

# The Economic Cost of Health and Safety in Work Places: An Approach on the Costs Calculating Model

Efat Lali Dastjerdi, Hassan Sadeghi Naeini, and Hadi Sanjari

**Abstract**—One of the important steps in a safety and risk management system is the economical evaluation of occupational accident and diseases costs in order to decrease accidents from reoccurring in the workplace. This study proposed a plausible method for calculating occupational accident costs and illnesses in work place. This method design for cost estimation takes into account both the personnel, organizational level as well as the community level especially intended for an Iranian work place. The research indicates that a using systematic method for calculating costs which also provides risk evaluation can help managers to plan correctly the investment in health and safety measures. Using this method is that not only is it comprehensive, easy and practical and could be applied in practice by a manager within a short period of time but it also shows the importance of accident costs as well as calculates the real cost of an accident and illnesses.

**Keywords**—Cost calculating model, Economics of health and Safety.

## I. INTRODUCTION

ECONOMICS is the science of scarcity. It analyses how choices are structured and prioritized to maximize welfare within constrained resources. We all use economics on a daily basis (Do I buy the cheaper car, or pay a bit more for the nicer one?) as we work within our own resource constraints (our desires say, 'Buy the nicer one, our resources say, Buy the cheaper one). By comparing the costs and benefits arising from the purchase of the competing cars, we are able to optimize our decision making. If we routinely use such economic techniques in our private lives, then surely it is not too great a leap of faith to apply them in our lives as health professionals? This is the basis of health economics.

It is universally acknowledged that the technical ability of healthcare systems to provide care (the wide array of new and expensive health technologies available) far exceeds the ability of any healthcare system to afford all such technologies. Once healthcare decision-makers have accepted the need for choice, they must inform that choice by

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prioritizing competing interventions through the analysis of their costs and benefits. However, it is important to recognize that healthcare exhibits a range of special characteristics that will fundamentally affect such analyses. Health economics reflects a universal desire to obtain maximum value for money by ensuring not just the clinical effectiveness, but also the cost-effectiveness of healthcare provision [1].

Each day, an average of 6000 people die as a result of work-related accident or diseases totaling more than 2.2 million work-related deaths a year [2]. One of the important steps in a safety and risk management system is the economical evaluation of occupational accident and illnesses costs in order to decrease reoccurring accidents in the workplace. Economic costs are not only borne by those injured but also by the enterprises concerned and the government and can be in the form of both direct as well as indirect/hidden costs. The direct costs of an accident are the easiest to see and understand. These costs include medical expenses, material damage, financial losses through experience related insurance premium. But indirect costs are just the tip of the ice-berg. These costs included lost capacity, lost production, time invested in dealing with legal processes and accident analysis, etc. some authors estimate these hidden costs for enterprises at several times the direct costs [3], [4].

The indirect costs can be best described as all unbudgeted costs associated with an injury in order to get the employee back to pre-injury status.

The majority of work place does not have any fair direct information about their occupational health and safety related costs. In light of work place safety in Iran, consistently there is no clear information about work place costs nor are there integrated systems for calculating accidents costs. The main reason why managers do not systematically calculate the accident cost is the fact that managers tend to believe that most expenses are insured. So the best strategy for dealing with these difficulties is a need a scientific and quantify method that to be able to show all the costs of the losses caused by an accident. During the last decades, different methods for accident evaluation have been developed. Each of these methods has qualities and restriction and different areas of application. Therefore selecting and using suitable method is regarded as an important step in calculating accident costs. The reliable evaluation of the cost of industrial accidents for an organization can help managers and workers to internalize the importance of safety measures from an economic-

managerial perspective, and to locate the work stations that require investment in safety measures. Also, reliable evaluation assists managers to correctly plan investment in safety measures [5].

The main objective of this paper is to produce a plausible method for calculating occupational accident and illness costs among work place sectors in Iran. In this work after considering methods proposed by other authors this method design for costs accident estimation takes into account both the personnel, organizational level as well as the community level. Techniques of Economic evaluation provides a systematic and objective framework for drawing up a balance sheet of costs and benefits which can assist decision-makers to make more informed choices. All economic evaluations have a common structure which involves explicit measurement of inputs (costs) and outcomes (benefits).

The paper is structured as follows. In the next section we present a literature and background. In the third section we present the methodology. The paper ends with conclusion.

## II. LITERATURE AND BACKGROUND

In most organization managers do not systematically calculate accident costs because they believe that most expenses are insured and therefore do not see a real reason to calculate these costs which require data collection. Another possible reason for the marginalization of accident costs by managers include: measurement difficulties, overloaded managers, biased accounting methods and the low status of safety departments [5]. As money is the language of business, financial information about the effects of occupational accidents might be used more extensively in a company than specialized statistics such as accident rates, frequencies and lost working hours. Managers would have less trouble relating monetary information to their goals and thus be more likely to include it in their performance evaluations. However, to do that occupational accident costs would have to be integrated into corporate management control practices. In relation to management control and budgeting two options were mentioned as possible ways forward. The first option was to calculate the total accident costs for the company and then find the standard costs for each accident type. Based on annual accident rates, the expected number of accidents could then be calculated for the year to come and estimated costs of accidents allocated to different managers, departments, workstations, etc. The costs of the accidents could be monitored based on the actual number of accidents during the year and variances—both negative and positive—could be explored with the responsible manager. The other option could be to budget with zero accidents for each responsible manager. When these happened anyway and the accident costs were calculated then these would show up as negative variances in the yearly budgeting control process and would have to be explained by the responsible managers [6].

In response to this need, researchers have conducted many studies on the cost of occupational accidents. Their findings include the following:

LaBelle [7] suggests a method for cost evaluation based on several categories: cost of time spent in relation to medical care, reduces production of the injured worker after returning to work, cost of supervision and investigation, reduce production, cost of replacement, learning and management cost and related to legal processes.

The systematic accident cost analysis (SACA) project was carried out by the Aarhus school business [6]. In these seminal studies costs include medical and emergency costs, lost wages, administrative costs, legal costs, workplace disruption, and loss of quality of life. These studies focus on the costs to society at large including business enterprises.

Ramessur Taruna [8] has carried out a study to measure the true economic and or social of occupational accident. in which the Costs were estimated based on some elements i.e., lost income through time off from work, productivity lost due to disability and death, cost of medical treatment which victims received, and the cost of investigation by occupational safety and health inspectors.

Romain Jallow and his colleges [9], [10] have attempted to develop a model for calculating an indirect-cost suitable for workplace. The results of this study have been shown that a local approach appears to be the best method for calculating indirect the costs of work place accident in comparison to “bottom up” or “top down” approach. Four criteria that are type of approach must satisfy to be compatible with the time constraints and accuracy demands of occupational health and safety stakeholders in the organization.

Arieh Gavius et al. [5] also points out that a method for reliable evaluation of the costs involved in industrial accidents in an organization- especially in relation to loss of production. The model they propose assume that as the workload increases, whether it is mental or physical workload, the probability of industrial accidents increases. The general structure of the model in which the total costs of industrial accidents are the sum of its direct costs, indirect costs, payment and immeasurable costs.

According to these studies would seem to suggest that researches have emphasized on indirect costs calculating. As a matter of fact indirect costs are all the “uninsured” additional costs associated with an accident while direct costs are insured costs for an accident that usually considered those costs covered by workers compensation insurance. What is important point is indirect costs are usually much greater than direct costs. Another important point is that, unlike direct costs, indirect costs are insured. These are the costs that can drive a company into the red.

One also should not overlook the fact that there are other costs that are difficult or impossible to measure including unknown or unknowable costs of workplace accidents: moral and reputation. When a serious accident or fatality occurs in the workplace, in many instances employee morale suffers, and this usually negatively impacts the quantity and quality of the work perform. Employee turnover usually increases after a serious accident. Another factor that might affect the long term success company is that of reputation. Employees and the members of the local community think about a company that

does not keep its work place safe and healthful. The reputation of a company is a reflection of its public image and must be considered as an important factor influencing its success.

In order to calculate the true economic and or social accident costs this study proposed a model that computing accident costs in four sections: direct costs, indirect costs, payment costs and disability adjusted life years (DALY) index. Using this method is easy and practical that could be applied in practice by manager within a short period of time and also shows the importance of accident costs as well as calculates the real cost of an accident.

### III. METHODOLOGY

In the first step of our study, we analyzed different methods for calculating work place accident costs which had been proposed by other authors.

Arieh Gavious et al. [4] proposed a model for estimating the total of an industrial accident; these costs include: direct costs, indirect costs, payment and immeasurable costs. Ramessur Taruna Shalini [7] put forward a study for measuring the economic costs of occupational accident by using both quantitative and qualitative approach. In this study costs are estimated using the following elements: lost income through time off from work, productivity lost due to disability and death, cost of medical treatment which victims received, cost of investigation by occupational safety and health inspectors.

Eugenio et al. [11] calcified occupational accident in construction project in four categories: insurance costs prevention costs, accidents costs, and recovery costs.

As mention earlier, we designed a cost calculating methodology specifically adapted for work place sectors in Iran. This methodology classifies costs in four categories that are summarized in Table I.

TABLE I  
 CATEGORIES OF COSTS AVD THEIR COMPONENTS

Category	Component
Direct cost	Damage
	Medical
	Fine
	Insurance
Indirect costs	Capacity lost
	Schedule
	Recruit
Payment costs	Work time
	Marginal cost due to the accident
DALY Index	years of life lost years lived with disability

The parameters that reflect the direct costs are include as: Damage, medical, fine and insurance costs

Damage costs: the damage costs refer to the damage of product, machinery and equipment.

Medical cost: medical and rehabilitation cost are associated with providing health service resources.

Fine cost: if an accident is caused due to fault of safety rules, the organization may be exposed to fines and imposed to criminal proceedings.

Insurance cost: The premium increase. The annual payment a company pays as an insurance premium is determined

according to an estimate of absence leave, number of hospitalization days, the severity of the accident, potential lawsuits and the financial damage of equipment, commodities and facilities. In addition, Insurance cost also includes all legal expenses due to different lawsuits charged by either the authorities or the employee [5].

The parameters which reflect the indirect costs are: capacity lost, schedule, recruit, work time costs

Capacity lost: this includes loss of gross due to earning due to absence due to work. Both short-term absence immediately after accident and absence in future time.

Schedule cost: When an accident occurs production disturbance costs are associated with work reorganization and recruitment and induction of temporary or permanent replacement staff, equipment in order to maintain output. We need to provide alternative source of supply for customers.

Recruit time: The whole cost of hiring workers to replace the injured one (Hiring cost include interview, training cost for new employee.

Work time cost: Staff and management time to report and investigation accident. Work time also dedicated to cost of time invested in dealing with legal processes.

Payment costs are the result of all the factors that make Marginal cost due to the accident

The Disability Adjusted Life Year (DALY) is the only quantitative indicator of burden of disease that reflects the total amount of healthy life lost, to all causes, whether from premature mortality or from some degree of disability during a period of time. DALYs for disease or health condition are calculated as the sum of the years of life lost (YLL) due to premature mortality in the population and the years lost due to disability (YLD) for incident cases of health condition [12]. For calculating DALY index is refers to World Bank report, Investing Health 1993.

Table I registers the accident costs components relevant to our study, and classifies them in the four previously mention categories. This list includes the cost components considered by other authors [5], [6], [8]. However, the components displayed in Table I are categorized, presented, and subsequently tabulated as parameters calculating method that could be used to compute the accident rate at the work place (Table II). Using parameters from Table II, we would be able to calculate the costs of accident. Calculating the cost of occupational accident in a work place involves determining the element related to each cost factor.

TABLE II  
 THE ACCIDENT COST CALCULATOR

<i>Direct costs</i>	costs
<b>The damage of equipments and machinery costs</b>	
Repair of damaged equipments (e.g. repairable machineries)	USD
Renting or purchasing of tools, equipments, layouts and services (e.g. unrepeatable machineries, but instead renting and purchasing of new machineries is required)	USD
Costs of materials damage (raw material)	USD
Costs of products damage	USD
<b>Medical costs</b>	
Cost of treatment using first aids (For which the doctor's presence in not required)	USD
Medical expenses (Includes injured persons who need to be in the hospital, doctor's fees and the cost of hospital, in general, those which require the doctor's presence)	USD
Time lost due to disability worker immediately after accident (expenses other than salaries)	USD
<b>fine costs</b>	
Costs of fine is exerted true authorities	USD
Insurance cost	USD
Increase in premium ( The company cannot use of insurance company discount)	USD
<b>Indirect costs</b>	
<b>Capacity lost costs</b>	
Work stoppage cost due to accident ( lost production time)	USD
Employee's overtime cost ( Employee's overtime to compensate the damage and the stoppage of the production)	USD
Productive time lost by employees and supervisor because of accident	USD
<b>Schedule costs</b>	
Fines for canceled order that company could not deliver orders due to the accident	USD
Fines for a canceled contract (if the company can not supply for existing customers due to the accident)	USD
Fines due to delays in delivers	USD
<b>Costs of recruit</b>	
The costs of hiring workers to replace the injured one(Hiring cost include interview, training cost for new employee	USD
Work time costs	USD
Costs of accident analysis and investigation	USD
Cost of time invested to replace injured worker	USD
<b>Payment cost</b>	
Salary of injured worker while off work ( while worker is on the medical treatment)	USD
New worker salary (the salary should be pay to replace the injured one)	USD
Cost of representative and legal cost	USD
Cost of new changing ( management, organizational and services ) for preventing of similar accident	USD
Costs of clean up and start up of operations interrupted by an accident	USD
<b>DALY index</b>	
years of life lost and years lived with disability	USD
<b>Total</b>	USD

#### IV. CONCLUSION

This paper suggested a model which calculates occupational accident in work place. It is based on a theoretical approach that classifies these costs in four categories: direct costs, indirect costs, payment costs and DALY index. A method of calculating the variable that make up each group of costs is proposed. It provides all parameters for the computing of the different types of cost that intervene in work place accidents. The main results and conclusions of current study are as follows:

1. There are many factors that justify the propose of a model that calculates occupational accident in industries. However, the main aim for such a method is that apply of accident cost information in view of how much value is lost due to occupational accident and illness, might be

profitable in the budgeting and management control process.

2. This method has the advantage of allowing employers and management to evaluate the costs which might be incurred during the execution of work before the accident actually happen. This way, protection measures for high-risk activities can be implemented.
3. The difficulty that all the organizations face is the recognizing, gathering and analyzing all the needed data for calculations. Such a model allows the user to determine which cost components are including in the computing, with regard to the organization's situation and available source.
4. Calculating accident costs systematically can illustrate the value created by the HSE (Health, Safety, and Environment) department by accidents prevention.

5. Using this method is that not only is it comprehensive, easy and practical that could be applied in practice by manager within a short period of time but it also shows the importance of accident costs as well as calculates the real cost of an accident.
6. Calculating costs coming from accident is a recurrent pattern in approach to risk management and therefore incorporates into the framework, in the sense that human behavior can never be fully controlled and accident will continue to happen to a priori anonymous member of society.
7. The risk manager can use this model to assess the benefits of the next iteration (i.e. safety and health project) versus the costs. Therefore, this result may be used to determine an appropriate timeframe for implementation; as according to us, in a resource constrained world one extra safety project means another, apparently equally worthwhile, project elsewhere must be forgone."

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