INVESTMENTS IN OHS DURING CONSTRUCTION AND THEIR EFFECTIVENESS

Ing. Jana Madová; doc. Ing. Zdenka Hulínová Ph.D.

Abstract

Decision making on OHS investments influences on many factors. On one hand it is necessary to keep the legislation requirements directly related to preventive protection of employees. On the other hand the decision on keeping or failing to comply the rules also brings possible costs for recovery of damages from occupational accidents.

The basic assumption, which is the nature of this article is hypothesis, if it is worth for companies to invest in preventive protection of workers and what is the limit, in which this type of protection is effective.

Key words: *protection of workers, prevention costs, cost of accidents, hypothesis*

1 INTRODUCTION

Operational health and safety system (here and after OHS) is stated in legislation, however companies do not have the same approach to this topic. Based on various analysis of OHS state, various resources can be assumed, which can help companies to decide on approach. The concrete approach to requirements stated in legislation has usually the impact on final result. Employers have various approach to OHS and results of their approach differ as well. The result might be the state in which the organization is, with or without operational injuries and other damage, especially on health, loss, which usually have huge implications.

A popular assumption holds that more WSH investment in workplace safety results in better safety performance (e.g., Laufer 1987; Brody et al. 1990; Hinze 2000). However, because such investment cannot be limitless, the problem is that it is not known how much money should be invested in improving WHS performance [1].

To define the level of approach to OHS and investments is crucial for companies.

2 STATISTICAL OUTPUTS

The target of a good company is the same level of approach to OHS compared to the approach to production. This allows to create such OHS culture, which influences on overall culture in organization and will influence on more effective and healthy workforce and will maximize the productivity and support the brand and competitiveness.

Returns on investment is as high as 12:1 (EUR 12 profit for every EUR 1 invested) can be achieved through investing in good OSH [2].

D.Leipziger´s statement: There is a clear and direct relationship between the social behavior of a corporation and its reputation, sales, brand and indeed overall value. This correlation (and these consequences) get stronger as both the size of the business and the value of the brand increase [2].

The size of a company significantly influences on the approach to OHS and application of legislation rules. In terms of small and middle sized companies, the probability of application of protective

actions is smaller 82% of accidents happen in small or middle size companies and almost 90% are fatal. Statistics shows that some 60 % of companies that are disrupted for longer than nine days go out of business [3].

Keeping of all requirements from legislation requires costs and time for the implementation and application. The result is safe environment and minimization of risk of injuries, which extent is identified by input values. Companies usually prefer to use the resources for production rather then to invest in OHS.

The model for estimation of return of investments in OHS is missing in the decision making strategy of companies. This model would allow to estimate the effectivity of costs invested in safety and protection of employee´s health.

3 SAFETY INVESTMENTS EFFECTIVENESS MODEL

The total safety costs of a building project include safety investment and accident costs. If the output of a building project remains constant, the marginal cost of production increases when total safety costs rise. Thus, an underlying motive driving building project safety investment is to reduce production or operating costs for the sake of profits (Grimaldi and Simonds 1975) [1].

The decision about investments to OHS influences on many factors, the main input values for the model. These factors characterize also the behavior of OHS system. On one hand there are investments to preventive security of employees and on the other hand costs for the recovery of damages, which are the result of operational injury.

With regards to the fact that this system is exposed to various random effects, it is necessary to look for assumptions, which will help us to better understand consequences of our decisions.

Basic assumption, which is the core of the model, is connected to statement, if it is worth for companies to invest in preventive protection of employees and what is the limit when is the protection still effective (**Basic hypothesis**).

For the model construction it is necessary to analyze the costs, which are the part of prevention in OHS as well as all the costs for the repair of damage after the operational injury.

3. 1 Investments to prevention in OHS

The amount of investments for OHS is composed of several items. For example: risk management programs, systematic documentation of OHS documents, resources for personal protection equipment, resources for collective protection equipment, education, trainings and exercises, costs for professional services, motivational factors etc.

In publications of EU-OSHA (European Agency for Safety and Health at Work), we can find evidence, confirming important assumptions, for instance that WHP programmes have positive impact on internal factors [4]: increase of productivity rates and production, decrease of sick leaves, increase of employee satisfaction, improvement of work ethic, decrease of costs in corrective actions from operational injuries, increase in saving of costs.

And other external factors such as: improvement in customer services, better image of a company, better relations with other organizations etc.

In making decisions on OHS investments the company is balancing the costs and benefits of OHS. Preventive services are supposed to lead to lower occupational accidents and diseases, lower sickness absence and disability pensions which all improve the economic performance of the company [5].

3. 2 Investments in corrective actions

In case of investments of corrective actions we are taking into account 2 possible types of costs: costs related to not keeping the legislation requirements (penalties and fines supervisory bodies, as well as contractors) and costs for damage recovery from operational injuries (compensation, compensation for sick leave, sanctions and penalties from supervisory authorities, completion of protection activities etc.).

In the analysis of costs, in which the costs for non-sufficient or no OHS system should be covered, we need to include five basic categories [6]: costs for health care (direct), costs related to productivity (indirect), such as costs related to decrease of performance or production, costs related to decrease of life quality (intangible), such as financial contributions to life quality decrease, for example: physical pain and suffer, administration costs, such as costs for administration, for example request of contribution to social insurance or reporting of accident at work, costs for insurance, such as compensation and possible increase of costs for instance.

4 APPLIED METHODOLOGY

In the studies, which are indicated on EU-OSHA web pages as outputs from national statistics, the method of incidence and prevalence is applied for OHS state modeling. In the method of incidence the amount of new cases in a year is estimated (and costs for these cases are calculated), the total amount of cases in specific year is estimated by the method of prevalence. Each of them is methodologicaly valid, choice is primarily dependent on availability of data. The incidence method, however, gives a better approximation of current conditions, which may be useful for estimating changes over time.

Definition of costs of occupational accidents that occur due to insufficient or absenting care for safety and health (OSH) is a very complex task [6].

Accident costs to contractors are the sum of direct and indirect accident costs (e.g., Heinrich 1931; Brody et al. 1990; Hinze 2000; Feng et al. 2015). According to Hinze (2000), the direct costs of work injuries tend to be those associated with treatment of an injury and any unique compensation offered to a worker as a consequence of being injured. Further, according to Hinze (1991, 2000), direct costs are typically those covered by work injury compensation insurance (workers compensation) whereas indirect costs consist of all costs not so covered [1].

5 HYPOTHESES

Protection of employees at work and provision of safety work environment is difficult, especially for high risk activities, because of occurence of various random actions. These actions indicate that obtaining of expected result is influenced by probability. Based on this, it is possible to state various hypotheses, lot of them confirmed, but some of them needing to be approved or disproved.

Hypothesis 1: Designer may influence on OHS in the phase of design, realization as well as operation of a construction.

A designer should address health and safety issues from the very start. Where issues are not addressed early on, projects can be delayed and it can become significantly harder for contractors to devise safe ways of working once they are on site. The client may also be forced to make costly late changes, so the building can be used and maintained safely once it is built [7].

Hypothesis 2: The incident occurrences can be modeled as a Poisson process characterized by some mean arrival rate [8].

Operational injuries occurence is based on probability, which means it is non-determinic.

Authors D. K. H. Chua, M. ASCE and Y. M. Goh in article [8] (Poisson Model of Construction Incident Occurrence) state that construction incidents are essentially random events because they have a probabilistic component that causes their occurrence to be indeterministic. Thus, as with most random events, one of the best ways to understand and analyze construction incidents is to apply statistical methods and tools.

Incident records for 14 major projects were used in the analysis. Hypothesis testing using the chi-square goodness-of-fit and dispersion tests shows that the incident occurrences can be modeled as a Poisson process characterized by some mean arrival rate.

Authors stated an interesting opinion, that in general it cannot be assumed that the distribution of incident occurrence for the categorized subprocesses will share the same distribution as the overall project, and even then, the parameters for the subprocesses are not readily available from the parameter for the overall project.

The results show in article there is no evidence to reject the Poisson distribution, which is a sound and convenient model. The mean arrival rate, also facilitates benchmarking with other projects or companies [8].

Hypothesis 3: The amount of investment directly depends on size of a project.

Various research teams were dealing with solution to this hypothesis. They developed studies of the costs incurred for the implementation of occupational health and safety in realization of construction projects.

In 2013, there was a research in Istanbul, focusing on specification of investments in OHS in construction projects realization, where the main problems of a construction industry are especially fatal accidents. The research focused on small and middle size companies. The aim of the research was to provide estimation on OHS costs in primar phase of a construction as well as at the realization. Results show that the rate of costs of OHS to total construction costs is 1,92%, also expressed in 0,85USD/Nh , in terms of area 5,68 USD/m2 [9].

Values, obtained from a research, are expressed on axis. On the X axis, there is a total area of a construction object and on the Y axis there is a percentual expression of investments in OHS to total costs of a construction (including costs for OHS). Results were later statisticaly transformed to logaritmic equation, the result of which is a regression curve in the Fig.1.

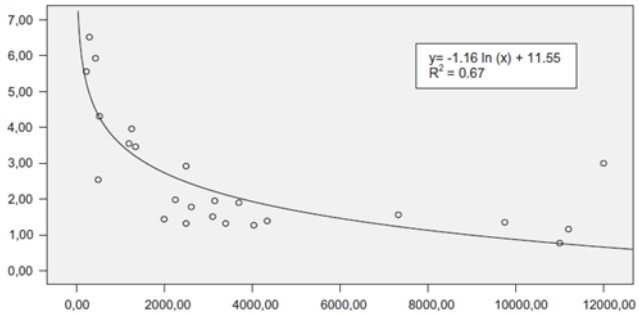

Fig. 1 Share of Safety Cost in Total Project Cost for Recent Research (%) [9].

Based on the regression curve, it is possible to estimate the conclusion, that the bigger is the area, the lower are the costs related to OHS.

Hypothesis 4: The higher the costs for prevention, the lower the costs for accidents.

Hypothesis 5: The higher the budget for OHS, the lower the amount of accidents and costs for the recovery.

Authors [10] stated few hypotheses, including the influence of safety costs to size of a project. They studied also the possibility of Poisson model aplication and found out, that according to the results obtained with Poisson distribution:

- the average number of accidents varies positively with the total number of workers,
- the average number of accidents varies positively with the average number of subcontractors,
- the average number of accidents varies positively with the health and safety budget,
- the average number of accidents varies inversely with the cost of accident prevention.

From this authors conclude that, when the other regressors remain unchanged:

- the number of accidents is positively associated with the total number of workers,
- the number of accidents is positively associated with the average number of subcontractors,
- the number of accidents is inversely associated with the cost of accident prevention.

The relationship between the average number of accidents and the degree of progress of the project is quadratic. The degree of progress of the work has a quadratic effect on the average number of accidents. Using the submitted model, it is possible to predict the change in the average number of accidents according to the degree of progress, while other regressors remain constant.

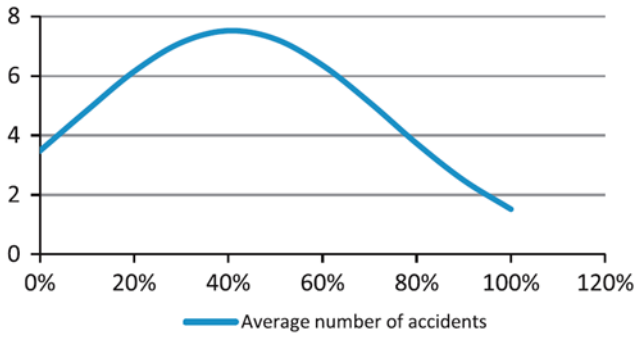

Fig. 2 Average number of accidents for degree of progress [10].

In Fig. 2 it can be seen that the average number of accidents is maximum, at about 7, for a degree of progress close to 47%. In the construction projects most accidents occur in the initial phases, such as earthmoving and structures. Most of the accidents (57.3%) are concentrated in the first few months of work, corresponding to 0–30% progress [10].

Application of the Poisson model enables us to predict the number of accidents that will occur on a construction site, from a set of significant variables. Once the number of accidents on a construction site has been estimated, it is possible to estimate their cost, and hence the total cost of safety on the work site, to be added to the cost of prevention.

6 CONCLUSION

Companies have individual approach to OHS depending on various factors. The main factors are size of a company, level of awareness and responsibility, which are characteristic for culture in organization.

Majority of companies consider gaining a profit and meeting the deadline the most important. They realize the importance of investments in operational health and safety after operational injuries.

Convincing argument, when deciding on OHS investments, is verification that the cost of preventive actions are lower in the amount, compared to costs for recovery after operational injuries. Currently, there are many verified hypotheses and evidence to this argument.

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