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Quantifying the intangible costs related to non-ergonomic work conditions and work injuries based on the stress level among employees

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ABSTRACT

Undoubtedly, no specific method exists to measure the cost of displeasure among employees due to unpleasant or non-ergonomic work conditions. Despite the financial impact of these hidden costs on organizations' performance, these types of expenses are usually ignored. The intangible costs are insubstantial and represent expenses that have no common quantity or labeled value attached to them. Estimating intangible costs related to work conditions based on stress level among employees is a technique that attempts to formulize a multidimensional relationship between input qualitative variables related to the state of work conditions or work injuries and the monetary value of the hidden costs encountered with them. This technique approaches the problem from a unique standpoint, revealing the concealed effect of the state of disorder of the production system and the stress level among employees that impact the overall efficiency. In addition, the influence of the stress level on the invisible costs of the optimal amount of labor and capital due to reduced ergonomic work conditions will be investigated over both the short run and the long run. Finally, the effect of work conditions on profit-cost-volume and the breakeven quantity will be formulated.

1. Introduction

In today's competitive global economy, attempts to reduce production costs are a serious priority for most industries. The fluctuations in raw material and fuel price and the tumbling in sales rates stimulate companies to develop policies to guide and control their expenses. The costs of work injuries and the effect of non-ergonomic work conditions are major contributors to the overall expenses. Worldwide, there are more than 270 million work accidents and 2 million deaths due to work injuries or work related diseases yearly (TC-OSH, 2013). The unquestionable economic impact of these work condition related injuries are massive at the individual, enterprise, and societal levels. In the USA, the detectible cost of work injuries and fatalities is $198.2 billion a year (Michaels, 2014). Consequently, new strategies should be adapted to minimize the contribution of work conditions and injuries to the total expenses. Although the unobserved costs of inappropriate work conditions and work injuries are usually disregarded, they have a significant influence on the total costs and are consequently worth investigating (Dorman, 2000). Work injuries and flawed work conditions increase the stress level among employees, which results in extra costs related to declining co-worker integrity, morality, and virtuous behavior. Likewise, hiring and training new or temporary employees increases the undesirable turn-over rate. Time lost from work, overtime, and the administrative time spent in accident investigations will intensify the overhead costs unnoticeably. The costs of equipment impairment or unsecured products caused by work accidents add further unscheduled obstacles to organizations' overwhelmed budgets. Meanwhile, litigation expenses, legal penalties, citations, interrupted production schedules or any failure to fulfill customer commitments will reduce the competitive edge of the company and have a severe impact on the total revenue (Miller et al., 2002; Aldana, 2001).

2. Literature review

To promote less stressful work conditions, understanding the real causes that provoke stress among employees is necessary. Work places with high stress levels reduce employee engagement. Employees become less productive and have higher absence rates than those operating under lower stress conditions. A global survey showed that 90% of staff were disengaged with high stress levels and 57% of those felt absolutely disconnected from their employer. Additionally, the survey conveyed the destructive link between high stress levels and reduced productivity (Dyble, 2014). The

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foundations of stresses at work are numerous and might originate from certain areas that are not immediately visible to management without a good communication structure. Robert (2014) found that 22% of employees in Great Britain accused their financial situation of having a negative impact on their productivity at their workplace. Furthermore, 82% of employer respondents said that helping employees to manage their finances would reduce employee stress levels. In addition, Knauth (1998) addressed the effect of certain characteristics of work schedule on fatigue. Night shifts, early morning shifts, extended working days, and short daily rest periods are among the characteristics that may cause work accidents and reduced productivity. The core concept of reducing risks of fatigue with a shift schedule is to keep it simple. Inconvenient work conditions cause fatigue that reduce the personal ability to think and function well (Wilkinson, 2013). On the other hand, research conducted by Cheese (2010) addressed the fatal combination of fear of losing a job and fatigue that results in rising workers' compensation claims. The study found that the poor economy encouraged organizations to cut their workforce to stay afloat. Accordingly, those who were left to operate the production lines were working prolonged hours and performing duties that were unfamiliar to them without proper training. Statistics show that human errors contribute to up to 80% of industrial accidents. A study on 24/7 industries revealed that a large share of human-error incidents can be attributed to fatigue caused by long work weeks, nighttime work, and repetitive activities, not by equipment or system malfunctions (Carter, 2007). Brecher (2014) addressed the role of management to understand the factors that cause poor job performance among employees. The study showed the impact of work environments on employees' performance, behavior, and motivation.

Previous research focused on the estimation of the cost of work injuries due to unsuitable work conditions using one of three primary methods: the human capital method, the friction method, and the willingness to pay method (Amador-Rodezno, 2005; Behm, 2004; Oxenburgh, 2005). The human capital method suggests that the costs lost in production due to mortality or permanent disability are a multiplication of the prospective discounted earnings by the probability of living to that age. This approach is the most common approach used to estimate the cost of work injuries. However, this approach has two major limitations. First, certain groups are assigned a higher value of impact than others according to their age, gender, etc. The second drawback is the use of full replacement costs independent of whether the worker was replaced or not. The friction cost method has been proposed as an alternative to the human-capital approach of estimating indirect costs. The friction cost method is argued to be based on implausible assumptions not supported by neoclassical economic theory. Furthermore, consistently applying the friction cost method would mean that the method should also be applied in the estimation of direct costs (Johannesson and Karlsson, 1997). Additionally, the friction cost method considers the productivity costs only during the restoration period needed to return to initial production level. This approach covers the cost of short term disability and hiring or training a new employee (Koopmanschap, 1995; Ale, 2008). Determination of the duration period to return to the initial level of productivity is a major shortcoming of this approach (Currie, 2000; Goeree, 1999. The willingness to pay method considers the maximum amount that person would be willing to pay or sacrifice to mitigate or eliminate the probability of injury risk. It measures the monetary difference between the good choice and the bad choice. Usually, this will be conducted by a survey or the additional pay for high risk jobs. The drawback of this method is that the cost will be intensified and overestimated (Rydlewska-Liszkowska, 2005; Hirth, 2000).

3. Tangible and intangible costs of a non-ergonomic work place

Obviously, no specific and unique method could monetarily describe the cost of displeasure due to unpleasant work conditions or the cost of pain due to work injuries. Despite the impact of these costs on organizations' performance, these types of costs are usually ignored and mistreated. Accordingly, the costs of work conditions and any subsequent injuries or diseases should be classified as tangible costs and intangible costs. The tangible costs are those that have a common quantity or a tag value attached to cost objects. The costs of equipment repair due to work accidents represent an example of tangible costs (Reville, 2001). Furthermore, the tangible costs can be classified as direct and indirect costs. Reimbursement, compensation, medical invoice, rehabilitation, remedy, wage, and continuation of benefit are examples of direct costs that have close and diametric connections with work injuries (EU-OSHA, 2009; Niven, 2000; Leigh, 1997). On the other hand, indirect costs are the implicit and inevitable expenses that are related to work injuries. Property damage, work interception, rescheduling, administrative costs, rehiring and training, costs of contingency plans, settlements and legal expenses are typical examples of indirect cost of work injuries. The cost object of a direct or indirect cost should be determined to a certain extent without any ambiguity. The sum of both the direct and indirect costs measures the overall cost of work injuries (Weil, 2001). The problem that arises is how to estimate the uncertain intangible costs of work injuries (Mrozek, 2002).

The monetary value of the intangible cost objects related to the level of stress among employees is not well defined. This cost could not be recognized directly during the accounting period. Thus, the intangible costs are insubstantial and can neither be collected within the normal accounting system nor rely on the past or future payments or commitment to pay. The ground of intangible costs is flimsy, and they measure the opportunity that is lost or sacrificed when the choice of action requires an alternative course of action to be given up. The real cost of forgone efficiency or declined performance, lost time due to work accidents, or loss of pleasure are a few examples of intangible costs. Estimating the intangible costs gives a significant judgment about the actual cost of any course of action when there is no explicit accounting system or determinant monetary price attached to the cost objects. Ignoring the intangible cost will result in illusions and false estimations of the true costs that are directly related to the state of work conditions. Based on the tangible and intangible expenses, the cost of inconvenient work conditions and work injuries could be formulated as:

$$C = \sum_{i=1}^{k} T_i + \sum_{j=1}^{m} I \tag{1}$$

where C, the total seen and unseen costs; T, the tangible costs; I, the intangible costs; k, the set of all cost objects of tangible costs; m, the set of all cost objects of intangible costs.

4. The effect of stress on efficiency

Details of the intangible costs of work injuries should be accumulated to describe the entire imperceptible cost objects. For example, suffering due to work injury is a case of input quality variable that relies on but is not limited to other qualitative variables such as the severity of injuries, age, and duration of pain. Based on these descriptions, the intangible cost analysis based on stress level evaluates the employee performance. These evolutions in most cases are qualitative. The intangible costs of work injuries are a function of multiple variables and the relationship between these variables and their values are interpreted and mapped to the input vector. The sum of the individual's deficiency due to work