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Socio-economic costs of accidents at work and work-related ill health

Key messages and case studies

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Socio-economic costs of accidents at work and work-related ill health

Key messages and case studies

European Commission

Directorate-General for Employment, Social Affairs and Inclusion

Unit B.3

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Foreword

This publication aims to shed light on the socio-economic costs of accidents at work and the incremental benefit of prevention for companies if they develop and implement effective health and safety management policies.

The calculation of costs and benefits for companies can increase awareness at management level that may help to stimulate the introduction of preventive actions which, in turn, will result in the reduction of accidents and work-related ill-health. The publication presents the results of the multiple case studies with the cost-benefit analysis of the suggested prevention measures. The cases covered in the publication come from companies of different sectors tackling various types of accidents and work-related health problems.

A key message of the publication is the need to consider the calculation of costs and benefits as a management issue with an added value on company management practices. The evidence collected in the case studies shows that investing in occupational safety and health makes good business sense.

The publication is meant to enable employers and workers organisations and representatives, policy makers, managers and authorities to get an overview of the economic aspects of health and safety management. The publication shows that investing in prevention pays back and the calculation of costs and benefits on company level may be a helpful and convincing economic argument on the prevention choices.

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Introduction

In Europe, every year approximately 6.9 million workers are confronted with an accident at work and approximately 23 million persons with a work-related health-problem (EU-27, data from 2007, Eurostat, 2010). These accidents and health problems bring about huge costs for society, companies and individuals. This is why it is important to provide companies an insight in the costs of accidents at work and work-related ill-health. It raises the awareness of the economic benefits of occupational safety and health.

The costs of accidents at work and work-related ill-health support the case for investing in occupational safety and health. It is clear that this approach can never replace the fundamental commitment of a company to strive towards healthy workplaces. The motives for developing an effective occupational safety and health policy must stem from social, legal as well as from economic objectives.

Studies show that legal compliance is the most important driver for occupational safety and health (OSH) on corporate level. Also ethical arguments (right thing to do) play an important role as well as some financial considerations. But, higher-level activities and resources do require a business case. Moving beyond legal compliance requires a sound strategy on occupational safety and health tying its outcomes to the overall business outcomes. Economic analysis can help to build business cases that show how strategic investments in innovative OSH practices offer financial opportunities. A better understanding of positive effects of a good working environment can support the implementation of an effective health and safety policy at company level. Companies need to be convinced that it is worthwhile to develop their own OSH objectives and to integrate these objectives into the overall company objectives.

The benOSH study relied on a two-track approach: firstly, a desk research comprising a statistical scoping study and a literature review; secondly a field research based on multiple case studies. The literature review discusses topics such as the global burden of accidents at work and work-related ill-health, the impact on several groups (individuals, companies and society at large), methods to calculate costs, cost categories, the benefits of prevention, economic assessments of OSH interventions, etc. The scoping study was aimed at delivering a basis for selecting the case studies. Therefore, a statistical analysis was made to provide a relevant sample serving as a framework for approaching companies and conducting case studies. The case studies provide on the one hand data on the costs of accidents and work-related ill-health and on the other hand information on the profitability of preventive measures (cost-benefit analysis). The conclusions of the benOSH study emphasize the benefits of prevention and indicate that making cost assessments and/or cost-benefit analysis, as part of a business case, can offer strong arguments on company level. Based on the results, from the literature and from the case studies, the benOSH study derived key messages supporting the case of occupational safety and health.

These key messages are incorporated in this publication. Especially employers, prevention officers, employee representatives, etc. can find useful information on economic aspects of OSH. The first part addresses the general picture of costs of accidents at work and work-related ill-health. However, emphasize is put on the company level. The publication deals with cost aspects (how do accidents at work and work-related ill-health affect business, why is it important to calculate) and also with the benefits of investing in OSH (what types of benefits can be expected, how does this show in practice). Further information derived from practice can be found in the page numbering
case studies section. Examples from companies show that investing in OSH can yield positive results.

The importance of costs

Costs of accidents at work and work-related ill-health place a considerable burden on society, companies and individuals. The costs are not evenly distributed and are partly shifted from companies to society and individuals. Nevertheless, all resources and productive capacity that are lost in this way are even more vital to the economy in order to stay competitive in times of crisis, globalisation and demographic change.

Key messages
Accidents at work and work-related ill-health hinder economic growth
Consequences of accidents at work and work-related ill-health go beyond the workplace
Costs are partly shifted to society and individuals

Accidents at work and work-related ill-health hinder economic growth

Many workers in Europe continue to perceive that their jobs pose a threat to their health or safety. Almost 28% of workers in Europe say that they suffer from health problems, which are or may be caused or exacerbated by their current or previous job. This is shown by the results of the fourth European Working Conditions Survey[1] of working conditions (EWCS 2005).

These data are confirmed by the statistics on health related outcomes such as accidents at work and work-related diseases. No less than 1 out of 10 European workers is every year affected by an accident at work or a work-related health problem.
According to a recent Eurostat study (2010)[2] 3.2% of the workforce in the EU-27 reported an accident at work in the past 12 months (data from 2007). And although this figure represents a slight decrease in comparison with 1999 (3.5%, 10 EU countries), it still means that approximately 6.9 million workers were victims of an accident at work.
Accidents at work bring about a vast number of sick leave days. 73.4% of the accidents at work result in a sick leave of at least one day and 22% in at least one month. In total, it was estimated that accidents at work caused 83 million calendar days of sick leave in 2007 (Eurostat, 2010). Every year around 100 000 accidents at work lead to permanent incapacity to work. Moreover, every year 5,720 people die in the European Union as a consequence of work-related accidents (ESAW 2007).

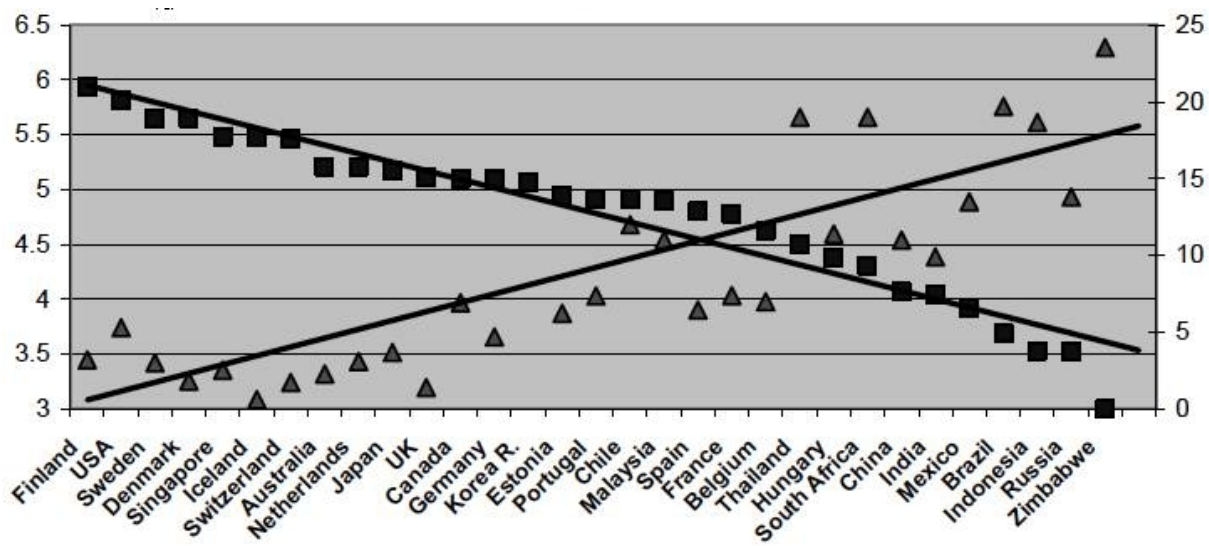
For work-related health problems, the figures are even more staggering. No less than 8.6% of the workers in the EU-27 reported a work-related health problem in the past 12 months (data from 2007). This corresponds to approximately 23 million persons. Musculoskeletal problems were most often reported as the main work-related health problem (60%), followed by stress, depression or anxiety (14%).
62% of the persons with a work-related health problem stayed at least one day in the past 12 months at home; 22% of the persons at least one month. It was estimated that work-related health problems resulted in minimally 367 million calendar days of sick leave in 2007. Moreover, 1.4 million persons expect never to work again because of their work-related health problem. Furthermore, work-related health problems have an effect on early retirement. Eurostat findings indicate that workers with work-related health problems leave the workforce before the age of 55. Data shows that the occurrence of work-related health problems strongly increases with age. However, in the oldest workers group (55-64), the increase in the occurrence of work-related health problems slows down in men, and a decrease was found in women (Eurostat, 2010). These findings are all the more important in light of demographic change and support the case of healthy ageing policies targeting the workplace.

[1] Survey of the European Foundation for the Improvement of Working and Living Conditions, http://www.eurofound.europa.eu/ewco/surveys/index.htm
[2] Full citations of the references cited in this publication can be found in the reference list of the benOSH study report.

The accidents at work and cases of work-related ill-health bring about huge costs. According to the ILO the total costs of work-related accidents and ill-health amount to approximately 4 per cent of the worlds GDP (ILO, 2006). A considerable loss that has a negative impact on economic growth and puts a burden on society. On the other hand, good health is considered a strong predictor of economic growth. Health leads to economic growth by increased savings, investment in human capital, labour market participation, foreign direct investment and productivity growth (Suhrcke et al., 2008). Thus preventing occupational accidents and diseases should make good economic sense for society as well as being good business practice for companies.

The negative impact of outcomes of work-related problems is illustrated in the graph below (figure 1) demonstrating the strong correlation between national competitiveness and the national incidence rates of occupational accidents. Countries with the best records on accidents at work are the most competitive leading to the conclusion that poor working conditions put a heavy burden on the economy and hinder economic growth.

Figure 1 - Correlation between competitiveness and the incidence of accidents at work



■ Competitiveness, left scale (competitiveness index)
▲ Deaths, right scale (fatal accidents/100 000 workers)
Source: ILO, 2006

Consequences of accidents at work and work-related ill-health go beyond the workplace

Poor and hazardous working conditions affect several groups. These are also the groups that will benefit – directly or indirectly – if the working conditions improve and if the health of the employees improves. These target groups can be sorted into three levels:
- society: public or collective funds, healthcare systems, insurance companies;
- company: OSH services, company/management, shareholders, customers, other companies;
- individuals: workers, workers' families, friends.

All of these groups have to bear the consequences of accidents at work and work-related ill-health and subsequently also the costs. Table 1 provides an overview of these consequences indicating that some of these are not or very difficult to quantify. Moreover, none of these groups sees or experiences the full extent of the social and economic consequences of accidents at work or work-related ill-health. The nature of the consequences is such that it is rare all the costs are combined to provide an overall picture of the magnitude and complexity of outcomes (Adams et al., 2002).

But, getting a clear picture of all costs is not an easy task. It is not so that if one manages to gain an insight in the costs of each group, total costs can be counted by making the sum of them. Costs are not mutually exclusive and there is a substantial overlap. Furthermore what one group might perceive as a cost might not necessarily be a cost for another group. It is all a matter of perspective. For instance, a significant portion of the medical cost of accidents at work and work-related ill-health in the industrialized countries is paid for by social insurance systems and it is not easy to establish who pays this cost and how. The cost may be so spread out as to be invisible at the private level (Dorman, 2000a).

Table 1 - Consequences of accidents at work and work-related ill-health for different groups

	Non tangible	More or less tangible
Victim	Pain and suffering Moral and psychological suffering (especially in the case of a permanent disability) Lowered self-esteem, self confidence Strain on relationships Lifestyle changes	Loss of salary and premiums Reduction of professional capacity Medical costs Loss of time (medical treatments)
Family and friends	Moral and psychological suffering Medical and family burden Strain on relationships	Financial loss Extra costs
Colleagues	Psychological and physical distress Worry or panic (in case of serious or frequent accidents/cases of ill-health)	Loss of time and possibly also of premiums Increase of workload Training of temporary workers
Company	Presenteeism Company image Working relations and social climate	Internal audit Decrease of the production Damages to the equipment, material Quality losses Training of new staff Technical disturbances Organisational difficulties Increase of production costs Increase of the insurance premium or reduction of the discount Early retirement Administration costs Legal sanctions
Society	Reduction of the human labour potential Reduction of the quality of life	Loss of production Increase of social security costs Medical treatment and rehabilitation costs Early retirement Decrease of the standard of living

Source: De Greef and Van den Broek, 2004 (a)

Costs are partly shifted to society and individuals

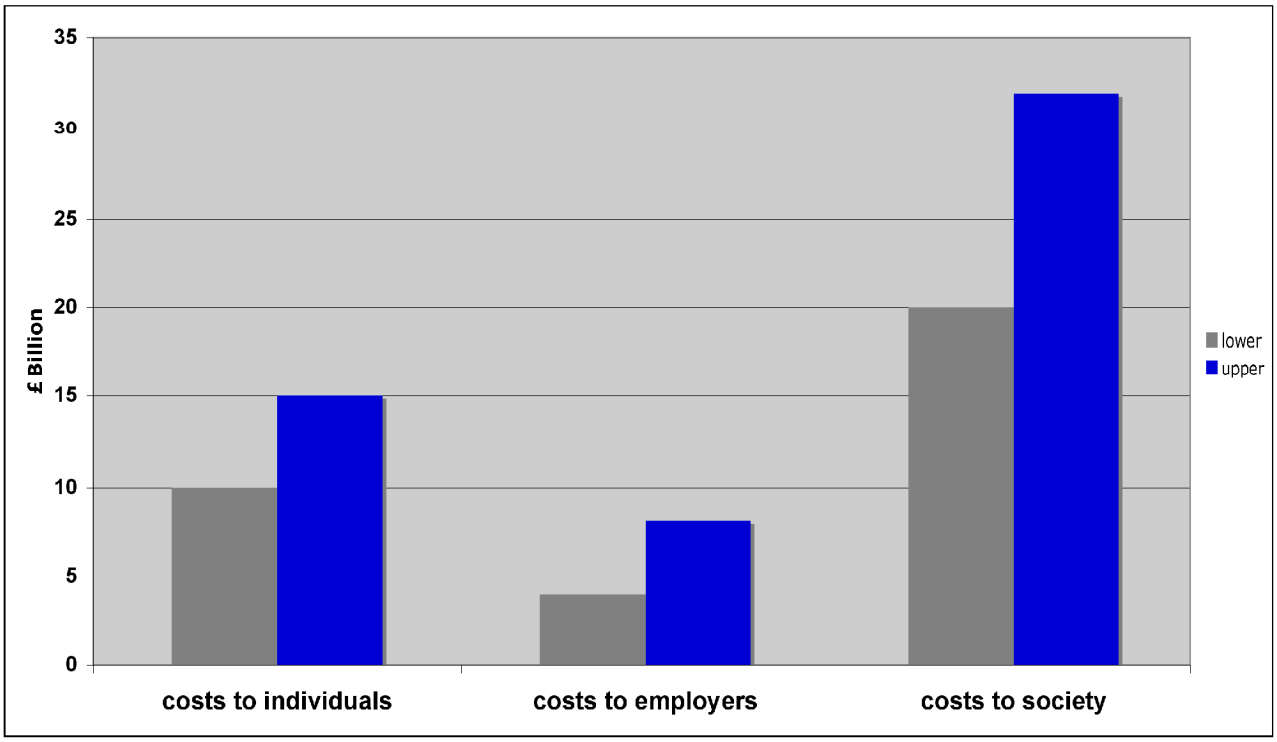
An uneven distribution

Just as work affects many areas of our lives, the impacts of accidents at work and work-related ill-health reach all aspects of society, rippling out to influence personal, social and workplace relationships. Individuals suffer serious consequences and their quality of life can diminish. Physical and psychological functioning in everyday activity can be affected, self-esteem and self-confidence reduced and family relationships stressed. Labour relations in workplaces may be damaged. Other costs involve loss of (future) earnings and medical costs. In many cases these economic consequences for individuals are not compensated in any way.

On societal level, the costs related to additional health-care expenditures that may be associated with accidents at work and work-related ill-health catch the eye but other costs such as the foregone earnings of individuals and households put an even greater burden on economy. Estimates suggest that 55% of the total costs can be attributed to lost earnings compared to 17% medical costs and 10% insurance costs (Leigh et al., 1997). This impact on future productivity gains is all the more important within the context of demographic change. Especially the European Union is faced with an ageing workforce making it even more essential to avoid any loss of resources and productive capacity.

Studies point to the fact that costs are unevenly distributed between groups. Society bears the largest part of the costs due to accidents at work and work-related ill-health, followed by individuals. Employers bear the smallest part of these costs (figure 2) (Pathak, 2008). This means that employers will continue to have weaker than optimal incentives to reduce occupational safety and health risks.

Figure 2 - Costs to Britain of workplace accidents and work-related ill-health (2001/02)



Source: Pathak, 2008

Cost-shifting mechanisms

Who pays what and how much depends in some extent on the Workers' compensation system that is in place. The extent to which these costs are borne by those who caused the accidents at work and cases of work-related ill-health differs from country to country. Examples of costs (Dorman, 2000a) that are shifted from companies to other groups are:

- Victim's lost wages, current and future, that are not compensated by the social security system;
- Victim's medical expenses that are not compensated by the social security system or other (employer-paid) insurance;
- Time and resources expended by the victim's household in nursing and recuperation;
- Lost household production by the victim;
- Productivity no longer available to society due to disability or premature death;
- etc.

Cost shifting can be seen in every economy. However, some characteristics increase the extent to which it is society and not the employer who pays. These characteristics are:
- the degree of market competition: in highly competitive markets individual companies are more likely to try to avoid bearing safety and health costs (since individual companies are under a lot of pressure in highly competitive markets (within a sector, a specific industry, a region, etc.), they will tend to shift as many costs as possible in order to gain an advantage compared to their competitors);
- the unemployment rate: when unemployment rates are high, companies are more able to shed costs on their workers;
- the transfer and social insurance programmes: countries with highly developed public welfare programs are more vulnerable to cost externalisation since risks are more equalized to all companies or transferring the costs to taxpayers.

In many countries systems exist that bring the costs back to the company or the person who inflicted the costs (cost internalisation). Methods for cost internalisation are e.g. liabilities, legal sanctions, differentiation in premiums, etc. However, these incentives have their limits. It might be impossible to bring all costs back to the company. If for instance, the insurance costs would increase too much to include also costs for pain and suffering they might have an opposite effect. Furthermore, not all societal costs can be adequately calculated and attributed, which makes it impossible to assign them properly to companies. This shows that cost internalisation is neither feasible nor desirable. In practice it is impossible to put the total burden on the company.

OSH pays, but for whom?

The economic impact of accidents at work and work-related ill-health illustrates that these costs would not be created if these accidents and cases of ill-health could be prevented. Thus preventing occupational accidents and diseases should make good economic sense for society as well as being good business practice to companies (Dorman, 2000a; Rikhardsson, 2003).

The problem remains that this is not automatically the case. This is due to the nature of costs and benefits. Stakeholders do not automatically invest in prevention or promotion programmes since no single stakeholder has an over-riding incentive because of the nature of how the costs and benefits accrue: the costs of accidents and health problems are spread across many different stakeholders (e.g. employers, the social security budget and individuals) and there is uncertainty over when and how the benefits from interventions will accrue. The benefits might also only be visible in the long run. For instance for national security bodies, the benefits of reducing the future flow of incapacity claims, is a long-term gain rather than an immediate win. Furthermore from society's perspective, no stakeholder has an incentive to invest in programmes in a socially optimal perspective because each stakeholder considers the private costs and benefits rather than the societal costs and benefits. The consequence of this distinction is that when employers set up OSH programmes, they will under-invest from society's perspective because they focus on the private benefits rather than the social benefits (Nera, 2006).

In conclusion, making cost studies of accidents at work and work-related ill-health is not about looking for large amounts, because they seldom offer a good incentive to act. Any attempt to argue that OSH pays must specify for whom. Unless a relevant decision-maker can be identified for whom OSH pays, the argument has no capacity to motivate action to reduce accidents at work and work-related ill-health.

Work-related ill-health and accidents: costs and consequences

Companies facing accidents at work and work-related ill-health don't perceive all consequences of such cases. The consequences are not always straightforward and easy to identify. Still, it is clear that accidents at work and work-related ill-health increase company costs and at the same time decrease the revenues. Therefore, preventing accidents at work and work-related ill-health positively influences profits and enhances company performance.

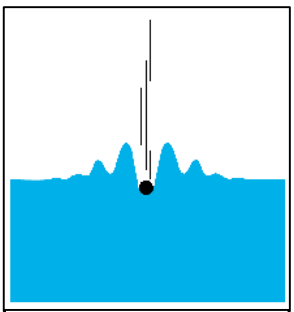
Key messages
Consequences of accidents at work and work-related ill-health are not always noticed
Consequences of accidents at work and work-related ill-health increase company costs and decrease revenues
Calculating costs raises awareness about the necessity of prevention
Accidents at work and work-related ill-health bring about considerable costs

Consequences of accidents at work and work-related ill-health are not always noticed

Accidents at work and work-related ill-health bring about consequences that go beyond the immediate and obvious effects. Costs of accidents at work and work-related ill-health are the costs that can be linked to measurable consequences.
However, the effects or consequences of accidents at work and work-related ill-health are not always straightforward and easy to identify. The metaphor of a stone thrown in a pond illustrates this (figure 3). When a stone is thrown in the water, it causes ripples in the water surface. However, the farther away from the point where the stone fell in the water, the less obvious it will be that a ripple is caused by the falling stone. This is also what happens when an accident occurs or when someone falls ill due to work. The consequences are not always noticeable since they might occur in another time or another place. Ripples can be noticed a long time after the event took place or at a long distance from where the event took place.

The costs assessments carried out in the framework of the benOSH study support the fact that consequences can occur in another time or another place. For instance, in the case of needle stick injuries, a nurse sometimes is confronted with a six-month period of uncertainty about a possible infection. When a courier of a delivery company has an accident and can't make the delivery, the client has to be compensated (see case 8).

Figure 3 – The Pond Model



Source De Greef, 2003

Furthermore, the more important the case, the more important the ripple effect. So, the impact of severe cases is certainly bigger and more noticed but since the ripples undulate farther and longer, also in these cases a lot of consequences go unnoticed.
Smaller companies can be more affected by a case than bigger companies. A stone that impacts the water causes more and bigger ripples in a small pond than in a big one.

Consequences of accidents at work and work-related ill-health increase company costs and decrease revenues of companies

Consequences bring about costs and in that regard the *costs of accidents at work and work-related ill-health* should be considered as *the effects on the costs and the revenue of an organisation (company) that would not have emerged if the accident/case of work-related ill-health would not have taken place* (De Greef and Van den Broek, 2009). These costs are by nature non-value added and should be avoided. They have a negative impact on the corporate value creation.

The consequences of accidents at work and work-related ill-health increase on the one hand the costs of a company and on the other hand diminish the revenue. Often, the effects on the costs of the company are immediate while revenues are affected in the long run (table 2, box 1). Lowered staff morale for instance can be considered as an effect in the long term.

The increase of costs is mainly due to non-productive time. This is time lost due to the accident or case of ill-health. It is not just about the days of absence of the victim, whose salary is also partially reimbursed by the insurance system, but also the time spent on the immediate response to the accident, taking measures for reorganising the work and the replacement. This non-productive time affects in a negative way the cost of a company. Problem is that this non-productive time often remains hidden and is not assigned to the phenomenon that causes the costs: the accident or case of ill-health.

Box 1 – Definitions

Cost of an accident at work/case of work-related ill-health = the effects on the costs and the revenue of an organisation (company) that would not have emerged if the accident/case of work-related ill-health would not have taken place.

Impact on the profitability of a company = difference between the profits of the situation with and without accidents at work/cases of work-related ill-health
Profit (P) = Revenue (R) – Costs (C)
$\Delta P = \Delta R - \Delta C$

Short-term scenario: increase of the costs
Long-term scenario: decrease of revenue

	ΔR	ΔC	ΔP
Short-term	=	↗	↘
Long-term	↘	↗	↘

Source: De Greef and Van den Broek, 2009

Table 2 - Overview of the effects on the costs and revenue of a company due to accidents at work or work-related ill-health

	Effects on costs	Effects on revenue
absence of the victim	+	
interruptions in the production process	+	
re-organisation of the work	+	
first aid	+	
accident/case analysis	+	
administrative follow-up	+	
recruitment and additional pay for temporary worker	+	
training of replacement worker	+	
repair and/or clean-up (accident)	+	
replacement of damaged equipment/goods (accident)	+	
fines, increase of insurance premiums	+	
production losses		-
loss of orders/clients		-
company image		-
job satisfaction		-

Source: De Greef and Van den Broek, 2009

Calculating costs raises awareness about the necessity of prevention

Most companies have a limited notion of costs of accidents at work and work-related ill-health. They simply don't calculate. Limited time and resources, perceived complexity and lack of expertise are the most cited barriers to conducting accidents at work and work-related ill-health cost assessments.

Using the language of costs is an attempt to speak the language of management and to make the safety and health message appealing. Companies are in business to maximise profit, so achieving loss minimisation contributes to profit maximization and the bottom line. Demonstrating the financial impact of health and safety failures forms a lever for change.

In analysing the consequences and the associated costs, it becomes apparent that consequences go beyond what is easy noticeable. As shown in the pond model, consequences can occur in a later stage or in another place. In that respect, the analysis and calculation carried out in the benOSH project proved to be highly interesting. It was maybe not so much the exact amount that came out of the analysis, but the fact that more consequences could be revealed, that served as an eye-opener. However, the study also demonstrated that it is not possible to capture all consequences. The impact on staff morale for instance, is difficult to estimate. Discussions with the companies showed that these aspects do play a role but one has to accept that it is not always possible to put everything in monetary values.

Accidents at work and work-related ill-health bring about considerable costs for employers

In the framework of the benOSH study the costs of 401 cases of accidents at work or work-related ill-health were calculated. The cases were clustered in low, medium and high severity (see box 2).

Box 2 – Severity definition in benOSH

Low severity:
- No to slight functional impairments of body parts or organs after accident impact, ambulatory treatment may be necessary, e.g. slight bruises or strains, superficial wounds, breaks of minor bones (metacarpus, toes, metatarsus, fibula in the middle third, lost of teeth et al.).
- Days of absenteeism: 0 – 15.

Medium severity:
- Medium functional impairments of body parts or organs after accident impact, in-patient treatment where necessary (not more than three days), e.g. wounds transgressing the subcutaneous fatty tissue and beyond, face injuries, fractures of medium sized bones (clavicle, ulna, radius, ankle, wrist, neck of humerus, shoulder blade et al.) requiring an adjustment or a surgery.
- Days of absenteeism: 16 – 35.

High severity:
- High functional impairments of body parts or organs after accident impact, not or during a longer period to be compensated by medical treatment, in-patient treatment of more than three days necessary.
- Fatal accidents
- Accidents with a high risk of fatal effects like needle sticks involving patients with HIV and hepatitis C.
- e.g. open fractures of all kinds, fractures of major bones (shinbone, lower leg, several rips, spine, skull et al.) injuries of the skull leading to unconsciousness, injuries of body cavities, injuries of major trunks, severe inner injuries, multiple injuries, indications of shock.
- Days of absenteeism: more than 35

The cost calculations showed that accidents at work and work-related ill-health bring about considerable costs. For the cases, the study found a median of €1.651,54 for cases with low severity, of €4.985,9 for cases with medium severity and of €11.760,35 for cases with high severity. These represent costs that fall entirely on the employer. The type of case affects the monetary values. For cases with low severity, aggression has the highest median followed by car accidents. Back pain entails the most costs in the category of cases with high severity. Falls from height show high median values in all categories (figures 4-6).

The costs mentioned are the costs borne by the employer. They have to be considered in light of the severity definition that was used. For instance the cases with low severity also included very small cases with no absence and a limited impact. Actually, the study showed that these minor cases must not be ignored and bring about costs that seldom are noticed. Mostly they are not registered let alone reported to the insurer.
Furthermore, in valuing lost time it can not be ignored that companies have buffers and spare capacity to deal with disruptions. In the case studies this impact was valued to some extent (see case descriptions) but it is clear that these costs go beyond accidents at work and cases of work-related ill-health and affect the overhead costs of the company.

The cost assessments did not put monetary values to all consequences of accidents at work and work-related ill-health. Effects on staff morale, customer satisfaction, market share, etc. were not valued.
Therefore the costs must not be regarded as an absolute value (the price paid for a case) but seen in light of the possible benefits.

The costs were calculated using the Matrix[3]. The Matrix is based on activity based costing principles and distinguishes cost categories and cost centres. For the cost centres a categorisation is used clustering consequences into Human, Equipment, Environment, Product, Organisation (HEEPO). The categorisation of the cost categories is based on the principles of cost accounting (accountancy). The costs are related to two

[3] The Matrix was developed by Prevent in collaboration with the occupational accidents insurance organisations in Belgium (De Greef and Van den Broek, 2006).

main categories: operating costs (goods, services, staff) and depreciation. By relating every cost to a cost centre and a cost category a matrix can be build up. The total sum is the sum of all costs. Since the Matrix uses concepts from prevention as well as from accountancy it is a useful tool to mainstream occupational safety and health into the financial decision making process and stimulates OSH practitioners to take into account the economic aspects of prevention.

The results of the benOSH study show that the most important consequences of accidents at work and work-related ill-health are related to the aspect Human. In this area 88% of the cost consequences are situated. Cost items such as absence, over time, first aid, etc. are part of the aspect Human. The case study examples show that a lot of productive time is lost since the victim is absent, a replacement has to be found, colleagues have to work overtime, etc. Organisation is affected by almost 10% of the cost consequences. Organisation comprises items such as investigation time, administration, training time, etc. The other categories are very small, less than 1%. Exceptions are cases such as fork lift accidents or traffic accidents. The case on the courier services illustrates this (case 8).

However, not everything can be calculated. The case studies present detailed calculations but also reveal that it is not always possible to put a monetary value on everything. In that respect, making an analysis can be highly interesting. Because maybe it is not so much the exact amount that is important but the fact that so many of the associated consequences (costs) remain unnoticed and can only be revealed by making a more thorough analysis.

Figure 4 - costs of accidents at work and work-related ill-health based on the case studies according to type, cases with low severity

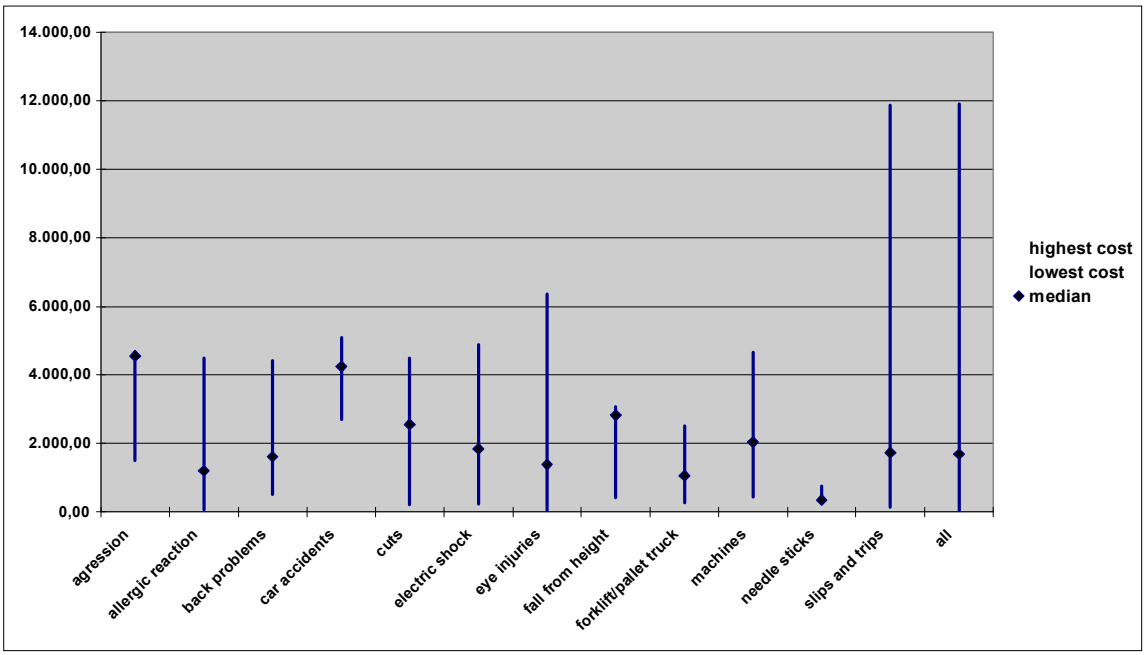


Figure 5 - costs of accidents at work and work-related ill-health based on the case studies according to type, cases with medium severity

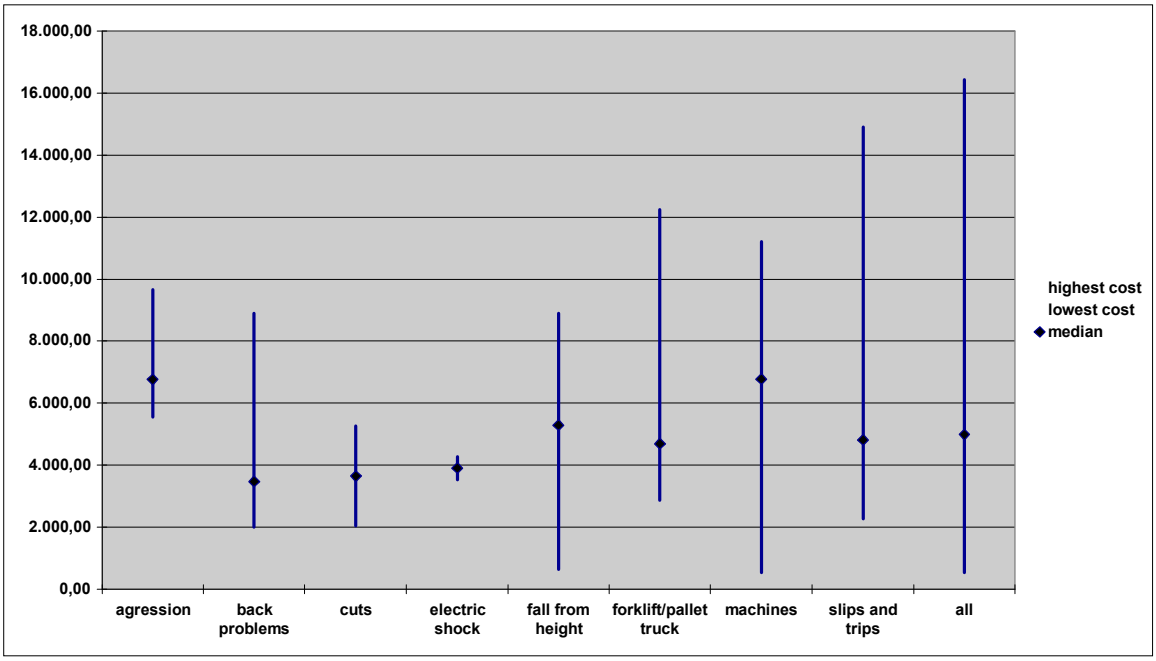
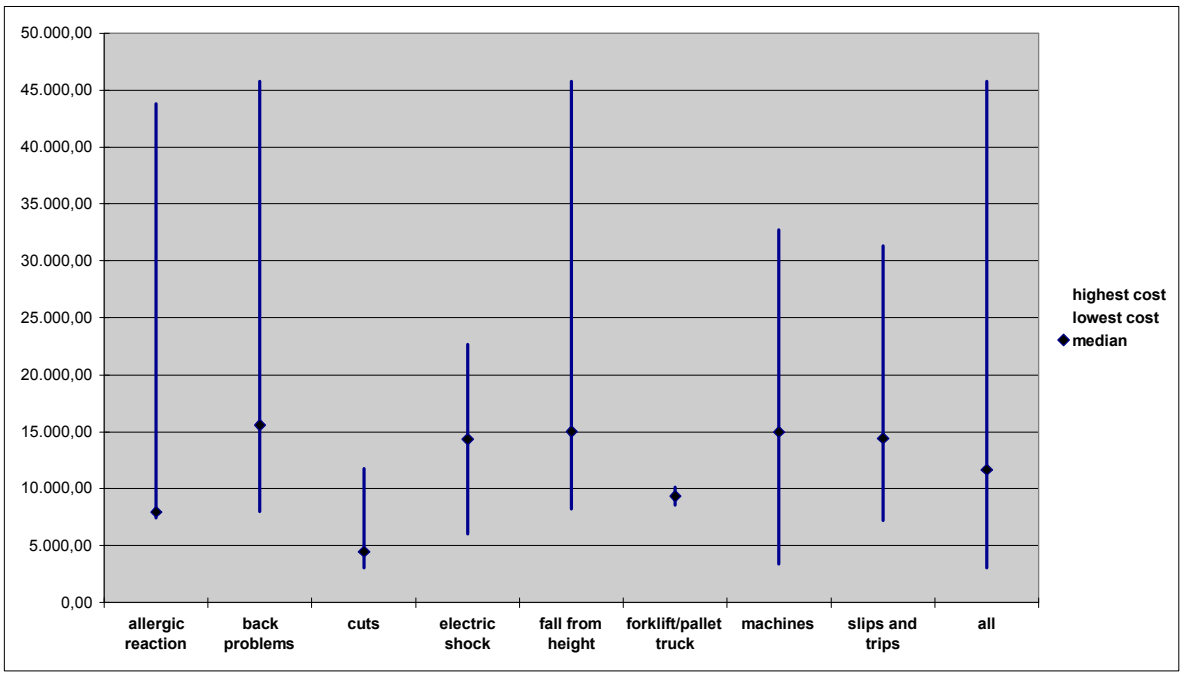


Figure 6 - costs of accidents at work and work-related ill-health based on the case studies according to type, cases with high severity



When prevention meets the bottom line – why it pays to prevent

Companies investing in occupational safety and health programmes obtain tangible results such as a reduction in costs arising from absenteeism, reduction in staff turnover, greater customer satisfaction, increased motivation, improved quality and enhanced company image. This theoretical framework can be backed up by case studies supporting the fact that investing in occupational safety and health is profitable. Especially when several measures are brought together into a comprehensive programme, a positive return can be expected.

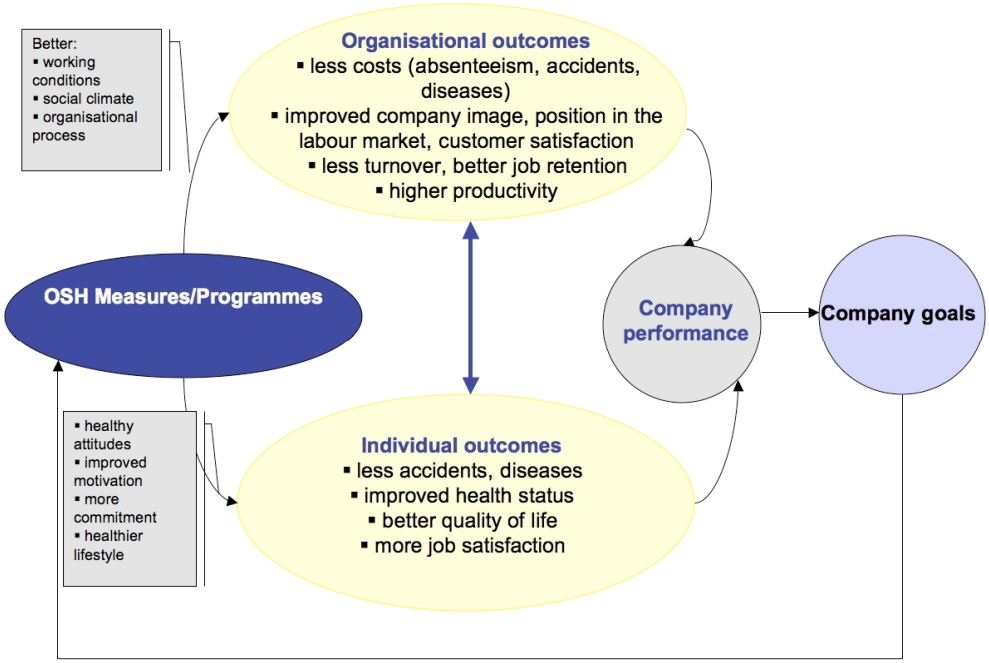
Key messages
Investing in occupational safety and health contributes to company performance through tangible outcomes
Evidence derived from practice: cost-benefit analysis studies show that investing in occupational safety and health yields positive results

Investing in occupational safety and health contributes to company performance through tangible outcomes

Studies show that legal compliance is the most important driver for OSH on corporate level. Also ethical arguments (right thing to do) play an important role as well as some financial considerations. But, higher-level activities and resources do require a business case (Miller, Haslam, 2009). Moving beyond legal compliance requires a sound strategy on occupational safety and health tying its outcomes to the overall business outcomes. Economic analysis can help to build business cases that show how strategic investments in innovative OSH practices offer financial opportunities. A better understanding of positive effects of a good working environment can support the implementation of an effective health and safety policy at company level. Companies need to be convinced that it is worthwhile to develop their own OSH objectives and to integrate these objectives into the overall company objectives.

Integrating health and safety in company strategy and policy is key to business excellence and success, allowing businesses to contribute to sustainable growth enhancing welfare and innovation. Figure 7 offers an insight into the relationship between occupational safety and health prevention measures and programmes, the process and the outcomes. Occupational safety and health programmes generate effects and outcomes that influence company performance positively and which contribute to the company goals. In order to have an effective influence on company performance, the occupational safety and health programme must be aligned with the company goals. In this respect, it forms part of the business strategy and also the continuous improvement circle that drives a company towards excellence. Outcomes are noticeable on organisational level since occupational safety and health measures lead to change by creating better working conditions, improving the social climate and the organisational process. The results are positive organisational outcomes such as less costs, improved company image, less staff turnover and higher productivity. On an individual level, an occupational safety and health programme leads to greater health awareness (healthier lifestyle) and an improved motivation and commitment. These changes result in several outcomes such as more job satisfaction. Moreover the framework shows that important additional effects and outcomes can be obtained since there is a clear link between the various outcomes and between the organisational and individual level.

Figure 7 - Outcomes of OSH measures and programmes in relation with company performance and company goals

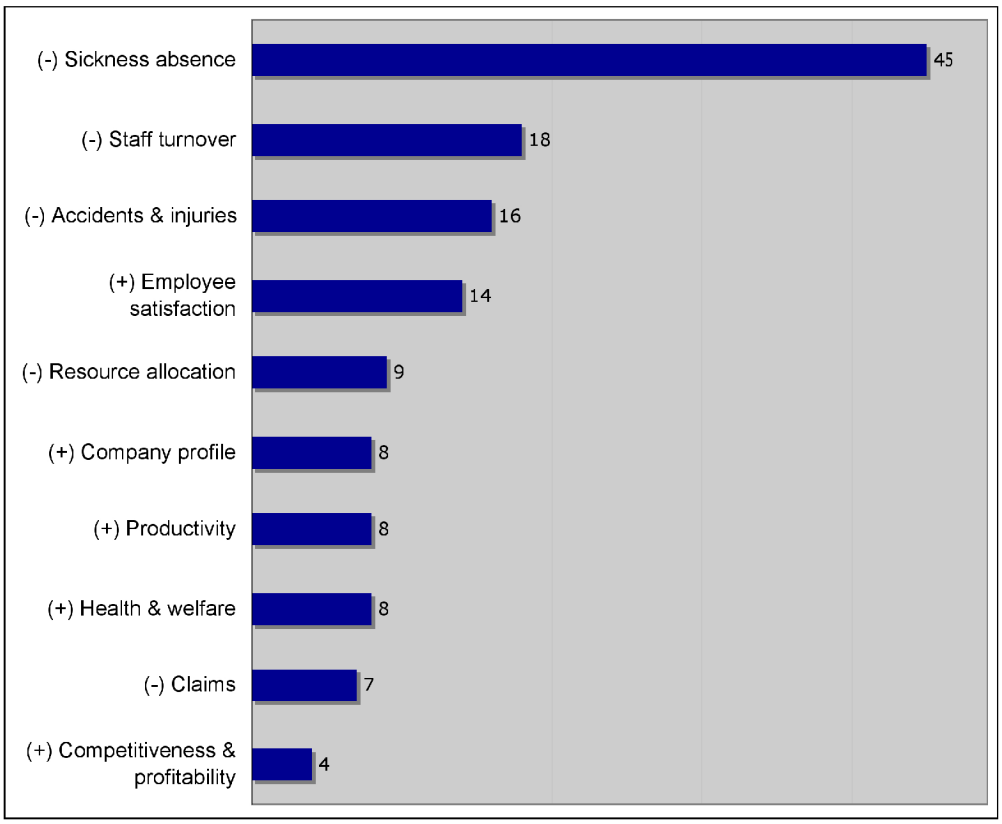


Source: De Greef and Van den Broek, 2004 (b)

This theoretical framework also highlights that employers and employees have equal interests in improving working conditions and investing in occupational safety and health. Enhancing the quality of work is of interest to employees since it leads to good and healthy working conditions, fewer strains and, as a result, fewer health complaints, illnesses and injuries. Furthermore employees appreciate a positive working atmosphere and have an interest in being able to experience work satisfaction. But this is also in the employers' interest. Alongside humanitarian considerations and legal obligations, health and safety also pay off for the company. Investments in occupational safety and health result in business benefits such as:
- a reduction in sickness and absenteeism rates;
- a reduction in staff turnover;
- an increase in productivity;
- an improvement in the image presented to the customers;
- keeping qualified personnel in the long term.

These business benefits are clearly linked with quantifiable financial outcomes that directly affect the bottom line. A reduction in absenteeism rates will lower personnel costs. Less staff turnover means less recruitment costs and so on. Health and safety as well as economic efficiency thus go hand in hand.
Demonstrating such intermediate business benefits such as lower accident rates is essential to show the impact on quantifiable financial outcomes and link occupational safety and health to economic performance. Evidence from 55 UK case studies show that occupational safety and health programmes result in financial benefits, either through cost savings or additional revenue generation, as a consequence of the improvement in a wide range of intermediate business measures (figure 8).

Figure 8 – Benefits attributed to workplace health promotion programmes in the UK (scale: number of case studies, n=55)



Source: PriceWaterhouseCoopers, 2008

This shows that occupational safety and health can be identified as an important business enabler that can push companies to perform better. Consequently it is not that important to look at the costs of investing in safety and health but rather to indicate to what extent safety and health can make a contribution to the achievement of company objectives. In that perspective good occupational safety and health performance can be seen as part of corporate culture. Arguments for OSH are evolving away from mere legal compliance towards competitive advantage and business performance.

Evidence derived from practice: cost-benefit analysis studies show that investing in occupational safety and health yields positive results

The benOSH study assessed the costs of 56 prevention projects in companies of different sizes and sectors. The case studies show the positive results of investing in occupational safety and health. The prevention measures were evaluated using a cost-benefit analysis. A cost-benefit analysis is a method that is commonly used on corporate level to make an economic evaluation of the costs and consequences of an action. The method expresses all costs and consequences in the same unit, which is usually money. The analysis results in the calculation of indicators such as the Net Present Value, the Profitability Index and the Benefit Cost Ratio (see also box 4). These indicators can be helpful in decision-making e.g. to make a choice whether or not to invest, or to choose between two alternative measures.

Table 3 – Overview of the projects according to type of measure (main measure) – median values

				Scenario 1*			Scenario 2*		
Measure	**Code**	**#**	**%**	Net Present Value	Profitability Index	Benefit-Cost Ratio	Net Present Value	Profitability Index	Benefit-Cost Ratio
substitution/avoidance	I	3	5.4	2,207.52	2.56	1.60	13,857.89	4.08	2.25
organisational measure	II	6	10.7	2,310.96	1.74	1.04	21,829.57	3.18	1.36
new equipment/auxiliaries	III	20	35.7	1,713.35	1.41	1.40	8,983.74	2.76	2.70
workplace adjustment	IV	6	10.7	2,389.38	1.37	1.22	8,984.01	2.15	1.66
training	V	16	28.6	605.02	0.95	1.12	8,092.65	3.39	2.51
personal protective equipment	VI	5	8.9	154.38	1.05	1.18	11,038.12	1.83	2.10
all		56	100	1,434.875	1.29	1.21	9,218.81	2.89	2.18

*Scenario 1 is based on a conservative assumption of the costs related to accidents at work and work-related ill-health that can be avoided; Scenario 2 takes a more optimistic assumption

Table 3 gives an overview of the benOSH case studies. The projects are clustered along the type of measure. The 6 main categories of the measures refer to: substitution/avoidance (I), organisational measure (II), new equipment/auxiliaries (III), workplace adjustment (IV), training (V), personal protective equipment (VI). In many cases a set of preventive measures were considered but for clustering purposes, the main measure is indicated. The highest values can be found for measures aimed at substitution or avoidance. The lowest values can be found for measures such as training and personal protective equipment. These results seem to support the case that measures considered to be the most effective according to the prevention principles are also more cost-effective (profitable).

However, it is difficult to make general conclusions. No workplace is the same and several variables such as corporate culture can make a big difference. Browsing through the case studies listed in the chapter below, one can see how different each story is. The case of the baker who is allergic to flour (case 9) is totally different to the case of the construction company struggling with the back problems of its workers (case 1). However, what all case studies have in common is the fact that they support the fact that investing in occupational safety and health is profitable. Especially when several measures are brought together into a comprehensive programme, a positive return can be expected.

Case studies: the benefits of occupational safety and health in practice

The ten case studies below are a selection of the 56 prevention projects assessed in the benOSH study. The descriptions provide an insight in the positive return that can be expected when investing in health and safety at work.

Sector	Risk/type	Prevention measures a) main measure b) additional supporting measure	Case	Page
construction	back problems	a) investing in a winch and a lifting aid for bricks b) additional: training	Case 1 Preventing back pain in construction	24
service sector	stress	a) internal meeting. increasing support b) additional: management training course	Case 2 Stress in a small consulting company	27
metal	cuts	a) improved cut-resistant gloves & introduction of PET straps. b) additional: awareness-raising campaign	Case 3 Cuts: which solutions are at hand?	29
food	slips and trips	a) slip resistant floor b) additional: awareness raising campaign housekeeping	Case 4 Reducing slips and trips: investing in a slip resistant floor	32
hospital/social	back problems	a) purchase of adjustable beds (high low beds); training of all personnel (care) b) additional: training	Case 5 Prevention of back pain in health care	34
waste	slips and trips	a) intensive training course (external) b) additional: behaviour-oriented awareness-raising	Case 6 Setting up an intensive training scheme to prevent trips and similar accidents	37
transport	aggression	a) de-escalation training; equipping busses with video surveillance systems. b) additional: staff involvement in improvement teams and prevention activities; coordination with police in sensitive areas; incident log and guide to prevention	Case 7 Prevention of aggression and violence against bus drivers	40
transport	car-accidents	a) training: awareness raising, defensive driving techniques b) additional: technical adjustments to the vans	Case 8: Courier services: tackling road safety	43
food	asthma	a) local exhaust at all workplaces and appropriate air flow in the whole room; machine to moisten the flour b) additional: dust reduced release flour	Case 9 Eliminating the risk: the baker's asthma case	46
construction	allergic reaction	a) general instructions and special instructions for new employees, focusing on the use of PPE b) alternative: adequate PPE. safe containers (hardener can be added to the resin without contact); purchase of special mixers limiting splashes.	Case 10 Allergic to epoxy: early warning symptoms	49

About the case descriptions

During the benOSH study[4] the costs of 401 cases of accidents at work and work-related ill-health were assessed and the costs/benefits of 56 OSH projects were analysed. The ten case descriptions below provide examples for the range of companies, prevention measures and risks included in these case studies.

The case descriptions are especially focussing on the benefits of investing in preventive measures. Each of the descriptions comprises a cost-benefit analysis of preventive measures targeting at specific safety and health issues. A cost-benefit analysis expresses all costs and consequences in the same unit, which is usually money. Cost-benefit analyses are commonly used on corporate level to make an economic evaluation of the costs and consequences of an investment, a programme, an action, etc. This means that all costs of the intervention are identified and compared to the expected returns (benefits). An important share of the benefits corresponds to the costs of accidents at work and work-related ill-health that a company can avoid in the future by implementing the necessary health and safety measures. Therefore the cost-benefit analysis also relies on making adequate assessments of the costs related to accidents at work and work-related ill-health. In the case studies the cost assessments were made based on the Matrix (see box 3).

Box 3 – Cost assessment: the Matrix

The Matrix distinguishes cost categories and cost centres.
For the cost centres a categorisation is used based on HEEPO (Human factor, Equipment, Environment, Product, Organisation). This categorisation allows inventorying costs related to the impact of the accident/case of ill health e.g. the absence of the victim (human factor), re-organisation of the work (the organisation), spills (the environment), damaged goods (the product), damaged equipment (the equipment).
The categorisation of the cost categories is based on the principles of cost accounting (accountancy). The costs are related to two main categories: operating costs (goods, services, staff) and depreciation.
By relating every cost to a cost centre and a cost category a matrix is build up. The total sum is the sum of all costs. To facilitate the cost assessment, a checklist was used comprising 40 cost items. Each item is linked to a cost centre and a cost category.

In each of the case studies below, an example of such a cost assessment can be found. The example gives:
- a short description of the case (what happened to the victim?);
- an overview of the cost items (a selection of the 40 items that are relevant for the case);
- the results along the Matrix (the costs clustered into cost centres and categories);
- the total cost of the case.

Each case description provides information on the company and the context of the occupational safety and health issues. Addressing these occupational safety and health issues requires adequate prevention measures. The cost-benefit analysis looks at the potential benefits of investing in the proposed measures. The analysis takes into account a time span of four years and presents the results based on the indicators Net Present Value, the Profitability Index and the Benefit Cost Ratio (see box 4). In each case study three scenarios are considered. The first and second scenario assess the costs and benefits of the same set of prevention measures, but the first scenario is based on a conservative estimate of the costs of accidents at work or work-related ill-health that could be avoided, while the second scenario takes a more optimistic assumption. These assumptions of how many costs of accidents at work or work-related ill-health could be avoided are based on discussions with the company, expert opinions, data from research and good practice. This is then reflected in two estimates, a conservative one, calculated in the first scenario, and a more

[4] More information about the selection of the companies, the methods and the tools that were used, can be found in the benOSH study report.

optimistic one, calculated in the second. The third scenario considered either an alternative measure or additional measures.

Box 4 – Cost-benefit analysis: indicators

Net Present Value NPV

The net present value of a series of cash flows, both incoming and outgoing, is defined as the sum of the present values (PVs) of the individual cash flows. The NPV gives an indication of the amount a project adds to the value of a company. A project will be accepted when the NPV is larger than 0.

Profitability Index PI

The Profitability Index is defined as the present value of expected cash flows over the value of the Initial Investment. It is a ratio of the present value or cash flows and the initial investment. A Profitability Index of one yields the internal rate of return. A Profitability Index of less than one suggests that the project should be rejected and value of one or greater suggests that investment should be accepted. If there is a choice between two or more alternative projects, the one with the largest PI should be chosen.

Benefit-cost ratio BCR

The benefit-cost ratio is the ratio of the benefits of a project relative to its costs. Both benefits and costs are expressed in discounted present values. A project will be accepted when the BCR is larger than 1.

The following case studies are illustrative. They should be considered as a package to show the nature and range of scenarios for addressing OSH risks. The individual case studies should not be read as absolute figures or indicators for all cases for a given type of work-related health problem or accident at work.

Case 1 Preventing back pain in construction

Company Description

The company specialises in the construction of new houses, especially energy efficient homes. The company employs 350 employees, of which 80% work on site (blue collar).

Case study

Absence due to work-related back pain is very common in construction. The causes for back pain are manifold and multi-factorial. It is not always easy to identify the specific risk factors. Each project is unique and therefore the circumstances as well as the activities differ bringing about various risk factors. Harmful working postures, repetitive movements and handling heavy loads can be associated with work-related back pain.
On average, 3 cases a year occur in this company. This makes it one of the most important work-related problems. Moreover since back pain cases can result in long periods of work inability and absence, in some cases more than a year. For a construction company that heavily relies on the skills of its experienced workers this causes difficulties in a competitive market where keeping up with tight building time schedules is an important business asset.
Based on the cost assessment of cases due to work-related back pain, it became clear that if no additional preventive measures are taken, the costs related to this type of cases can cost between € 55,178.18 and € 110,356.36 over a four year time span. Below an example is given of the costs of one such case. From the perspective of investing in preventive measures, these costs can be considered as benefits (avoided costs). The cost-benefit analysis looks at the potential benefits of investing in auxiliary equipment.

Example: What is the cost of one back pain case?

In order to assess the cost of cases of work-related back pain, the costs of several cases were examined. The following example gives an idea of such a case.

A construction worker was trying to move working material to the first floor via the scaffolding. While lifting the working material of the ground, he felt a sudden pain in his lower back. The victim was unable to work for 28 days (160h). The line manager and the prevention advisor investigated the accident. The accident was reported to the insurer and the project manager started the reorganization of the work. The victim's colleagues took over his work. The case was discussed in the company, e.g. at the prevention committee. Special information sessions were organised to inform all workers.

Cost of the case (Matrix)

Human	€
absence of the victim – time period during which the employer covers the salary	1,300
absence of the victim – after the time period during which the employer covers the salary	3,390.27
colleagues interrupt the work	32.5
overtime of colleagues to compensate	1,560
Organisation	
accident investigation by management	50
accident investigation/time spent by colleagues	16.25
accident investigation by OSH specialist (internal)	200
discussion of the accident in safety meeting/management	15
discussion of the accident in safety meeting/workers representatives (trade unions)	9.75
discussion of the accident in safety meeting/OSH specialist	5
administrative follow-up	60
reorganising the work	17.50
training of the replacement (time of the trainer)	1,230

	Human	Equipment	Environment	Product	Organisation	TOTAL
Goods	55.74	0.00	0.00	0.00	13.07	68.81
Services	47.78	0.00	0.00	0.00	11.21	58.98
Personnel	6,322.58	0.00	0.00	0.00	382.84	6,705.42
Depreciation	15.93	0.00	0.00	0.00	3.74	19.66
	6,442.02	0.00	0.00	0.00	410.85	6,852.87

The estimated costs for this case are € 6,852.87. The largest costs relate to the impact of the case on the human factor, which led to high personnel costs (€ 6,705.42).

Prevention Measures

The underlying mechanisms leading up to back pain are complex and different risk factors play an important role. Often, it requires a whole set of measures to adequately address this problem. Correct lifting techniques for instance are important, but this measure alone cannot correct nor eliminate the problem. An effective approach requires a combination of measures considering ergonomic aspects (adaptation of the workplace, equipment and materials, work and task organisation, …) and adopting adequate work postures, lifting techniques, …

In order to reduce back pain related issues, the company is considering an investment in a winch and a stone clip. These investments allow for lifting of heavy objects and tools, such as buckets, wheelbarrows, mortar stones and others. Such devices contribute to reducing the risk of back injuries. Also, the company will make efforts to increase the construction workers awareness to this subject. To do this, the company is considering the organization of a half-day training for all workers (correct working postures to avoid back pain).

Cost-benefit analysis

In the framework of the cost-benefit analysis, three scenarios were considered as described below.

Scenario 1: Purchase of a winch and stone clip
If all teams can use a winch and stone clip, 25% of the annual costs of cases related with back pain could be avoided. The cost of this investment is € 3,803/team for a total of 8 teams € 30,424. Considering also an annual cost of € 2,000 for the maintenance of these devices.

Scenario 2: Purchase of a winch and stone clip
The second scenario is based on the assumption that a 50% decrease of costs related to back pain cases can be realized.

Scenario 3: Purchase of winch and stone clip, plus adequate training
The third scenario considers not only the investment in the winch, the stone clip but also an additional investment in training on correct working procedures to reduce back pain. The training is for all blue-collar workers. The scenario is based on the assumption that a 75% decrease of costs can be achieved. The calculation of costs for training is based on a single course. The costs are therefore mainly staff (internal trainer) and the non-productive time of the workers.

	Scenario 1	**Scenario 2**	**Scenario 3**
Net Present Value	1,280.60	27,151.42	35,701.02
Profitability Index	1.04	1.88	1.63
Benefit-Cost Ratio	1.2	2.3	2.1

All three scenarios present positive results. The conservative scenario shows a profitability index of € 1,04 for each euro invested. Just above the break-even point. The optimistic scenario based on the 50% cost reduction shows the best result with a profitability index of € 1.88 for each euro invested. Scenario 3, where two complementary measures are proposed, requires a higher investment and results in a less profitable situation than in scenario 2. Training is obviously time-intensive. However, it is often a pre-requisite to fully implement measures and it surpasses mere instructions because it also has benefits such as team building. Moreover, training can also improve workers commitment and lead to solution-oriented working procedures, all generating benefits that are not calculated.

Case 2 Stress in a small consulting company

Company Description

The company provides consulting services. It employs some 10 experts and administrative personnel.

Case-study

Psychosocial problems in companies continue to increase and require special attention. In this company the financial and economic situation became more and more critical. The board wanted continuously differently prepared figures. The employee in charge for establishing the figures was at the same time increasingly criticised and after some time developed a nervous breakdown and had to report sick for a long period.

Based on the cost assessment of cases due to work-related stress, it became clear that if no additional preventive measurements are taken, the costs related to this type of cases can cost € 38,704.00 over a four year time span. Below an example is given of the costs of such a case. From the perspective of investing in preventive measures, these costs can be considered as benefits (avoided costs). The cost-benefit analysis looks at the potential benefit of investing in training measures.

Example: What does a case of stress cost?

In order to make this cost-benefit analysis, costs from a case of stress were analysed: (high severity - absence of more than 35 days). The following gives some further details.

The employee was increasingly put under stress, developed a nervous breakdown and reported sick for 514 days. The company paid the salary for six weeks (€ 7,020). Thereafter the health insurance association paid the salary to a certain percentage, the remaining amount had to be complemented by the company (€ 23,364). In addition the company had losses because the work had to be reorganized (€ 150) and other employees had to step in temporarily for their sick colleague (€ 7,000).

<u>Cost of the case (Matrix)</u>

Human	€
absence of the victim – time period during which the employer covers the salary	7,020.00
absence of the victim – after the time period during which the employer covers the salary	23,364.00
overtime of colleagues to compensate	7,000.00
Organisation	
reorganising the work	150

	Human	Equipment	Environment	Product	Organisation	TOTAL
Goods	210.00	0.00	0.00	0.00	5.25	215.25
Services	175.00	0.00	0.00	0.00	4.50	179.50
Personnel	37,454.00	0.00	0.00	0.00	153.75	37,607.75
Depreciation	700.00	0.00	0.00	0.00	1.50	701.50
	38,539.00	0.00	0.00	0.00	165.00	38,704.00

Cost of the case (Matrix)

Human	€
absence of the victim – time period during which the employer covers the salary	528.5
colleagues interrupting the work	75
overtime of colleagues to compensate	442.75
Equipment	
damaged equipment	330
purchasing/time spent for management approval	25
Product	
damages	500
clean up (external services)	200
clean up & maintenance of damaged goods (internal)	30
Organisation	
accident investigation by management	25
accident investigation by OSH specialist (internal)	200
administrative follow-up	70
reorganising the work	100
training of the replacement (time of the trainer)	50

	Human	Equipment	Environment	Product	Organisation	TOTAL
Goods	18.12	335.08	0.00	503.50	15.58	872.27
Services	15.53	4.35	0.00	203.00	13.35	236.23
Personnel	1,059.19	148.63	0.00	102.50	456.13	1,766.44
Depreciation	5.18	1.45	0.00	1.00	4.45	12.08
	1,098.03	489.50	0.00	810.00	489.50	2,887.03

Analysis shows an estimated cost for this particular case of 2,887.03 €. The largest impact on costs is associated to human factor, specially focusing on personnel costs (€ 1,766.44). Product factor also scores high, which proves accidents have a clear effect on the products and services of the company.

Prevention Measures

Tackling road safety is not an easy issue for companies. A company has only a limited impact on the circumstances and risk factors. In this case, the company has worked out a comprehensive, global approach with appropriate measures influencing staff behaviour and implementing technical improvements.
Up to date the company has not yet made the necessary investments in these measures. A cost-benefit analysis can help the decision-making process.

1) Employee Training
Initially, a one-day training will be provided to all couriers (150). This training will be followed by a yearly two hour update session. The main topics for the training courses are: assessment of traffic risks, hazards of a loaded vehicle, safe driving behaviour, specific prevention measures, etc. The goal of these training courses is to change the behaviour and consequentially the number of accidents reducing material damages and injuries by 15%.

2) Technical improvements to vehicles
In order to maintain optimal weight distribution between front and rear axles a number of technical improvements are necessary. The extra weight will/should be re-balanced by adjusting the springs, possibly by placing a cushion or adding an extra spring. These technical improvements could assist the driver to stay in the lane much more comfortably and safely.

Cost-benefit analysis

In the framework of the cost-benefit analysis, three scenarios were considered as described below.

Scenario 1: Traffic Safety Day for all couriers
Organizing a traffic safety day and consequently avoiding 15% of the cost of current accidents. The prevention advisor provides the training (no cost for external trainers, or prevention personnel costs). Largest part of the costs is the loss of time by the 150 employees. After the initial traffic safety day, each year a follow-up and updating course of 2 hours will be organised.

Scenario 2: Traffic Safety Day for all couriers
The second scenario relies on the assumption that a 30% cost reduction can be achieved.

Scenario 3: Traffic Safety Day for all couriers and adjustments to the vehicles
This scenario involves a combination of both proposed prevention measures. On one hand taking into account the behavioural aspects of the employee by providing training, and on the other hand also considering technical aspects by implementing adjustments to the vehicle, resulting in safer and more comfortable road holding when heavily loaded. The cost of this investment is approximately € 2,000 per vehicle. Total cost of the investment for 150 vehicles amounts to € 300,000. Assumption: implementing both measures results in a 40% reduction of costs.

	Scenario 1	**Scenario 2**	**Scenario 3**
Net Present Value	-5,242.82	33,244.16	138,646.67
Profitability Index	0.81	2.20	1.42
Benefit-Cost Ratio	0.87	2.60	1.66

The table above shows that the second and third scenario are positive, not the first one. The second scenario based on a more optimistic scenario would result in a cost benefit of € 2.2 return for each euro invested. In all cases, speed and maintaining safe distance are important factors contributing to road safety. Investing in preventive measures and raising awareness can also lead to other benefits, such as improving company image, a higher efficiency, employee stress reduction, legal issues and insurance costs (less accidents = lower premiums), which were not calculated in these given scenarios.

Case 9 Eliminating the risk: the baker's asthma case

Company Description

The company operates a bakery and a shop in a small town. It employs some 10 production and sales personnel.

Case-study

About one percent of employees in German bakeries report sick with baker asthma annually according to the accident insurance association of the respective sector. In 2003 the association had to spend 37.5 million Euro on cases related to the occupational disease BK 4301: obstructive allergic respiratory sickness. The so called baker asthma is a reaction of the immune system to the normally harmless flour dust. First symptoms can be watering eyes and coughing attacks, later followed by rhinitis and sputum. Often the conditions deteriorate and the baker develops persistent sneezing and breathing difficulties. Finally the worker may end up with asthma. Then they may have to give up their profession.

In this bakery the son of the owner was supposed to take over the bakery in due time but he developed baker asthma, which severely affected his work and put a big question mark to his future in this profession. He had to be away from work for several weeks. Based on the cost assessment of cases due to work-related baker's asthma, it became clear that if no additional preventive measures are taken, the costs related to this type of cases can vary between € 65,742.00 and € 78,890.40 over a four year time span. Below an example is given of the costs of such a case. From the perspective of investing in preventive measures, these costs can be considered as benefits (avoided costs). The cost-benefit analysis looks at the potential benefit of investing in technical and training measures.

Example: What does a case of baker's asthma cost?

In order to make this cost-benefit analysis, costs from a case of baker's asthma were analysed: (medium severity - absence between 16 and 35 days). The following gives some further details.

In the end of the 1980s the baker developed baker's asthma and reported sick for 28 days during the year. The company paid his salary for these days (€ 8,400 Euro). In addition the company had losses because the work had to be reorganized (€ 105) and other employees had to step in for their sick colleague (€ 5,760).

Cost of the case (Matrix)

Human	€
absence of the victim – time period during which the employer covers the salary	8,400.00
overtime of colleagues to compensate	5,760.00
Organisation	
reorganising the work	105

	Human	Equipment	Environment	Product	Organisation	TOTAL
Goods	201.60	0.00	0.00	0.00	3.68	205.28
Services	172.80	0.00	0.00	0.00	3.15	175.95
Personnel	14,304.00	0.00	0.00	0.00	107.63	14,411.63
Depreciation	57.60	0.00	0.00	0.00	1.05	58.65
	14,736.00	0.00	0.00	0.00	115.50	14,851.50

The analysis shows an estimated cost for this particular disease of € 14,851.50. The largest impact on costs is associated to human factor, specially focusing on personnel costs (€ 14,411.63).

Prevention Measures

In the early 1990ies the company contacted the accident insurance association for the food sector, BGN. Initially the manager attended a special course conducted by the insurer. Thereafter every year one employee has been sent to this three days course learning what can be done to avoid flour dust in the bakery. BGN has also issued a brochure summarising the content of these courses.

In the next step all workplaces were connected to a newly implemented exhaust system combined with installations providing an appropriate air flow in the whole room.

Although at this time the manager did no longer show any signs of allergic reaction when working in the bakery he continued to improve the prevention measures by taking part in the development of a flour moistening machine. The flour is transported from the storage hopper to the mixing-head by means of a conveying screw. There the flour is moistened with an adjustable predefined amount of water. The water binds the fine particles of dust to a harmless particle size, whereby the development of dust is reduced by up to 98%.

As a fourth preventive measure the manager participated in the development of dust reduced release/separating flours which are meanwhile also available on the market and are increasingly used by bakers at their workplaces.

Flour with and without moistening

Since almost twenty years now the manager has not yet shown symptoms of baker’s asthma and no other employee has developed this sickness in this bakery.

Proposals, alternative measures:

The company has implemented an exhaust system and a machine for moistening the flour. Only one system would be necessary to provide protection against baker's asthma, in this alternative scenario only the flour moistening machine will be considered.

Cost-benefit analysis

In the framework of the cost-benefit analysis, three scenarios were considered as described below.

Scenario 1: Company measures as described above
Considered costs for preventive measures: courses offered by the insurer: 720 Euro annually, exhaust system: € 33,000, machine for flour moistening: € 15,000.
Conservative assumption: the costs related to the cases would be reduced by 90%.

Scenario 2: Company measures as described above
Optimistic assumption: the costs related to the cases would be reduced by 100%.

Scenario 3: Alternative scenario
The company has implemented an exhaust system and a machine for moistening the flour. Only one system would be necessary to provide protection against baker's asthma, in this alternative scenario we consider only the flour moistening machine and calculated that the cases would be reduced by 100% as indicated by the accident insurance association.

In addition to the health aspects, test-trials have shown that, among other benefits, the moistening of the flour considerably improves the workability and the quality of the dough.

	Scenario 1	Scenario 2	Scenario 3
Net Present Value	-618.38	2,325.56	15,985.83
Profitability Index	0.98	1.06	1.96
Benefit-Cost Ratio	1.1	1.2	2.4

Investing in the above described measures shows a negative NPV (profitability index: € 0.98 return for each euro invested) in the more conservative scenario 1. The more optimistic scenario 2 shows a better result, based on the company's experience that the costs of work-related absences due to baker's asthma could be reduced completely during the following years. Scenario 3 requires an investment for only one technical measure (in this case the flour moistening machine), which is sufficient, and shows therefore a very positive result. The difference in the NPV between the first and the second scenario, although the underlying assumption is only slightly different (95 versus 100%), can be explained by the fact that investing in these prevention measures requires a substantial investment. Furthermore, one also has to consider the fact that in the benOSH study a four year time span was adopted for every cost-benefit analysis. However, for the investment in these measures a longer time span would have been also acceptable since such an investment can be depreciated over a longer period. However it can be assumed that the technical and training measures would not only reduce baker's asthma but would also improve health and safety in general as well as the motivation of staff. As mentioned above, test-trials have shown that the moistening of the flour considerably improves the workability and the quality of the dough leading to better productivity and customer perception.

Case 10 Allergic to epoxy: early warning symptoms

Company Description

This construction company uses epoxy resin and hardener to line large floors e.g. in car parks.

Case-study

In companies processing large amounts of epoxy resins and related hardeners we can often find workers developing an allergy.
In the presented German company employing about 160 workers, there are one hundred of them showing slight symptoms and one worker with severe problems who had finally to give up his work because he was running the danger of developing an allergic shock. There is a high fluctuation in the company. Many workers try to leave the company after a short while.

Based on the cost assessment of cases due to the development of an allergic reaction to epoxy, it became clear that if no additional preventive measurements are taken, the costs related to this type of cases can vary between € 414,687.22 and € 439,320.58 over a four year time span. Below an example is given of the costs of such a case. From the perspective of investing in preventive measures, these costs can be considered as benefits (avoided costs). The cost-benefit analysis looks at the potential benefit of investing in the below specified measures.

Example: What does a case of allergy against epoxy cost?

In order to make this cost-benefit analysis, costs from four cases were analysed: three of low and one of high severity. (Low severity: absence of up to 15 days, medium severity: absence between 16 and 35 days; high severity: absence of more than 35 days or fatal accident.)

The following example gives some further details.

The worker developed an allergic reaction when working with epoxy resin and hardener in 1997. It became worse and he could only work when taking drugs. Finally he had to report sick for about a half year and the doctor said, he should give up working with epoxy resin, because he would end up with an allergic shock and asthma. The accident insurance association for the construction sector paid for treatment, cure and rehabilitation. The company paid his salary for 30 days (€ 5,520). After six weeks the salary was paid by the accident insurance association (€ 10,258). Further losses were incurred because colleagues had to work overtime (€ 10,511) and the company had to employ a temporary worker (€ 4,600). Also the treatment at the first aid station (€ 46), the investigations by OSH specialists (€ 50), administrative follow-up (€ 60) and the reorganization of the work (€ 140) led to further costs.

Cost of the case (Matrix)

Human	€
absence of the victim – period of time which the employer must pay salary	5,520.00
costs of a replacement (temporary worker) (additional costs)	4,600.00
overtime of colleagues to compensate	10,511.00
first aid and reporting (first aid worker)	46.00
Organisation	
accident investigation by OSH specialist (internal)	50.00
administrative follow-up	60.00
reorganising the work	140.00

	Human	Equipment	Environment	Product	Organisation	TOTAL
Goods	316.71	0.00	0.00	0.00	8.75	325.46
Services	4,863.93	0.00	0.00	0.00	7.50	4,871.43
Personnel	16,182.57	0.00	0.00	0.00	256.25	16,438.82
Depreciation	1,055.70	0.00	0.00	0.00	2.50	1,058.20
	22,418.91	0.00	0.00	0.00	275.00	22,693.91

The analysis shows an estimated cost for this particular case of € 22,693.91. The largest impact on costs is associated to human factor, specially focusing on personnel costs (€ 22,418.91).

Prevention Measures

The company provides personal protective equipment, e.g. general chemical gloves (changed daily) and masks, however skin contact cannot always be avoided. Besides general instructions also special instructions for new comers are offered.

Proposals, alternative measures:
According to the accident insurer strict preventive measures, especially avoiding any skin contact, can prevent allergies: proper butyl gloves changed daily, overalls, masks, goggles, skin care products, safe containers (hardener can be added to the resin without contact), buying special mixers which do not produce splashes, looking for less hazardous products, special training (how to mix the components, how to keep handles clean, how to store ready mixed remains, ...).

Photo left:
This safe container includes resin and hardener. The hardener is released into the resin by piercing the inner capsule.

Photo right:
Pistol integrated mixing of components

Cost-benefit analysis

In the framework of the cost-benefit analysis, three scenarios were considered as described below.

Scenario 1: Company measures as described above
Special instructions for newcomers (50 persons x 1 hrs x 23 Euro = € 1,150)
Conservative assumption: the costs related to epoxy cases are reduced by 1%.

Scenario 2: Company measures as described above
Optimistic assumption: the costs related to epoxy cases are reduced by 5%.

Scenario 3: Company measures as described above plus proposed measures
When following the suggestions of the insurer the company would have the following additional costs: study for less hazardous products, safe containers, appropriate PPE: € 100, difference for gloves € 3 (3 x 100 workers x € 200 = € 60,000), special mixer: 10 per € 1,000 = € 10,000; additional instructions: 100 persons x 0.5 hrs x 23 ca. € 1,200.
In this alternative scenario we calculated according to statements from the insurer, that the costs related to the cases would be reduced by 70%.

In addition to the tangible benefits this prevention approach will also improve the workers motivation.

	Scenario 1	**Scenario 2**	**Scenario 3**
Net Present Value	-382.75	7,210.11	23,411.59
Profitability Index	0.67	7.27	1.32
Benefit-Cost Ratio	0.9	3.5	1.2

Investing in the above-described measures the more conservative scenario 1 shows a negative NPV (profitability index: € 0.67 return for each euro invested). The more optimistic scenario 2 shows a very good result, based on the assumption that the costs of work-related absences due to allergies could be reduced by 5% during the following years. Scenario 3 requires an investment for comprehensive measures as recommended by the accident insurer and shows a positive result. The difference in the NPV between the first and the second scenarios can be explained by the little investment needed and the underlying assumption (1 versus 5%). The alternative scenario, although the investment is much higher, still shows a clear profitability and the largest savings. It can be assumed that the measures would not only reduce allergies considerably but also would improve the motivation of staff, decrease the fluctuation and lead to improved productivity.

Conclusion

In general, the case studies support the fact that investing in occupational safety and health is profitable. The economic indicators differ but the projects do result in positive net present values. Both the profitability index and the benefit-cost ratio show the positive impact of the projects. Especially when several measures are brought together into a comprehensive programme, a positive return can be expected. However, because the results of a cost-benefit analysis are influenced by many variables, they have to be interpreted carefully. It is clear that elements such as the existing OSH practice, the type of intervention, the type of company, the safety culture, etc. affect the results of cost-benefit analyses. But, the impact of all these variables cannot be excluded since they are an inherent part of tailor-made case studies.

In times of crisis, restructuring and reorganisation, management is especially focussed on cost-cutting in order to maximise profits in a competitive market. This strategy often leads to cutting the expenditures for health and safety, instead of focussing at cutting avoidable costs (such as the costs of accidents at work and work-related ill-health) that offer no added value. Furthermore, developing and implementing prevention measures should be considered as investments generating a reduction or elimination of avoidable costs linked to accidents and ill-health. In this way, investing in health and safety creates benefits - equal to the reduction of the avoidable costs – that add value to the firm. Moreover, investing in health and safety will also increase the productivity and the performance of the staff and the equipment, thus creating a double added value to the firms' profit.

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