COST-BENEFIT ANALYSIS IN OCCUPATIONAL HEALTH AND SAFETY

Delfina Ramos,* Paulo Afonso and Pedro Arezes

Department of Production and Systems, University of Minho, Portugal

* Corresponding author: gramos@det.uminho.pt, University of Minho, Azurém, 4800-058, Portugal

KEYWORDS
Cost-Benefit Analysis, Occupational Health and Safety, Delphi Methodology

ABSTRACT
The implementation of preventive and corrective measures within Occupational Health and Safety (OHS) lacks a proper systematic economic evaluation that allows to compare alternatives and to understand the impact of each of them. Firstly, there should be a financial evaluation of the measures considering costs and income for the organization resulting from the implementation of identified measures. However, it is also important to perform an analysis of the impact of each measure in society, in other words, to measure the involved externalities. The measures taken by an organization to prevent risks usually have an indirect positive effect (positive externality) in society, while not taking any action, compared to the cost they represent for the organization, can have important negative effects to society (negative externality). It follows that these different economic effects (for the organization and society) should be duly considered in decision making on occupational health and safety. This paper discusses the use of cost-benefit analysis related to Occupational Health and Safety. An exploratory qualitative study is proposed, considering the application of the Delphi methodology.

INTRODUCTION
According to ISO/IEC 31010 (2009), the cost/benefit analysis can be used for risk assessment. In this case, expected total costs are weighted against the total expected benefits in order to choose the best, or most profitable, option.

Evaluation and Risk Analysis in OHS
The Occupational Health and Safety (OHS) management system can be regarded as part of the management system of an organization used to develop and implement the OHS policy and manage the related risks (OHSAS 18001:2007). Risk management is considered as including the risk assessment and control, comprising the systematic application of management policies, procedures and work practices to analyse, assess and control risk (Roxo, 2004). Although risk assessment is a legal obligation, in terms of methodology there are no strict rules on how this should be done. Roxo (2004) considers that Risk Assessment is nothing more than a dynamic process, conducted in workplaces, in order to detect the components therein, capable of causing damage(s) to the exposed employee(s). It is a process that brings a dual purpose: a) estimating the severity (magnitude) of a particular risk and b) obtaining the needed information for an appropriate decision-making, including information on the need and type of preventive measures to be taken. In the opinion of Roxo (2004), Risk Assessment should include two steps: a) risk analysis, which aims to determine the magnitude of risk and b) risk evaluation, which aims to evaluate the significance of the assumed risk. If a risk assessment (identification, estimation and evaluation) determines that a specific risk is not acceptable - acceptable risk is a risk that has been reduced to a level that can be tolerated by the organization and taking into account their legal obligations and its own OHS policy according OHSAS 18001 (2007), then it is necessary to proceed to the set of actions to control risk. This refers to processes of decision / action for the management and risk reduction, its implementation and periodic review, by using the results of risk assessment as an input. Typically, organizations make a more or less detailed evaluation of the monetary impact (positive or negative) on the actual organization of each decision/action to implement. Any preventive measure is translated into a cost and the real profitability can only be confirmed through an appropriate cost-benefit analysis (Miguel, 2010).

Literature on Occupational Health and Safety presents several approaches that assess the impact of these measures particularly in terms of cost analysis and the level of cost-benefit analysis. Hokstad and Steiro (2006) have developed a comprehensive strategy for risk assessment and setting of priorities for risk regulations, in which they approached the support of planning and priority setting for risk control. For some risks, particularly those threatening human life or implying damage to the environment, the ALARP (as low as reasonable practicable) can be applied. This methodology divides risks into three bands according to
two levels of risk: a level above which the risks are not acceptable and thus should not exist, except in extraordinary circumstances and a level below which the risks are insignificant and need only to be monitored to ensure they remain low. Accordingly, there is a central band, in which the risks should be kept as low as reasonably practicable. At this level of risk, a rigorous analysis of costs and benefits can be applied. However, when risk level are close to the intolerable, the expectation of the ALARP principle is that treatment will occur unless the treatment costs are grossly disproportionate to the benefits obtained.

Cost Analysis in OHS

During the middle of the last century, Heinrich (1959) drew attention to the high costs of occupational accidents in American companies. This author considered the division of accident costs in to two types of costs, direct and indirect. The former include: compensation, health care spending and other costs related to management and may be represented by the insurance cost, while the latter include: the time lost by injured workers and others, the time used in determining the causes of the accident, the time required for selecting and training a replacement for the injured, production losses, losses due to repairs, losses due to defective products, losses on the level of efficiency and performance when the injured worker returns to work, commercial losses and losses resulting from the deterioration of the company’s external image - ISO/IEC 31010 (2009). Heinrich established a linear relationship of 1:4 for direct costs and indirect costs respectively, as referred by Miguel (2010).

When the result of a project cannot be measured in monetary units, analysts adopt the cost-effectiveness analysis (CEA). The cost-effectiveness analysis is an evaluation technique used to select a project that will bring the lowest production cost of a certain product or choose the project that will lead to maximum production at a given cost. According to EVALSED (2009), the cost-effectiveness analysis (CEA) is a tool that can contribute to an efficient application of resources and investments in sectors where benefits are difficult to assess. This approach is useful to identify and select alternative projects with the same objectives (quantified in physical terms). The CEA can identify an alternative project that for a given level of expected results, minimizes the actual cost or, for a specific cost, maximizes the level of expected results. For example, the evaluator can compare the different projects by means of simple linear relations result/cost. Typically, the assumption is that a benefit or desired result can be achieved through different alternative ways. Thus, in this approach are usually only considered the costs and the cheapest way to get to achieve the desired benefit.

However, a financial assessment of the alternatives can be done if a monetary value can be assigned to all costs and tangible and intangible benefits. Generally, there is an initial cost and benefits that arise after a long period, making it necessary to update these cash flows using a discount rate appropriate for the company, referring to the present, so that a valid comparison can be obtained. Thus, all costs and benefits are expressed in present value. The present value of all costs and benefits for all stakeholders can be combined to produce a net present value (NPV). A positive NPV means that the action / project is beneficial, which means that the income generated outweigh the costs incurred. If there is uncertainty about the level of costs and benefits, one or both terms may be weighted according to their probabilities. This analysis can be expressed quantitatively as a net present value (NPV), internal rate of return (IRR) or as the ratio between the present value of benefits and present value of costs.

Cost-Benefit Analysis

The cost-benefit analysis (CBA) is used to determine whether a project is feasible from the standpoint of social welfare by the sum of the costs and benefits, discounted over time (EVALSED, 2009). The CBA usually accompanies a feasibility study (technical, financial, legal, organizational) of the project and is its final synthesis. According to EVALSED (2009) CBA is characterized by five main stages: 1) project identification, technical analysis and demand, 2) financial analysis, 3) correction of tax effects, 4) calculation of positive and negative externalities, 5) market prices to shadow prices and 6) calculating the economic profitability of the project. The financial analysis is the departure point for a subsequent economic analysis. It provides all the needed data in terms of inputs, outputs, their relative prices and how these are distributed predictably over time. The financial analysis can be performed using measures such as the net present value, the internal rate of return and the payback period. The financial analysis from the viewpoint of the private investor includes some items, such as income taxes, which do not represent a social benefit or a cost but a transfer from one social group to another. There are other examples of tax effects in the case of subsidies, social contributions considered in the cost of manpower and the effects of taxes on prices of inputs and outputs. In assessing the “appropriateness”, the public operator also takes into account the externalities generated by the project. Externalities consist of social costs or benefits that manifest themselves beyond the realm of the project and influence the welfare of third parties without any monetary compensation. A final correction is made by calculating the appropriate conversion factors, which multiplied by market price estimate the value of shadow prices. This correction is necessary because markets are imperfect and the market prices do not always reflect the opportunity cost of an asset. If prices are distorted, they are not an appropriate indicator of the well-being.
In order to fix the market prices of inputs and outputs, the following elements are used: the marginal cost, for non-traded goods such as land, services, local transport, etc.; the price "outside the country" for tradables, the conventional conversion factor for small non-tradable goods. In order to measure the economic convenience, after time rebate with a social discount rate (generally different from the financial rate), it is now necessary to calculate the net present value and internal rate of return, following the same methodology used in financial analysis (calculating the present net value NPV and calculation of the net internal rate of return IRR). It is expected that the economic internal rate of return exceeds the rate of financial return. If this is not the case, the project will be more convenient for a private investor than for a public operator (unless there are considerable social benefits that are not quantifiable in monetary terms).

A cost-benefit analysis should take into account the costs throughout the life cycle of the subject under study, involving both economic costs and benefits "accountable" and the impacts are not "accountable", known in literature as externalities (Queiroz, 1999).

**Externalities**

According to Rebitzer et al. (2004), externalities can be divided into the internalized externalities and the not internalized externalities, as it is important to distinguish the variant environmental and social from the cost of the environmental life cycle. According to Mann and Wüstemann (2008), there are textbooks of economy that suggest that externalities must be internalized in order to achieve a Pareto optimum. According to Barros (2009), an allocation of resources is preferable to any other if it leads to the improvement of the welfare of an individual, without diminishing the welfare of other individuals within the same society. Thus, from the moment when it is not possible to improve the welfare of an individual without diminishing the welfare of other individuals that allocation of resources is Pareto optimal.

Externalities consist of social costs or benefits that manifest themselves beyond the realm of the project and influence the welfare of third parties without any monetary compensation (EVALSED, 2009). Van Beukering et al. (1998) consider that an externality occurs when an economic decision has an impact on the welfare of another economic agent not directly involved in the process, resulting from the fact that the possibility of impact has not been properly addressed at the planning stage. In general, an externality is present when the welfare function (Y) of some economic agent (utility or profit) includes real variables whose values are chosen directly by others (X), without special attention to the effect on the welfare of agent Y that they affect. Where the project needs or deserves an evaluation by a public entity, the externalities generated are taken into consideration. However, the evaluation of projects of a private nature does not consider the effects on third parties arising from associated externalities. Indeed, the externalities generated by the projects are in many cases difficult to quantify. This is the case, for example, of calculations related to the "value" of human life.

For Varian (1992), the definition of externality is that the action of an agent directly affects the living conditions of another agent. Externalities can also be defined as: "the uncompensated impact of actions of one person over the welfare of a spectator" (Mann and Wüstemann, 2008). The focus on human welfare, primarily used as a synonym for human utility, is due to the traditional utilitarianism of economics. There are several types of externalities, positive or negative, depending on the fact that its effects on third parties are harmful or beneficial, and externalities of production or consumption, when they arise from the production or consumption of certain goods (Sousa, 2000). According to Barros (2009), externalities may also be positive (external benefits) or negative (external costs) and occur both at production or consumption. An example of positive externality in consumption is the case of two neighbours in which one decides to build a garden; if both are enjoying the garden then the one who built the garden produced to the other a positive externality. Example of negative externality in consumption: in a closed room where some people smoke and others do not, those who do not smoke are forced to breathe smoke, having a negative externality.

The concept of externality can and should be applied to the area of OHS, namely through the implementation of a cost-benefit analysis. When an organization performs a risk analysis integrated in the assessment of its OHS management system, several steps are suggested to solve the identified resolve the situations. Usually the organization makes a detailed analysis of the monetary impact (positive or negative) for the organization of each considered measures. However, it is also important to perform an analysis of the impact of each measure in society, i.e., to measure the involved externalities. The measures taken by an organization in risk prevention may have an indirect positive effect (positive externality) in society, while no action, due to the costs for the organization, may have significant negative effect for society (negative externality). It follows that these effects should be duly considered in decision making.

This paper aims at discussing the use of the cost-benefit analysis within the OHS domain. With this purpose, a qualitative exploratory study is proposed, using the application of the Delphi methodology. In this study it is intended to get some input from an expert panel by conducting a series of questionnaires in order to determine the most important factors to consider in the cost-benefit analysis on OHS.

**DELPHI METHODOLOGY**

The Delphi methodology is an exploratory study that allows gathering the views of the considered
participants, typically a panel of experts on the study domain, which is called the Delphi panel. This process is carry out by conducting a series of questionnaires on a specific subject. In this study, the subject to be examined is the application of "Cost-Benefit in OHS". Some of the characteristics of the Delphi methodology are the anonymity of the participants, the statistical representation of the distribution of results and the use of the feedback from the group to review the answers in a later round. Table 1 presents the main steps of the Delphi methodology, which is carried out during several consecutive rounds.

The variables are discrete, categorical and ordinal characteristics are obtained: median, mode and interquartile range. The interquartile range (IQR) is a measure of the dispersion and the median is the obtained value for 50% of observations. Thus, an IQR of 1 or less means that more than 50% of all opinions fall on a given point on the scale (von der Gracht and Darkow, 2010). After each round, a set of statistical measures are applied for each subjective estimate associated with each content/topic individually considered: median, mode, arithmetic mean; interquartile amplitude and range between quartiles to offer, iteratively and to each participant, the statistical feedback of the group.

After each round, a set of statistical measures are applied for each subjective estimate associated with each content/topic, namely: the median, the mode, the mean and interquartile range; these measures will give some feedback to each participant about the group’s opinion. The median and interquartile range are the most used statistical feedback of the group. The interquartile range is such a value that the variable number of observations to lower values is 25% and above is 75%, e.g., the first quartile (Q1) refers to 25% of agreement among experts and the third quartile (Q3) refers to 75% of agreement. The interquartile range is the difference between the third quartile and first quartile (Q3-Q1). The interquartile range is the difference between the first and third quartile in the range where it lies 50% of the core values (PSP, 2011). The greater the amplitude, the greater the dispersion in the data, thus a small inter-quartile range indicates a small variation in the responses of panel members, which shows that they

It is intended to compare a set of ratings given by the experts, upon the whole content/topics in order to understand if there is a consensus among the experts about the given answers, since the choice is limited to the number of factors corresponding to the levels of classification proposed. The consensus is indicated by the distance between the first and third quartile and the median value. The median is simply the value that lies in the middle of the ordered set of values, from the lowest to the highest. Thus, there must be an order relation of the values, so the median can be calculated both for ordinal variables and for the pure quantitative (PSP, 2011). The median indicates the degree of support group for each factor and if it is high, it appears that there is a great support from the group. Of course, the median is also the second quartile or the 50th percentile (PSP, 2011).

The presentation of the quartiles allows an assessment of the degree of convergence of the answers. The quartiles are used to help the measurement the variability or dispersion of the observed data. The first quartile is such a value that the variable number of observations to lower values is 25% and above is 75%, e.g., the first quartile (Q1) refers to 25% of agreement among experts and the third quartile (Q3) refers to 75% of agreement. The interquartile range is the difference between the third quartile and first quartile (Q3-Q1). The interquartile range is the difference between the first and third quartile in the range where it lies 50% of the core values (PSP, 2011). The greater the amplitude, the greater the dispersion in the data, thus a small inter-quartile range indicates a small variation in the responses of panel members, which shows that they

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experts selection</td>
<td>In the selection of experts a balanced distribution of elements should be seeked, making use of universities, research institutes, industries and other sectors of society. The quality of the result depends primarily on the study participants. A panel from 10 to 15 specialists is considered sufficient to generate relevant information (Skulmoski et al., 2007).</td>
</tr>
<tr>
<td>Completing the questionnaire</td>
<td>The questionnaire is available by post or by email; a form can be used and the answers are entered into a spreadsheet.</td>
</tr>
<tr>
<td>Statistics analysis of results</td>
<td>After a pre-defined period, the team collects the data and complete the corresponding statistical analysis. After the analysis of the 1st round, the coordination team must decide on the need to incorporate new issues in the 2nd round, which is quite common. After each round, a set of statistical measures are applied for each subjective estimate associated with each content/topic, namely: the median, the mode, the mean and interquartile range; these measures will give some feedback to each participant about the group’s opinion. The median and interquartile range are the most used statistical feedback of the group.</td>
</tr>
<tr>
<td>Preparation of the questionnaire</td>
<td>The second round of the Delphi questionnaire must present the results of the first questionnaire, allowing each respondent to review the initial answer by considering the group’s results. The goal is the convergence of results. At least two rounds are essential according to the Delphi methodology; there are only rare examples of studies with more than three rounds of the questionnaire.</td>
</tr>
<tr>
<td>General conclusions and final report</td>
<td>The final results are processed from the consensus generated by the group. The results may be qualitative in the form of reports, conclusions, etc. and quantitative (subjective probabilities, mean, median, interquartile range, etc.).</td>
</tr>
</tbody>
</table>
have reached a consensus. An interquartile range of 0 indicates a perfect consensus among panel members. In the Delphi method, the required type and level of consensus should be defined in advance. A consensus means that the degree of convergence of individual estimates is achieved when opinions exhibit an acceptable degree of similarity. There are many criteria to establish the moment they reached a consensus, these can be: a) no topic be accepted if it is not adopted by x% of the participants in the last round, b) x% of the topics receiving the most votes after Y rounds; c) only the topics that have received an average score greater than or equal to 3 on the Likert scale (1-5) are adopted, d) only the topics that have received at least rating 2 in a scale 1-3 by 51% of participants are adopted, and e) topics that have been rejected by at least x% of participants are rejected (Oliveira, 2008).

**QUESTIONNAIRE**

The design of a questionnaire must be preceded by certain prerequisites. First, the focus of the study must be carefully defined. Second, the study objectives must be translated into measurable factors that contribute to that focus. Third, the researcher must ensure that he or she is well competent in the topic. Finally, it must be consistently administered (Glasow, 2005). There are some rules for designing good questions in a questionnaire. As stated by Fowler and Floyd (1995, p. 3) “...a good question is one that produces answers that are reliable and valid measures of something we want to describe”.

In this case, the questionnaire is divided into six distinct parts. The questionnaire has a total of 50 questions. Section 2, occupational risk assessment, is composed by 13 questions. Section 3 has 10 questions covering issues on cost and benefits analysis of occupational risks. Sections 4, 5 and 6 will permit to collect the opinion of the specialists on the relevance of financial assessment, economic analysis, cost-benefit analysis and externalities to understand the implementation of the measures identified under occupational risk assessments. These three groups sum a total of 25 questions. Table 2 presents the content/topics in each part of the questionnaire.

Next subsections present all the questions of this questionnaire. The questionnaire will be complemented by a document where all main concepts are briefly explained; in some cases simple examples are given. All questions are measured with a Likert scale from 5 for a “very high” importance to 1 for a “very low” importance. A specialist will be available for clarifications by email.

## Section 2. Occupational Risk Assessment

How important are the following items for the Occupational Risk Assessment?

1. The separation of accident costs in terms of direct and indirect costs
2. The rigorous and comprehensive assessment of the direct costs of workplace accidents
3. Using a large number of items in calculating the costs of workplace accidents
4. The standardization of the main cost items of workplace accidents which can be applied in different situations and companies
5. The rigorous calculation of indirect costs of workplace accidents
6. Using the insurance premium as an estimate of the direct costs
7. Calculating indirect costs from direct costs assuming a certain ratio of proportionality (e.g. 4 to 1)
8. Some indirect costs can and should be calculated or estimated by substituting or reducing the application of the proportionality relation
10. Using economic valuation of the risks of preventive measures to take
11. Using a simple analysis of the monetary impact of each decision/action to implement in the organization
12. Using the ALARP principle in the evaluation and control of risks
13. To adopt an analysis focused only on costs and benefits of mid-level risk according to ALARP classification

| Table 2 – Topics addressed in the developed questionnaire on Cost-Benefit Analysis in OHS |
|---|---|
| **Sections** | **Contents/Topics** |
| 1. Introduction | Aims of the study; Structure of the questionnaire; Methodology |
| 2. Occupational Risk Assessment | Risk Analysis; Risk Assessment; Risk Control |
| 3. Costs and Benefits Analysis of Occupational Risks | Cost of measures; Tangible benefits; Cost-minimization; Cost-effectiveness; Cost-utility; Costs used; Cost-benefit analysis |
| 4. Financial Assessment (for the company) | Simple Payback; Discounted Payback; IRR; NPV; Annualized value; ROI |
| 5. Economic Evaluation (for the society) | Tax adjustments; Shadow prices; Correction of externalities; Opportunity cost; Economic NPV; IRR economic |
| 6. Externalities | Positive; Negative; Consumption; Production; Cash Benefits; Technology; Social |

255
Section 3. Costs and Benefits Analysis of Occupational Risks

How important are the following approaches in the Analysis of Costs and Benefits of Occupational Risk?
1. Measuring in monetary units the costs of preventive measures which could be undertaken
2. Measuring in monetary units the tangible benefits of preventive measures which could be undertaken
3. Adopting a cost-minimization analysis (CMA)
4. Adopting a cost-utility analysis (CUA)
5. Adopting a cost-effectiveness analysis (CEA)
6. Comparing alternatives with equal efficacy in order to select the lowest cost solution
7. To consider that interventions have impact in terms of morbidity and mortality
8. The use of measures expressed in terms of quality adjusted life years (QALY)
9. The use of natural units such as “life years gained”
10. To analyse the incremental cost of achieving a better outcome computing a cost per unit effect

Section 4. Financial Assessment (from the company’s perspective)

How important are the following aspects for the Financial Evaluation (from the company’s perspective) of the measures identified under the Occupational Risk Assessment?
1. Considering the future cash flows in the evaluation of preventive measures which can be undertaken
2. Actualizing future cash flows using an average discount rate for the sector instead of a discount rate calculated for each case
3. The implementation of the measures which have a positive net present value (NPV)
4. The implementation of the measures which have a ratio between the present value of benefits and the present value of costs above a certain value (e.g. benefits/costs > 1.5)
5. The implementation of the measures which have a payback or capital recovery time below a certain threshold (e.g. 3 years)
6. Calculating the Return on Investment (ROI) of the preventive measures which can be undertaken

Section 5. Economic Evaluation (for the society)

How important are the following aspects for the Economic Evaluation (in terms of society – i.e. considering externalities) of the measures identified under the Occupational Risk Assessment?
1. To undertake a cost-benefit analysis (CBA) of the measures, e.g. assess the impact of its implementation from the standpoint of social welfare
2. To calculate a social discount rate
3. To calculate the economic NPV
4. To calculate the economic Internal Rate of Return
5. The correction of tax effects in the CBA of the measures
6. The calculation of positive and negative externalities in the CBA of the measures
7. The calculation of shadow prices in the CBA of the measures
8. The use of conversion factors for calculating shadow prices in the CBA of the measures
9. The CBA is important for the evaluation of occupational hazards from the company’s perspective
10. The CBA is important for industry associations to evaluate occupational hazards from the industry’s perspective
11. The CBA is important for public institutions to evaluate occupational hazards from the society perspective
12. The CBA can be used to prioritize measures to be implemented considering their impact on business and society
13. The CBA can be used to promote, support, subsidize or to legislate in a reasonable manner the measures of prevention of occupational hazards

Section 6. Externalities

How important are the following aspects in the Evaluation of Externalities for a proper analysis of Costs and Benefits of Occupational Risk?
1. Analyzing the positive externalities
2. Analyzing the negative externalities
3. Analyzing externalities of consumption
4. Analyzing the externalities of production
5. Analyzing the technological externalities
6. Analyzing the social externalities

CONCLUSIONS AND FURTHER RESEARCH

Given the apparent lack of studies on the use of cost-benefit analysis related to OHS, in this paper it is proposed an exploratory qualitative study applying the Delphi methodology. This methodology allows the assessment of the views of experts, by conducting a series of questionnaires on the subject, where the final results are processed from the consensus generated by the group. According to Geist (2010), the Delphi method can be used to determine important issues such as a precursor to the development of a search. For Geist (2010) it is important to send daily reminders to specialists during the whole process, to obtain higher response rates. For some authors, e.g. Skulmoski et al. (2007), the method of data analysis and reporting results are directly related to the type of questions used in the Delphi questionnaire. The authors note the importance of applying appropriate analysis techniques and the inclusion of analysis of results sorted according to areas of agreement and disagreement. The Delphi method allows for anonymity, and all opinions have equal weight, avoiding the problem of
dominant personalities. Moreover, participants need not to be gathered in one place and at the same time. When research questions can be addressed through the use of questionnaires and the research purpose is mainly exploratory, the Delphi methodology is an excellent research tool, mainly because its application is relatively inexpensive and allow a fast way to acquire data through an effective and scientifically valid way. In contrast, the disadvantage of this approach is that it is a laborious and time-consuming technique, as participants need to be able to express their views, it presents a typical low internal consistency and reliability of opinions among experts and therefore a low reproducibility of the predictions based on the results. There must be a sensitivity of the results in relation to the ambiguity and reactivity of respondents in the questionnaires used to collect information and it is difficult to assess the degree of knowledge possessed by the participating experts.

Thus, a questionnaire was developed with the purpose of apply it to several experts; it is expected that with the planned three rounds it may be possible to obtain important conclusions and to have a better understanding of the importance of the cost-benefit analysis application in the OHS domain. Through the questionnaire it is expected to get a response rate of at least 75%, although it is desired that the response rate can be ranged between 85% and 90%.

The opinions of the expert panel will clarify what issues are important to consider in the development and application of cost-benefit analysis on OHS. In fact, the implementation of corrective and preventive actions under OHS requires a proper and systematic economic evaluation, in order to compare alternatives and understand the impact of each of them. For this, it is important to consider not only the costs and benefits for the organization but also the so-called externalities, which correspond to the impact of each measure in the whole society.

Thus, the current paper, with the aim at developing the subject of cost-benefit analysis related to OHS, proposes a qualitative exploratory study by using the application of the Delphi methodology. Accordingly, a questionnaire, which will be sent to several experts, has been developed. It is expected that after the planned three rounds it will be possible to obtain some important conclusions and a better understanding of the importance of the application of the cost-benefit analysis in the OHS domain.

REFERENCES


