

# ERGONOMIC FACTORS AND THEIR IMPACT ON COMPUTER OPERATORS' WORK PRODUCTIVITY

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## Abstract

Ergonomics plays a pivotal role in modern information technology oriented organizations and most of the organizations are trend to acquire latest information technology infrastructure for organizational business processes, when introducing new technology fit between technology and human factor essentially need to be considered. Ergonomics related theories and guidelines provides the knowledge for effective organizational design, however due to the changes of organizational context, nature of work and demographics of workers outcomes of applying or ignoring Ergonomics principles need to be study in specific context. The purpose of this study was to investigate the ergonomic factors and their impact on computer operators' work productivity. Studies done on technology based productivity enhancement are considerably record high amount at the time of this study, however still there exist a research gap for ergonomics factors and productivity enhancement in specific organizational contexts. To fill this gap, the research was conducted in private bank located in a rural area of Sri Lanka, with a sample of 100 computer operators in Anuradhapura city. Stratified random sample technique was used to choose the research sample. Data was collected from a standard questionnaire specifically prepared based on literature based conceptual model. The Correlation statistics of the study revealed that ergonomic factors have a positive and strong relationship on computer operators' work productivity. Also, the results of the study found that the environmental ergonomic factors, cognitive ergonomic factors, and organizational ergonomic factors have a significant positive impact on computer operators' work productivity and physical ergonomics haven't any significant impact on computer operators' work productivity.

**Keywords:** *Ergonomic factors, Job Effectiveness, Job Efficiency, Job Satisfaction, Work Productivity*

## 1. Introduction

In the global context, all industries and operations have become very competitive. In such a competitive environment, productivity is a key aspect that any organization tries to achieve. According to Yadav and Marwah (2015) productivity is a ratio to measure how well an organization (or individual, industry, country) converts input resources (labour, materials, machines, etc.) into goods and services. Anyway organizations have many productivity types such as work productivity, machine productivity, capital productivity, energy productivity, and so on (Yadav & Marwah, 2015).

The working environment of an organization is rapidly changing due to the rapid development of technology, ways of doing jobs easier are emerging as the developments of computer technology. Most of the organizations today, working with machines, and the majority of them are computers. Computer operators' productivity is influenced by several factors, motivated computer operators do their best to achieve high work productivity. Vimalanathan and Thangavelu (2017) show the effect of ergonomic factors influences the work productivity, health, and wellbeing of office workers and most of the office workers are working with

computers. Also, numerous studies show the importance of ergonomic factors for improving the performance of computer operators.

The concept of an ergonomically designed workstation is complex and depends on a myriad of elements. Vimalanathan and Thangavelu (2017) stated that all the ergonomic factors are grouped under the four main factors as Physical, Environmental, Cognitive, and Organizational ergonomics factors. So, Organizations should concern about the environmental, physical, cognitive, and organizational factors of the workplace on additional human skills to increase computer operators' work productivity.

There are several proven benefits of a strong workplace ergonomic process. Ergonomics reduces costs, it improves the quality of products, ergonomics improves employee engagement and it creates a better safety culture. The problem of an improper workstation design may be due to a lack of knowledge or inappropriate application of ergonomic principles. If any organization implement ergonomic improperly it causes to occur some downsides. Employees face musculoskeletal disorders, headaches, and migraines is the main downside that occurs because of the poor ergonomics. According to Kumah et al., (2016) organizations who standing without proper ergonomics are become to failure easily and therefore occur Injuries and discomforts in higher propensity within those organizations. This study, therefore, seeks to assess the impact of ergonomic factors on the work productivity of computer operators.

Most of the organizations haven't enough awareness about how ergonomic factors influence computer operators' performance, how to use ergonomic principles to increase work productivity and performance. Mostly, government sector organizations have less awareness about the effect of ergonomics. So, the importance of optimizing workplace ergonomics has received little attention within organizations. Factors such as the position of the work chair, workstation table, keyboard, mouse, monitors, ambient room lighting, job fear, memory, task difficulty, training, goal setting, communication, and supervision have become secondary considerations and it caused to make an improper workstation design (Harisinghani et al., 2004).

## 2. Literature Review

### *Computer operators' work productivity*

Work productivity is one of the most important indices among partial productivity indicators and plays a key role in the productions and services as the outcome (Shirouyehzad et al., 2013). According to Massoudi and Hamdi (2017), work productivity is the most used partial factor productivity measure and work productivity is an assessment of the efficiency of a worker or group of workers. From the viewpoint of Sauermann (2016) work productivity could thus be measured as an output, e.g. sales or units produced, relative to an input, e.g. the number of hours worked or the cost of labour. At the individual (worker) level, two very common dimensions are the quality at which a job is performed, and how fast it is done (quantity). Clements-croome (2018) presents the following work productivity measures. Absence from work or workstation, health costs, interruptions to work, controlled independent judgments of work quality, self-assessments of productivity, speed and accuracy of work, the output from pre-existing workgroups, costs for the product or service, exchanging output in response to graded reward, volunteer overtime, and the cycle time from initiation to completion of the process, multiple measures at all organizational levels. further, Harris (1994) has been indicated that his definition of individual work productivity includes effectiveness (producing the right products or services), efficiency (prudent utilization of resources), and quality (meeting technical and customer specifications). Pickson et al (2017) used job satisfaction for investigating the effect of ergonomics on employee productivity.

So, when measuring work productivity of computer operators' researcher has been taken some assorted dimensions through the above literature regarding computer operators' work productivity. Thus this study has

been recommended four dimensions of computer operators' work productivity such as job satisfaction, work efficiency, work effectiveness, and quality of work. According to Aziri (2011), Job satisfaction represents one of the most complex areas facing today's managers when it comes to managing their employees and it has a large impact on work productivity. Further Rue and Byars (2003) found that determinants of satisfaction and dissatisfaction like employee loyalty, commitment to organization, turnover, absenteeism, strikes, grievances, tardiness, and sabotage. In the viewpoint of Jayamaha and Mula (2011) efficiency means prudent utilization of resources and concept of work productivity is closely related with that of efficiency. However, when a firm achieves maximum output from a particular input level, with utilization of inputs at least cost and better speed it is considered to be an overall efficient firm. According to Duffy (2015), effectiveness means producing the right products or services and there is a relationship between ergonomic factors and work productivity. Further Joy (2018) indicated that four dimensions of organizational effectiveness. Goal accomplishment and strategic constituencies' satisfaction, resource acquisition are some of them. According to Zare, Croq, Hossein-arabi, Brunet and Roquelaure (2015) there is a relationship between ergonomic factors and quality of work. Furthermore, Abdel-Maksoud and Abdel-Kader (2007) indicated some measurements of work quality like scraps, defects, batches, uncompleted tasks and reworks.

### *Ergonomic factors*

The term ergonomics is derived from the Greek word *ergos* meaning "work" and *nomos* meaning "natural laws of" or "study of" (Abdul-Tharim, Jaffar, Lop, & Mohd-Kumar, 2011). Ergonomics is defined as the study of the design of a workplace, equipment, machine, tool, product, environment and system which takes into consideration human being's physical, physiological, biomechanical, and psychological capabilities and optimizes the effectiveness and productivity of work systems while assuring the safety, health, and wellbeing of the workers (Fernandez & Marley, 1998). Several scholars have noted that many researchers have been trying to identify several ergonomic factors within the workplace. Vimalanathan and Thangavelu (2017) stated that all the ergonomic factors are grouped under the four main ergonomic factors such as Physical, Environmental, Cognitive, and Organizational ergonomics factors.

### *Environmental ergonomic factors*

In principle, environmental ergonomics will incorporate the social, psychological, cultural and organizational environments of systems. Typically, ergonomists have mechanically considered the environment in terms such as the lighting or noise survey rather than as an integral part of ergonomics investigation. The establishment of the study of human responses to the physical environment has inconsistently repressed the progress of environmental ergonomics (Mishra, Goswami, & Goswami, 2001). Roelofsen (2002) stated that 10% of the office worker's productivity may be increased by achieving the improved indoor environment quality. According to Massoudi and Hamdi (2017) Companies should maintain an appropriate temperature for employees. Furthermore, colour is a visual phenomenon triggered by the response to the stimulation of light. It perhaps every aspect of our lives, embellishes the ordinary and gives beauty and drama to everyday objects (Holtzschue, 2002). In the viewpoint of Massoudi and Hamdi (2017) without proper lighting, people may strain to view objects, which can lead to eye fatigue. Sundstrom, Town, Rice, Osborn and Brill (1994) identified noise as an ambient stressor relating to job satisfaction in the work environment. According to the above facts it is quite clear, room temperature, indoor air quality, illumination, and noise are the related environmental ergonomic factors which can affect the performance, health, comfort, and productivity of computer operators.

### *Physical ergonomic factors*

Physical ergonomics deals with the human body's responses to physical and physiological stress. It takes into account the characteristics of the human such as anatomy, psychology, and biomechanics as they relate to

physical activity. Physical ergonomic issues, primarily in the workplace, typically dominate the public view and understanding of ergonomics. It is certain that when ergonomics principles are ignored in the workplace, musculoskeletal disorders (MSD) are a potential outcome (White & Michigan, 2008). In the viewpoint of Vimalanathan and Thangavelu (2017) workplace design, sitting arrangement, physical workload, fitness, visual comfort, and VDT are the physical ergonomic factors that can affect the productivity of computer operators. According to the above facts, it is quite a clear workplace design, sitting arrangement, physical workload, fitness, and visual comfort are the related physical ergonomic factors that can affect the performance, health, comfort, and productivity of computer operators.

#### *Cognitive ergonomic factors*

According to White and Michigan (2008), Cognitive ergonomics is an emerging branch of ergonomics. It is a subset of the larger field of human factors. It focuses on the fit between human cognitive abilities and limitations and the machine, task, and environment. Cognitive ergonomics is concerned with the mental processes such as perception, memory, reasoning, and motor response as they affect interactions among humans and other elements of a system. Relevant topics in cognitive ergonomics include mental workload, decision making, human-computer interaction and work stress. Berlin and Adams (2017) have indicated that the basic cognitive follows some processes likewise Sensation and perception, attention, short term memory, and long term memory. In addition to Vimalanathan and Thangavelu (2017) stated that several cognitive ergonomic factors. Task difficulty, job fear, mental workload, job stress, motivation, memory, job satisfaction, and depression are them.

#### *Organizational ergonomic factors*

Organizational ergonomics is focused on the optimization of sociotechnical systems, including their organizational structures, processes, and policies. This field is also known as macro ergonomics. The area of macro ergonomics proves that ergonomics is not just about how an individual interacts with an object. Even organizations need to be ergonomically designed. Organizational ergonomics is concerned with topics such as communication, work design, teamwork, crew resource management, teleworking, shift work, safety culture (White & Michigan, 2008). In the viewpoint of Massoudi and Hamdi (2017) Transparent & Open Communication, Work-Life Balance, Training & Development-Focused, Recognition for Hard Work, Strong Team Spirit, goal setting, performance feedback, and supervisor support are some of the organizational ergonomic factors. However, K and Babu T (2017) characterized organizational ergonomic factors likewise, training, promotion, incentive, bossism, commitment, and knowledge updating.

#### *Empirical evaluation*

Table 1: Empirical Evaluation

| <b>Date</b> | <b>Author</b>               | <b>Source</b>                                                                     | <b>Findings</b>                                                                                                                                                                                                  |
|-------------|-----------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2004        | (Harisinghani et al., 2004) | Importance and Effects of Altered Workplace Ergonomics in Modern Radiology Suites | The importance of optimizing workplace ergonomics has received little attention. Paying close attention to the basics of workplace ergonomics can go a long way in increasing productivity and reducing fatigue. |

|      |                                   |                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2017 | (Pickson et al., 2017)            | Investigating the Effect of Ergonomics on Employee Productivity: A Case Study of the Butchering and Trimming Line of Pioneer Food Cannery.         | It was established that all the indicators of work ergonomics have a significant positive correlation with employee productivity of Pioneer Food Cannery Limited (PFC) in Ghana.                                                                                                                                                                                                                                                                             |
| 2016 | (Kim, 2016)                       | Cognitive Ergonomics and Its Role for Industry Safety Enhancements                                                                                 | Cognitive ergonomics provide significant contributions to improving work performance, lean operations, productivities, and eventually creating safer and healthier work environments in the industry.                                                                                                                                                                                                                                                        |
| 2016 | (Vimalanathan & Thangavelu, 2016) | Impact of environment ergonomics on the productivity of employees                                                                                  | From the study result, the temperature and illumination are independently significant on the productivity of the office workers have been understood. It may further be noted that the indoor room temperature has more significant effect than either independent or combined effect of illumination. From this, it may be concluded that the impact of indoor room temperature is more on the office worker's performance than the effect of illumination. |
| 2017 | (Pickson et al., 2017)            | Investigating the Effect of Ergonomics on Employee Productivity: A Case Study of the Butchering and Trimming Line of Pioneer Food Cannery in Ghana | There is a positive relationship between ergonomic factors and employee job satisfaction                                                                                                                                                                                                                                                                                                                                                                     |
| 2018 | (Elbert et al., 2018)             | Ergonomics: How to design for ease and efficiency                                                                                                  | There is a positive relationship between ergonomically design workplace and job efficiency.                                                                                                                                                                                                                                                                                                                                                                  |
| 2015 | (Duffy, 2015)                     | The impact of organizational ergonomics on work effectiveness with special reference to concurrent engineering in manufacturing industries.        | Ergonomics contribute to effectiveness of employees                                                                                                                                                                                                                                                                                                                                                                                                          |

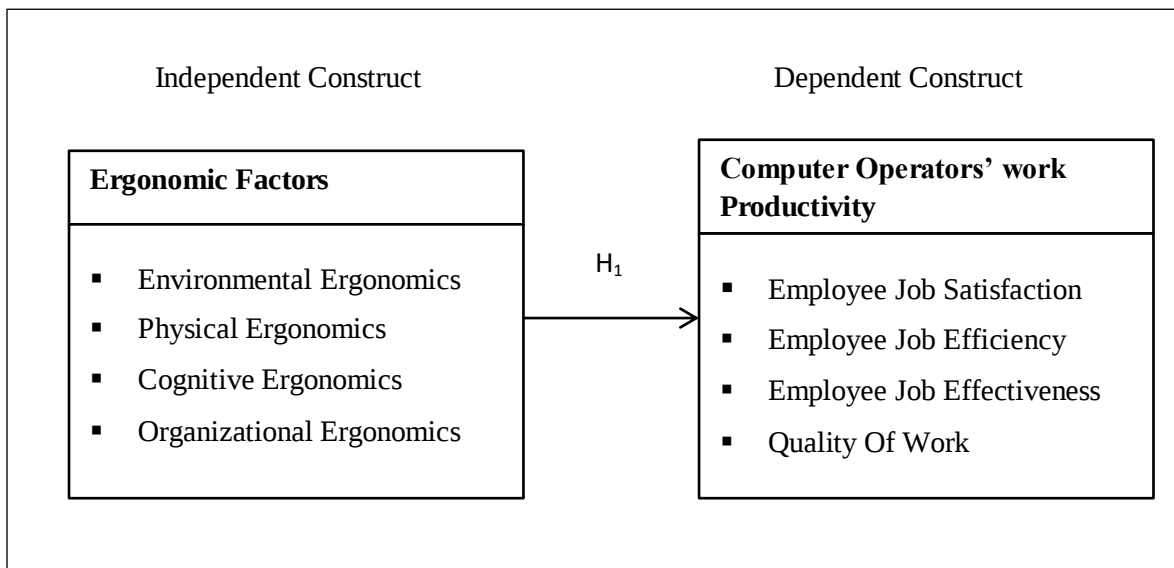
|      |                     |                                                                            |                                                                                                                             |
|------|---------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 2015 | (Zare et al., 2015) | Does Ergonomics Improve Product Quality and Reduce Costs? A Review Article | Ergonomic approach in the manufacturing production system can reduce defects and improve quality in the production process. |
|------|---------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|

(Source: Developed by Author)

### 3. Methodology

According to this study, ergonomic factors were considered as the independent construct while computer operators' work productivity considered as the dependent construct. According to the literature base of the study, all the ergonomic factors are grouped under the four main ergonomic factors such as Physical ergonomics, Environmental ergonomics, Cognitive ergonomics, and Organizational ergonomics and researcher used four aspects of computer operators' work productivity which are namely employee job satisfaction, employee job efficiency, employee job effectiveness and quality of work. Thus, the conceptual framework is illustrated as follows to implement the relationship among variables.

Figure 1: conceptual framework



Source: Developed by Author

The research hypothesis of the study is ergonomic factors impact on computer operators' work productivity, this hypothesis was developed based on the existing literature (Vimalanathan & Thangavelu, 2017).

In this study, the researcher attempts to identify ergonomic factors and their impact on computer operators' work productivity. For the study purpose, no artificial environment was created to test the effect and all the primary data of the study were collected from the real environment. The data required to measure the variables of the study were collected through a structured questionnaire, which was prepared and distributed among the computer operators in Anuradhapura city: a regional agricultural based city in Sri Lanka. The reliability of the instrument was tested before the final data collections stage and Cronbach's alpha value of each variable of the instrument recorded than the expected level (0.7). The questionnaires were provided to the respondents in a paper form. Basically the questionnaire of the study involves three parts. The first part is concern about the demographic information of respondents. The second part of the questionnaire is focused to

identify information regarding to ergonomic factors which are the independent construct of the study. The final part of the questionnaire is to recognize the information of computer operators' work productivity.

### Population and Sampling

The population of this study is 280 computer operators work in 10 commercial banks in Anuradhapura city. The sample of the study was selected using the stratified random sampling technique, the sample size was 100 computer operators, and this sample represents all the commercial banks in the selected area.

### Data analysis methods

The main objective of the study was to find the impact of ergonomic factors on employee productivity. The statistical analysis and the Multiple Linear Regression were used to analyse the data.

## 4. Results and Discussion

### Sample Description

Table 2: Respondent's demographic factors

|                |                  | Marital status |                    |                    |             | Total |
|----------------|------------------|----------------|--------------------|--------------------|-------------|-------|
|                |                  | Married        |                    | Unmarried          |             |       |
| Gender         | Male             | 31             |                    | 21                 |             | 52    |
|                | Female           | 25             |                    | 23                 |             | 48    |
| Total          |                  | 56             |                    | 44                 |             | 100   |
|                |                  | Age gap        |                    |                    |             | Total |
|                |                  | Below<br>25    | Between<br>26 - 35 | Between<br>36 - 45 | Above<br>46 |       |
| Gender         | Male             | 10             | 19                 | 16                 | 7           | 52    |
|                | Female           | 12             | 18                 | 12                 | 6           | 48    |
| Total          |                  | 22             | 37                 | 28                 | 13          | 100   |
|                |                  | Age gap        |                    |                    |             | Total |
|                |                  | Below<br>25    | Between<br>26 - 35 | Between<br>36 - 45 | Above<br>46 |       |
| Marital status | Married          | 0              | 16                 | 27                 | 13          | 56    |
|                | Unmarried        | 22             | 21                 | 1                  | 0           | 44    |
| Total          |                  | 22             | 37                 | 28                 | 13          | 100   |
|                |                  | Age gap        |                    |                    |             | Total |
|                |                  | Below<br>25    | Between<br>26 - 35 | Between<br>36 - 45 | Above<br>46 |       |
| Job position   | Staff level      | 22             | 28                 | 12                 | 4           | 66    |
|                | Executive level  | 0              | 9                  | 15                 | 4           | 28    |
|                | Managerial level | 0              | 0                  | 1                  | 5           | 6     |
| Total          |                  | 22             | 37                 | 28                 | 13          | 100   |
|                |                  | Job position   |                    |                    | Total       |       |
|                |                  | Staff level    | Executive level    | Managerial level   |             |       |
| Gender         | Male             | 33             | 16                 | 3                  | 52          |       |
|                | Female           | 33             | 12                 | 3                  | 48          |       |
| Total          |                  | 66             | 28                 | 6                  | 100         |       |
|                |                  | Job position   |                    |                    | Total       |       |
|                |                  | Staff level    | Executive level    | Managerial level   |             |       |

|                |           |    |    |   |     |
|----------------|-----------|----|----|---|-----|
| Marital status | Married   | 28 | 22 | 6 | 56  |
|                | Unmarried | 38 | 6  | 0 | 44  |
| Total          |           | 66 | 28 | 6 | 100 |

(Source: Survey Data)

*Descriptive statistics for Independent variables*

Table 3: Descriptive statistics for independent variables

|                   | Mean      | Std. Deviat. | Skewness  |           | Kurtosis  |           |
|-------------------|-----------|--------------|-----------|-----------|-----------|-----------|
|                   | Statistic | Statistic    | Statistic | Std.Error | Statistic | Std.Error |
| Ergonomic Factors | 3.4326    | 0.38128      | 0.253     | 0.241     | 0.693     | 0.478     |

(Source: Survey Data)

The researcher has used four areas (Environmental ergonomics, Physical Ergonomics, Cognitive Ergonomics, and Organizational Ergonomics) together to measure the Ergonomic factors construct. According to the above table, the mean value of Ergonomic factors is significantly high ( $M=3.4326$ ,  $SD=.38128$ ), indicating that the banks have considered the ergonomics factors when they design work environment.

*Descriptive statistics for Dependent variables*

Table 4: Descriptive statistics for dependent variable

|                                              | Mean          | Std. Deviation | Skewness     |              | Kurtosis      |              |
|----------------------------------------------|---------------|----------------|--------------|--------------|---------------|--------------|
|                                              | Statistic     | Statistic      | Statistic    | Std. Error   | Statistic     | Std. Error   |
| Job satisfaction                             | 3.5513        | 0.48497        | 0.065        | 0.241        | -0.374        | 0.478        |
| Job efficiency                               | 3.3217        | 0.55315        | -0.516       | 0.241        | 0.579         | 0.478        |
| Job effectiveness                            | 3.4000        | 0.54019        | -0.377       | 0.241        | 0.963         | 0.478        |
| Quality of work                              | 3.6360        | 0.56524        | -0.190       | 0.241        | -0.329        | 0.478        |
| <b>Computer operators' work productivity</b> | <b>3.4768</b> | <b>0.41377</b> | <b>0.059</b> | <b>0.241</b> | <b>-0.124</b> | <b>0.478</b> |

(Source: Survey Data)

Table indicates descriptive statistics responses of respondents in the sample related to the dependent variables of the study. When considering the mean value of Job Satisfaction, it indicates that Job Satisfaction among computer operators' productivity is significantly high ( $M=3.5513$ ,  $SD=0.48497$ ). And in the case of Job Efficiency, it also indicates a high significance ( $M=3.3217$ ,  $SD=0.55315$ ) towards the computer operators' work productivity. The mean value of employee Effectiveness is also high ( $M=3.4000$ ,  $SD=.54019$ ). The highest mean value ( $M=3.6360$ ,  $SD=.56524$ ) has been recorded in the Quality of Work variable. Therefore computer operators' work productivity also indicates a high significance ( $M=3.4768$ ,  $SD=.41377$ ).

### Impact of Ergonomic Factors on Work Productivity

Through the multiple regression analysis, the impact of each ergonomic factor (environmental ergonomics, physical ergonomics, cognitive ergonomics, and organizational ergonomics) for the computer operators' work productivity can be described as in Table 5.

Table 5: Multiple Regression Analysis (Overall model summary)

| Model                                                         | R                  | R Square | Adjusted R Square | Std. Error of the Estimate |
|---------------------------------------------------------------|--------------------|----------|-------------------|----------------------------|
| 1                                                             | 0.893 <sup>a</sup> | 0.797    | 0.789             | 0.19020                    |
| a. Predictors: (Constant), Org_Erg, Cog_Erg, Phy_Erg, Env_Erg |                    |          |                   |                            |

(Source: Survey)

As per the results obtained for environmental ergonomics, physical ergonomics, cognitive ergonomics, and organizational ergonomics it gives the adjusted R square value of 0.789 as the overall model fit. This means that 78.9% of computer operators' work productivity is described from environmental ergonomics, physical ergonomics, cognitive ergonomics, and organizational ergonomics.

Table 6: Multiple Regression Analysis (ANOVA result)

| Model                                                                              | Sum of Squares | df | Mean Square | F      | Sig.               |
|------------------------------------------------------------------------------------|----------------|----|-------------|--------|--------------------|
| Regression                                                                         | 13.513         | 4  | 3.378       | 93.383 | 0.000 <sup>b</sup> |
| Residual                                                                           | 3.437          | 95 | 0.036       |        |                    |
| Total                                                                              | 16.949         | 99 |             |        |                    |
| a. Dependent construct: Comp_Op_Work_Prod ( Work Productivity)                     |                |    |             |        |                    |
| b. Predictors: (Constant), Org_Erg, Cog_Erg, Phy_Erg, Env_Erg (Ergonomics Factors) |                |    |             |        |                    |

(Source: Survey Data)

The P value from the ANOVA table is less than 0.001, which means that environmental ergonomics, physical ergonomics, cognitive ergonomics, and organizational ergonomics have an impact on computer operators' work productivity.

Table 7: Multiple Regression analysis (coefficient results)

| Model                                     |            | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig.  |
|-------------------------------------------|------------|-----------------------------|------------|---------------------------|--------|-------|
|                                           |            | B                           | Std. Error | Beta                      |        |       |
|                                           | (Constant) | 0.525                       | 0.190      |                           | 2.763  | 0.007 |
|                                           | Env_Erg    | 0.367                       | 0.051      | 0.546                     | 7.229  | 0.000 |
|                                           | Phy_Erg    | -0.069                      | 0.045      | -0.083                    | -1.540 | 0.127 |
|                                           | Cog_Erg    | 0.271                       | 0.048      | 0.273                     | 5.642  | 0.000 |
|                                           | Org_Erg    | 0.265                       | 0.060      | 0.333                     | 4.440  | 0.000 |
| a. Dependent construct: Comp_Op_Work_Prod |            |                             |            |                           |        |       |

(Source: Survey Data)

According to the above table, The P value of the environmental ergonomic factors is 0.000. Hence, it revealed that environmental ergonomic factors are significant predictors affecting the computer operators' work productivity. It means if environmental ergonomic factors increase by one, computer operators' work productivity increase by 0.367. The P value of the physical ergonomic factors is 0.127. Hence, it revealed that physical ergonomic factors are not significant predictors affecting the computer operators' work productivity. Further, The P value of the cognitive ergonomic factors is 0.000. Hence, it revealed that cognitive ergonomic factors are significant predictors affecting the computer operators' work productivity. It means if cognitive ergonomic factors increase by one, computer operators' work productivity increase by 0.271. As per the P value of the organizational ergonomic factors is 0.000. Hence, it revealed that organizational ergonomic factors are significant predictors affecting the computer operators' work productivity. It means if organizational ergonomic factors increase by one, computer operators' work productivity increase by 0.265.

## 05. Conclusion and Recommendations

### *Conclusion*

This study was focused on the ergonomic factors and their impact on computer operators' work productivity. In today most people work in some form of offices and the majority of them are working with computers. So, computer operators' work productivity becomes more significant and for that purpose, the researcher goes through this study to determine whether ergonomic factors have an impact on computer operators' work productivity. This research study was conducted through primary data and structured questionnaire survey from 100 computer operators in Anuradhapura city.

In here identified mainly four types of ergonomic factors such as environmental ergonomics, physical ergonomics, cognitive ergonomics, and organizational ergonomics that are most likely to impact on the computer operators' work productivity through reviewing the literature. From the literature review, twenty-two indicators are grouped into these four dimensions. The environmental ergonomics were tested with five indicators such as Room temperature, Indoor air quality, Illumination, Noise, and Relative humidity. The physical ergonomic factors have five indicators similarly the previous one likewise workplace design, Sitting arrangement, Physical workload, Fitness, and Visual comfort. Also, cognitive ergonomic factors have seven indicators named task difficulty, job fear, mental workload, job stress, motivation, memory, and depression are them. Further organizational ergonomics were measured using Transparent and open communication, Training and development focused, Goal setting, Bossism, and Recognition for hard work. As well as computer operators' work productivity was tested with four dimensions such as employee job satisfaction, employee job efficiency, employee job effectiveness, and quality of work.

Based on the findings of the study, it revealed that the environmental ergonomic factors, cognitive ergonomic factors, and organizational ergonomic factors have a significant positive impact on computer operators' work productivity ( $P=0.000$ ). But physical ergonomic factors are not significant predictors affecting the computer operators' work productivity ( $P=0.127$ ).

### *Recommendations*

According to this study, it identified that ergonomic factors have a significant and positive impact on computer operators' work productivity. The results revealed that the environmental ergonomic factors, cognitive ergonomic factors, and organizational ergonomic factors have more influence on productivity. So, organizations have to more concern about environmental, cognitive, and organizational ergonomics when designing their workstations. However, in our country optimizing workplace ergonomics has received little attention within organizations. Thus based on research findings, it provides some helpful recommendations as following.

Very first thing is that each organization should be aware of what means ergonomic factors, how ergonomic factors influence computer operators' work productivity, and how to use ergonomic principles to increase their work productivity. Therefore, some effective actions needed to be taken, to increase awareness about ergonomic factors within organizations. The computer operators should be made to undergo periodic training on ergonomic issues such as sitting arrangement, monitor height, eye-to-monitor distance, fitness, visual comfort, how to remedy from job fear, how to maintain mental workload, how face to physical workload, how to reduce stress and strains in repetitive work, and how to avoid injury and disorders at the workplace. Further workshops to spread awareness about ergonomic factors can be implemented by the management of organization.

As per the results of the study certified there are significant positive influences from ergonomic factors on employee job satisfaction, employee job efficiency, employee job effectiveness, and quality of work. In here several ergonomic elements such as Room temperature, Indoor air quality, Illumination, Noise, relative humidity, Task difficulty, Job fear, Mental workload, Job stress, Motivation, Memory, Depression, open communication, Goal setting, Bossism, and Recognition for hard work have been influenced this relationship. Therefore, authorities should take necessary steps to improve their work productivity through implementing an ergonomically designed workplace and also must continue to evaluate the office environment and adjust it accordingly by periodic reviews to make sure employees are willing and able to come to work every day.

For that purpose, an ergonomically designed workplace environment should be provided to better maintain and follow ergonomics standards because of the state and suitability of the workplace environment as viewed as a very important factor in enhancing the work productivity of computer operators in any organization. Thus organizations have to provide favourable temperature, air conditioning facilities, favourable light systems, favourable noise patterns, and so on. As per the management can launch special routines to identify ergonomic issues and take actions to adjust those things. Here management can observe the office environment and tasks to identify potential ergonomic issues and can find potential solutions for those ergonomic challenges. Further stress is mostly occurring due to excess of work pressure and work-life imbalance within organizations. So that, management should support and encourage employees to reduce their stress level and management can determine what motivates its employees and sets up formal and informal structures for rewarding employees behaving in the way required. Since money is not a sufficient motivator in encouraging the workplace performance required in today's competitive business environment. So management can set up a point system for their reward program that employees can use for useful and tangible things, such as cash gift cards, appliances, travel, etc.

## 06. References

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