad effect on employee’s discomfort.

**H<sub>1b</sub>**; Noise has significant bad effect on employee’s discomfort.

**H<sub>1c</sub>**; Lightening has significant bad effect on employee’s discomfort.

**H<sub>1d</sub>**; Temperature has significant bad effect on employee’s discomfort.

**H<sub>1e</sub>**; Spatial arrangement has significant bad effect on employee’s discomfort.

**H<sub>2</sub>**; Workplace design has significant positive effect on employee’s performance.

**H<sub>2a</sub>**; Furniture has significant positive effect on employee’s performance.

**H<sub>2b</sub>**; Noise has significant positive effect on employee’s performance.

**H<sub>2c</sub>**; Lighting has significant positive effect on employee’s performance.

**H<sub>2a</sub>**; Temperature has significant positive effect on employee’s performance.

**H<sub>2e</sub>**; Spatial arrangement has significant positive effect on employee’s performance

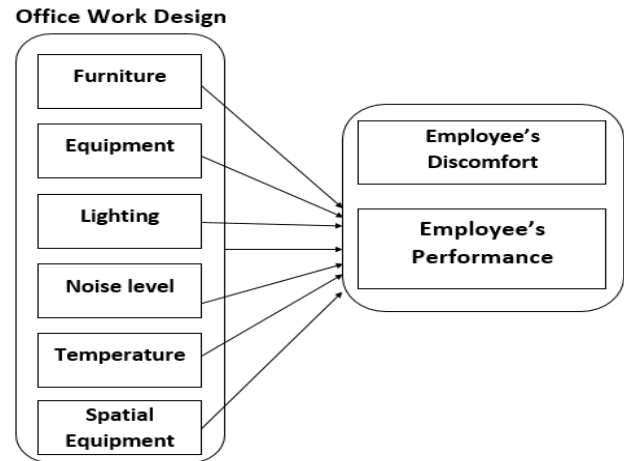


Fig. 1. Theoretical Framework

## IV. RESEARCH METHODOLOGY

### A. Data Collection

The aim of this study is to observe the result of workplace design on employee’s health and performance in the software industry of Pakistan. We have collected the data from software houses in Pakistan through close-ended questionnaires. We selected Software houses registered under PSEB (Pakistan Software Export Board) for the population of the study. There are 1100 software houses registered under PSEB. Simple random sampling was used to choose the software houses from the list. The sample size was 285. We sent one questionnaire to each software house by email.

### B. Instruments for Data Collection

A structured questionnaire was used to collect data which included close-ended. A 5 point Likert was used to test the hypotheses. Structure of questionnaire was as follow;

- 1) Demographic characteristic information
- 2) Workplace design
- 3) Employee Health
- 4) Employee performance.

Data collection procedure is conducted through online forms and sent by emails. We sent a total 285 questionnaires. A total 199 responses received (70 per cent response rate). Six responses discarded because of missing data, so total 193 responses were used for analysis.

## V. DATA ANALYSIS AND RESULTS

To test the effect of workplace design on employee’s health and performance, we used linear regression.

A. Reliability Analysis

We performed Reliability analysis for both independent and dependent variables by using Cronbach’s alpha in SPSS. Results showed that for office work design, the value of Cronbach’s alpha is 0.984, for employee’s health is .965 and for employee’s performance is .860. All the values are the above-accepted range.

B. Collinearity Diagnostic Test

Variance factor analysis was used to examine the multi-collinearity among workplace design construction (the independent variables). Results are displayed in Table 1.

TABLE I. COLLINEARITY DIAGNOSTIC RESULTS

Standard value of tolerance is considered > 0.20 and < 10 for VIF (variance inflation factor). Table 1 shows that all the values of tolerance are greater than 0.20 and VIF values for

Model	Collinearity Statistics	
	Tolerance	VIF
Furniture	.752	1.329
Noise	.578	1.731
Temperature	.824	1.214
Lightening	.688	1.454
Spatial Arrangement	.523	1.911

ergonomics constructs are < 10.

C. Pearson’s Correlation Analysis

In Table 2, Relation of the independent variable (office work design) and the dependent variable (employee’s health and employee’s performance) was examined using Pearson correlation analysis. We used Pearson correlation because variables had a linear relationship. Results indicated a significant correlation between the variables at 0.05 (Table 2).

The Pearson’s coefficient of correlation (r) for Workplace design and Employee’s Health is (-0.881). This value indicates that there is a weak correlation between workplace design and employee’s health and (-) sign indicates that direction of this relationship is negative. Also, this relationship is significant because (p=0.000) that is less than 0.05. So it is concluded that there is a weak, negative association among Workplace design and Employee’s Health, which is statistically significant (r = -0.881, p = 0.000).

The Pearson’s coefficient of correlation (r) for Workplace design and Employee’s Performance is 0.672). This value indicates that there is a weak correlation between these two variables and that direction of this relationship is positive.

Also, this relationship is significant because (p=0.000) that is less than 0.05. So it is concluded that there is a weak, positive relationship between Workplace design and Employee’s Performance, which is statistically significant (r=0.672, p = 0.000).

TABLE II. PEARSON’S CORRELATIONS

	Light	Spatial arrangement	Temperature	Noise	Furniture	Office work design	Performance	Health
Light	1	.170*	.811**	.809**	.823**	.955**	.669**	-.859**
Spatial arrangement	.170*	1	-.210*	-.284*	.220**	.198**	.237*	-.183*
Temperature	.811**	-.210*	1	.828**	.607**	.871**	.600**	-.732**
Noise	.809**	-.284*	.828**	1	.634**	.885**	.416**	-.686**
Furniture	.823**	.220**	.607**	.634**	1	.859**	.801**	-.882**
Office work design	.955**	.198**	.871**	.885**	.859**	1	.672**	-.881**
Employee’s Performance	.669**	.237*	.600**	.416**	.801**	.672**	1	-.794**
Employee’s Health	-.859**	-.183*	-.732**	-.686**	-.882**	-.881**	-.794**	1

D. Regression Analysis

1) Impact of Workplace Design on Employee’s Health

To explore the effect of workplace design on employee’s health, we used linear regression. To validate the assumptions of data normality, linearity, multi-co linearity and homoscedasticity, we performed the initial analysis. First, we accomplished the correlation analysis and the results indicated that all independent variables were correlated with employee’s health, so it implies that data was appropriate for conducting linear regression.

In Table 3, model explained 75.7% variance in the dependent variable i.e. employee health. Model strength (R-square) is 0.757. The values for F = 591.829, p = 0.000. The value of p that is less than 0.05 which means it is significant [55]. So, it means that this relationship is significant. The values for the workplace design (β = -0.834, p = 0.000) it means the workplace design have a negative relationship with the employee discomfort level and this relationship is significant. It means better the workplace design will lead to lesser the discomfort level of employee’s health.

TABLE III. WORKPLACE DESIGN AND EMPLOYEE’S HEALTH

Model	R	R Square	Adjusted R Square	F	Sig.	B	T	Sig.
1	.870 <sup>a</sup>	.757	.756	591.829	.000 <sup>b</sup>	-.834	-24.328	.000

a. Predictors: (Constant), office work design

2) Impact of Individual Workplace Design Constructs on Employee’s Health

Linear regression was used to test the effect of individual ergonomics constructs on employee’s health. Table 4 shows the results of analysis. Summary of the findings are as follows;

a) Furniture and lightening have explained most of the variance (77.9% and 74.1% respectively) in employee’s health. These relationships are significant as for furniture F = 668.239, B = -.846, p < 0.001 and for lightening F = 544.869, B = -.826, p < 0.001.

b) Temperature is the third construct that has explained most variance for employee’s health (59.2%). This relationship is also significant as F = 276.122 %, B = -.738 and p < 0.001.

c) Noise has a significant relationship with employee’s health. It has explained 48% variance for employee’s health. For noise F = 175.498, B = -.665 and P < 0.001.

d) The spatial arrangement has explained least variance (3.8%) for employee’s health. Values for F = 7.523, B = -.187, p < 0.001.

TABLE IV. WORKPLACE DESIGN CONSTRUCTS ON EMPLOYEE’S HEALTH

Independent Variables	R	R Square	F	Sig.	B	T	Sig.
Furniture	.882	.779	668.239	.000	-.846	-25.850	.000
Noise	.693	.480	175.498	.000	-.665	-13.248	.000
Temperature	.770	.592	276.122	.000	-.738	-16.617	.000
Lightening	.861	.741	544.869	.000	-.826	-23.342	.000
Spatial Arrangement	.195	.038	7.523	.000	-.187	-2.743	.000

3) *Impact of Individual Workplace Design Constructs on Employee’s Performance*

To explore the effect of workplace design on employee health, we performed linear regression. To validate the assumptions of data normality, linearity, multi-co linearity and homoscedasticity, we performed some initial analysis and correlation, and the results indicate that all independent variables were correlated with employee health, so it implies that data was appropriate for conducting linear regression.

In Table 5, the model explained 45.2% variance in the dependent variable i.e. employee’s performance. Model strength is (R-square) 0.452. The values for F = 156.796, p = 0.000. The value of p that is less than 0.05 which means significant [55][57]. So it means that this relationship is significant.

TABLE V. WORKPLACE DESIGN ON EMPLOYEE’S PERFORMANCE

Model	R	R Square	F	Sig.	B	T	Sig.
1	.672	.452	156.796	.000 <sup>b</sup>	.672	12.522	.000

Values for the workplace design ( $\beta = .672, p = 0.000$ ) it means the workplace design have the significant positive relationship with the employee’s performance. It means better the workplace design will lead to better the performance of employees.

4) *Impact of Individual Workplace Design Constructs on Employee’s Performance*

Linear regression was used to test the effect of individual ergonomics constructs on employee’s performance. Results of the analysis are shown in Table 6. Summary of the findings are as follows:

a) Furniture and lightening have explained most of the variance (64.2% and 44.8% respectively) in employee’s performance. These relationships are significant as for furniture F = 340.216, B = .801, p < 0.001 and for lightening F = 153.920, B = .699, p < 0.001.

b) Temperature is the third construct that has explained most variance for employee’s performance (36.6%). This relationship is also significant as F = 106.803%, B = .600 and p < 0.001

c) Noise has a significant relationship with employee’s performance. It has explained 17.3% variance for employee’s performance. For noise F = 39.696, B = .416 and P < 0.001.

d) Tthe spatial arrangement has explained least variance (0.1%) for employee’s performance. Values for F = .257, B = .037, p < 0.001.

VI. FINDINGS

A. *Workplace Design and Employee’s Health*

Results show that workplace design has statistically significant impact on employee’s health. Values for the workplace design ( $\beta = -0.834, p = 0.000$ ) it means the workplace design have a negative relationship with the employee discomfort level and this relationship is significant. The resultant value of r square is 0.757 that means that workplace design explains 75% variance in employee’s health. It means better the workplace design will lead to lesser the discomfort level of employee health. The overall results show that furniture and lighting have the most effect on employees’ health and the spatial arrangement has the least on the health of the employees in the software industry.

B. *Workplace Design and Employee’s Performance*

Results show that workplace design has statistically significant impact on employee’s performance. Values for the workplace design ( $\beta = .672, p = 0.000$ ) it means the workplace design have a positive relationship with the employee’s performance and this relationship is significant. The value of r square is 0.452 that means that workplace design explains 45% variance in employee’s performance. It means better the workplace design will lead to better the performance of employees in the software industry. The overall results show that furniture and lighting have the most effect on employees’ performance and the spatial arrangement has the least on the performance of the employees.

TABLE VI. WORKPLACE DESIGN CONSTRUCTS AND EMPLOYEE'S PERFORMANCE

Independent Var	R	R Square	F	Sig.	B	T	Sig.
Furniture	.801	.642	340.216	.000 <sup>b</sup>	.801	18.445	.000
Noise	.416	.173	39.696	.000 <sup>b</sup>	.416	6.300	.00
Temperature	.600	.366	106.803	.000	.600	10.335	.00
Lightening	.669	.448	153.920	.000	.699	12.406	.00
Spatial Arrangement	0.037	.001	.257	.000	.037	.507	.00

1) The conclusion of the study

This study establishes that workplace design has significant influence on both performance of the employees and health in the software industry of Pakistan. By providing good workplace design in software houses, the performance of employees can be enhanced and health related issues can be minimised.

2) Recommendations of study

Furniture and lightening were found to be the most significant factor that can affect both employee's performance and health. So, software houses should provide proper and adequate furniture and light to employees to improve their performance.

Some training are needed to guide the workers about the use ergonomics like the light, colour, computer appliances, chairs, desks and about the awareness of musculoskeletal complaints so the workers can get expertise to use the ergonomics and they can be able to maintain their health issues.

Workplace has to develop a criterion through sensors which can help to observe the employees ease. Through these observations the builders can establish the office to overcome all the difficulties that occur in performance and productivity of office employees.

3) limitations and future suggestion

First, this research is restricted to the setting of the Pakistan. Future studies can be conducted to other geographical settings to replicate the findings and to discover the effect of Countrywide culture on the association among workplace design and employees' health and performance. Second, this study is directed in IT sector of Pakistan. More studies can be conducted using other industries of Pakistan

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