

# The Relationship between Knowledge of Ergonomics and Determinants of Labor Productivity

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## Abstract

Today, knowledge of ergonomics is viewed as an effective factor of individual and organizational productivity and performance. The purpose of the present research is to determine the relationship between knowledge of ergonomics and effective factors of labor productivity in Pars Special Economic Energy Zone, site 2, and Iranian PetroPaydar Company. This is a correlation study. Research statistical population included employees of the two aforementioned (N=244). 96 individuals were selected as research sample through using simple random sampling method. Data were collected through using a five-point Likert scale (from extremely low to extremely high) questionnaire consisting of three demographic, ergonomic, and productivity divisions. Data of research samples were gathered using self-response method and analyzed through descriptive statistical indicators and Chi-square test. Research findings show that there is a significant relationship between ergonomics and productivity; further, staffs' highest mean scores were assigned to the clarity and role recognition (73.73), and ability (59.54) components. According to the obtained results, it is concluded that increasing labor productivity requires higher knowledge of ergonomics.

**Keywords:** Ergonomics, human labor, effective factors of labor productivity.

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## Introduction

In the present world of competition and management based upon machinery and human factors, most organizations and companies including public and private firms try to overtake other competitors and attempt to enhance labor productivity with the lowest compensation cost; on the other hand, it is necessary to cure the event before the occurrence. Several factors may influence decreased or increased labor productivity in an organization, of which ergonomic factors or the very human factors engineering is the most critical factor. Ergonomics is often introduced at critical points like war and when labors are at risk; so what is ergonomics? "Ergonomics is the science of optimizing environment, occupations, and equipment in consistent with human compatibilities and limitations" (Vink et al, 2006). According to the definition, it turns out that the science is widely ranged. Now, the main question raises here that whether labor ergonomics may lead to increased labor productivity; and consequently, to increased organizational productivity.

Over the past years, the critical role ergonomics plays in increased productivity, reducing musculoskeletal disorders, improved quality, as well as the safety and efficiency of the organizations is more specified. Ergonomics specialists improved human and system productivity through optimizing the coordination between human and other work components (Vink et al, 2006).

At present, attention to ergonomics in organizations, especially at industrial levels, has moved beyond just a simple means. Experiences of industrial nations reveal that dealing with ergonomic and its implementation may largely aid in organization's performance aspects. Ergonomics is now viewed as a critical characteristic in strategy formulation and implementation strategy to achieve organizational goals (Van der Molen et al, 2005). Therefore, ergonomics is introduced as the knowledge to optimize system efficiency, to provide a proper work environment, to prevent work-related accidents and events, and to improve human performance. Labor increased productivity, occupational safety, and health are of major issues in the industry. Some common problems are improper designing of work environment, incompatibility between worker capacities and job requirements, harmful jobs and work environments, improper designing of machine-human system, as well as poor management plans. These difficulties may lead to some risks at work, workers' weak health, and injuries from equipment, disabilities, reduced productivity of workers and production quality, and increased costs.

The main objective of the present paper is to study the role ergonomics plays in labor productivity, environment, and job equipment, and to determine the effects of ignoring ergonomics and safety at work. Human and work are the two essential and inseparable parts of the universe that must be proportionate. To prevent work-related accidents and diseases and to provide healthy labor, ergonomics may aid human as an effective approach.

Indeed, ergonomics is the means by which human being is enabled to design life and work environment, as well as the equipment consistent with own abilities and characteristics. Ergonomics introduces specific work conditions for human and enhances work quality and labor productivity (Escorpizo, 2008).

Ergonomics or human factors engineering is a combination science trying to design the means, machines (devices), work environment, and occupations regarding physical-intellectual abilities, restrictions, and human interests. It is created to enhance productivity considering human environmental health, safety, and well-being. Moreover, ergonomics also attempts to adapt environment with human rather than human adaptation with the environment (Axelsson, 2000).

According to management, economics, and sociology literature, the best performance of any organization is called synergy, which is interpreted as high productivity. Today, managers are highly interested in organizational productivity as the ultimate objective. Individuals define productivity respecting to their status. A supplier, for instance, may provide a definition different from a consumer or an official status. Productivity may refer to the combination of efficacy and efficiency.

In addition, productivity synonyms are also efficiency, effectiveness, performance, profitability, innovation, quality, culture, quality of working life, and the like. Considering that different fields of studies vary in productivity interpretation, it is also distinguished in managers' attitudes regarding the roles, knowledge, skills, counterparts, subordinates, and working context. Totally, it may be stated that productivity most comprehensive attitudes are attributed to the managers. Productivity management attitude embraces all organizational aspects that are significant in performance. In this attitude, productivity means efficiency, effectiveness, performance, quality of products, and stakeholders' satisfaction. Joyce Merilin, Joyce Institute President in Seattle, America, asserts that it is commonly believed that the companies consider productivity and quality control may apply ergonomics as a business sense in the plans; successful companies have integrated ergonomics with safety, quality control, and production plans to achieve maximum profit (APO Productivity Databook, 2009).

The present paper selects effective factors of working condition to study the effect of ergonomics on the activity; next, regarding the broad discussion, ergonomic aspects are investigated through a typology in terms of physical and intellectual aspects; and then, the effect of the aspects on individual performance is analyzed. And finally, findings are summarized in the conclusion and further recommendations are provided.

## **Research conceptual model**

Figure 1 depicts the conceptual framework of this study

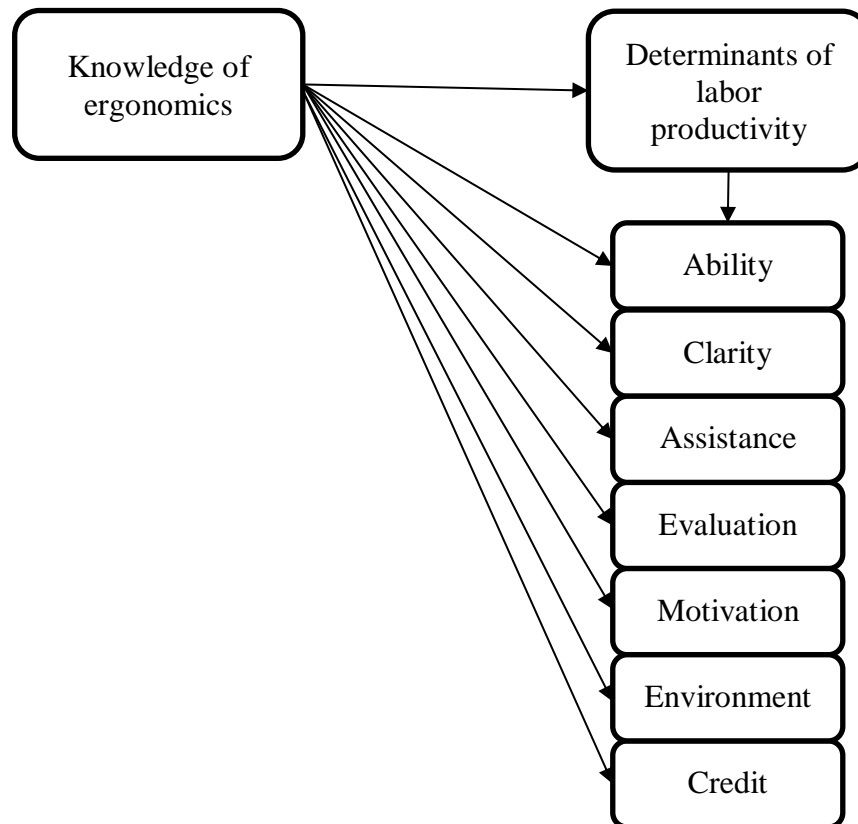


Figure 1. Conceptual Model

### **Research main hypothesis**

Knowledge of ergonomics positively influences effective factors of labor productivity.

### *Research sub-hypotheses*

- Knowledge of ergonomics positively influences ability.
- Knowledge of ergonomics positively influences the environment.
- Knowledge of ergonomics positively influences the credit.
- Knowledge of ergonomics positively influences evaluation.
- Knowledge of ergonomics positively influences motivation.
- Knowledge of ergonomics positively influences organizational support.
- Knowledge of ergonomics positively influences clarity.

## Research methodology

This is a correlation study. Research statistical population included employees of Pars Special Economic Energy Zone, site 2, and Iranian PetroPaydar Company. 96 individuals were selected as research sample through using simple random sampling method. Data were collected through using a questionnaire consisting of three sectors. The items contained personal characteristics, measuring knowledge of ergonomics and effective factors of labor productivity. Knowledge of ergonomics was measured using 10 questions based on the standard questionnaire applied in knowledge of ergonomics literature. Labor productivity was also evaluated through 26 items based on seven-part Gold-Smith model (ability, clarity or recognition, assistance, motivation, evaluation, credit, and environment (Khoshbakht et al, 2011).

Items were scored using a 5-point Likert scale (1=extremely low to 5= extremely high). The questionnaire validity was verified by experts' opinions; further, the questionnaire consistency was examined by test-retest method. Scores' correlation coefficient was measured 0.76 and 0.81 for ergonomics and productivity questionnaires, respectively in two phases.

In ergonomics and labor productivity evaluation, mean scores of labor productivity and ergonomics factors were initially computed; and then, were turned into the percentage. If the mean percentage of any staff were within 0-33.3, it would be poor indicator; 33.3 – 66.6% would be the intermediate, and up to 66.6% is the desired indicator. The relationship between ergonomics and staff productivity components was estimated by Chi-square test.

## Research findings

All understudied individuals were males. Of research statistical samples, 41 (42.7%) were younger than 35 years old, 41 (42.7%) between 36-45 years old, and 14 individuals (14.6%) were older than 45.

Respecting education level, 33 individuals (34.4%) were under the diploma and high school diploma, 22 (22.9%) hold associate degrees, 41 individuals (42.7%) were bachelor and higher. Respecting employment, 14 employees (14.6%) were official, 59 (61.5%) were contractors, and 23 individuals (24%) were corporate employees. In term of years of services, 39 individuals (40.6%) had 1-10 years of working experiences; 40 (41.6%) showed 11-20 years of experiences; and 17 individuals (17.7%) had 21-30 years of working experiences.

According to the ergonomics findings, mean score of knowledge of ergonomics was 0.42 indicating that knowledge of ergonomics may benefit some disadvantage in the two understudied areas.

Respecting to labor productivity, findings reveal that the highest mean scores of the seven productivity factors for employees are assigned to the clarity and recognition (mean= 73.42), ability (mean= 59.54), and evaluation (mean= 57.03); while, the least

indicator went for assistance (mean= 40.42) demonstrating that labor productivity factors are at the intermediate level excluding clarity and recognition (Table 1).

Statistical test results to determine the relationship between knowledge of ergonomics and labor productivity components uncovered that only evaluation factor of the labor productivity effective factors shows no significant relationship with knowledge of ergonomics. Respecting to the relationship between knowledge of ergonomics and effective factors of labor productivity in understudied areas, findings demonstrated that there is a relationship between knowledge of ergonomics and effective factors of labor productivity at significance level 0.01 and  $X^2= 57.009$  (Table 2).

Table 1: Means and rankings of labor productivity indicators

Labor productivity indicators	$\pm x$ SD	Ranking
Clarity and recognition	73.42	1
Ability	59.54	2
Evaluation	57.03	3
Environment	49.91	4
Motivation	48.91	5
Credit	45.70	
Assistance	40.42	7
Total		-

Table 2: The relationship between ergonomics and effective factors of labor productivity in the two understudied areas

Productivity components		Ability	Clarity	Assistance	Motivation	Evaluation	Credit	Environment
Ergonomics	Sig.	0.001	0.002	0.037	0.002	0.077	0.431	0.004
	Chi-square	212.51	144.29	137.95	286.71	155.82	78.51	166.8

### Conclusion and recommendations

According to research findings, it is stated that the testees have working knowledge; while, they suffer from lack of safety knowledge as well as the ergonomic principles in their work. It may lead to some difficulties and decreased individual and organizational productivity. On the other side, the participants showed sufficient ability for fulfillment; whereas, they may require adequate credit and assistance of the organization, which is not provided. The testees lacked enough motivation for work, too; in addition, they consider working environment improper. However, they were satisfied with evaluation and payments. According to the results of ergonomics questionnaire, it can be expressed that the testees lack proper knowledge of ergonomics, and work and working environment adaptation with self. The results of the study demonstrated that applying ergonomics may lead

to increased health, safety, higher job satisfaction, and worker productivity; in other word, to achieve the considered industrial objectives would probably be impossible ignoring ergonomics.

If ergonomic technology is properly applied, it causes health injuries reduced and job safety and efficiency increased. Several studies showed positive effects of ergonomics on machine designing, occupation, working environment, and facilities. However, it is still rarely applied in the industry and designing working systems are not adequately interested. The more industrial managers ignore ergonomic issues, the higher safety at working environments reduces.

Regarding broad scope of knowledge of ergonomics and considering that it embraces a wide range of industrial systems i.e. working environment, human, and machinery, it may be stated that knowledge of ergonomics and applying it for designing working posts is one of the significant ways of concerning for human being and its proper, superior performance. Thus, some recommendations are suggested to the suppliers, managers, planners, as well as industrial officials as follows:

- Teaching ergonomic concepts to the managers
- Recruitment based on the occupation, individual traits and capacities
- Labor pre-recruitment and periodical examinations regarding ergonomic models
- Design work posts based on anthropometric data and engineering instructions for human factors
- Considering employees' anatomy and physiology
- Labor-work optimal adaptation
- Applying principles of contingency management to satisfy workers
- Analyzing occupational accidents, causes, and economical losses
- Formulation of guidelines and occupational recommendations for the individuals employed by the system.

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