The Model of Accident Cost Estimation

In order to construct a model for estimating the total cost of an industrial accident, we take into account all parameters that reflect the possible costs imposed by the accident. We start by presenting the general structure of the model in which the total cost of an industrial accident is the sum of its direct costs (C_{direct}), indirect costs ($C_{indirect}$), payment ($C_{payment}$) and immeasurable costs ($C_{immeasurable}$).

Total cost = C_{direct} + $C_{indirect}$ + $C_{payment}$ + $C_{immeasurable}$ (1)

The parameters that reflect the direct costs are formulated as

$C_{direct} = C_{damage} + C_{medicaL} + C_{fine} + C_{insurance}$ (2)

Where,

C_{damage} The damage of products, equipment and machinery. Very often, an accident not only entails injuries, but also includes damage of products, equipment and machinery. This cost includes, among other things, the damage caused to machinery, raw-materials, damaged equipment, and the cost of cleaning and returning the working area back to functioning.

$C_{medical}$ Immediate medical treatment costs. This cost includes payment to evacuation to the hospital, payment for treatment given at the site of the accident, hospitalization, and the medical equipment that becomes unusable after the accident.

C_{fine} If an accident is caused due to violations of safety procedures or even breaking the law, the organization may be exposed to fines and claims given by the authorities.

$C_{insurance}$ 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. The premium varies from year to year according to the events occurring in the previous year.

The parameters which reflect the indirect costs are formulated as

$$C_{indirect} = C_{capacity\ lost} + C_{schedule} + C_{recruit} + C_{work\ time} + C_{wip} + C_{mang} \tag{3}$$

$C_{capacity\ lost}$	The costs resulting from capacity loss. An accident can cause a slowdown in production and even halt it for a period of time, for example, evacuation of the injured workers and damage to the equipment which should be handled immediately (like fire). Also, an accident may result in a new bottleneck causing production processes to slow down and imposed additional costs.
$C_{schedule}$	When an accident occurs, slowdown in production will affect the time table schedule and causing damages to the client. Clients can cancel the contract or demand a lower price. There may be solution that the company will create the absented product by contractor that will help the company to handle the schedule.
$C_{recruit}$	The cost of hiring additional workers to replace the injured ones, which includes the time invested in recruiting and training the new workers.
$C_{work\ time}$	The work managers invest in investigating the accident. Work time is also dedicated to instruction of the simple workers. Also the additional work hours that needed to replace the injured worker (it depends on the policy of the company if there are recruiting new workers or letting the senior to work extra hours).

C_{wip} When an accident occurs, it creates a new bottleneck. As a result, the inventory starts to grow and accordingly the cost connected to it grows as well. Managers need to find a solution to fit the inventory to the new bottleneck which will cause additional expenses. This cost is handled by specific managers and hence may vary from company to company based on managerial considerations.

C_{mang} The cost connected to the CEO time. The CEO time is very expensive and wrong usage of time can cause the company to lose sales.

$$C_{payment} = M(Pay_{new}W_1) + \sum_{i=1}^{W_2} Bi - NI \ \times W_2 \tag{4}$$

Paynew   The payroll of a new employee.

M   Number of months the injured worker is replaced.

W2   Number of injured workers.

Bi   Benefits (in money terms) given to the injured worker. Every worker is entitled to different benefits in accordance with his seniority. In the case of an accident, the organization must continue to pay these benefits.

NI   National insurance refund.

$$C_{immeasurable} = C_{reputation} + C_{morale}$$

$C_{reputation}$ Damage done to the company's reputation might result in customers turn to competitive suppliers

C_{morale} Impact on the morale of the workers. An accident may hurt the workers' morale and motivation, causing absence from work,

tardiness and a higher rate of worker substitution. Moreover, workers might demand salary-increases for endangerment in the working place. Since this is a psychological and an emotional cost, the numerical estimation of this damage is currently not measurable.