

Quality in Prevention

Prevention balance sheets from a theoretical and empirical point of view



Final Report

Project: “Quality in Prevention”

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Sub-project 5: “Prevention balance sheets from a theoretical and empirical point of view”

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Final report, as of 30th September 2008

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1 Introductory remark

Our world of employment is currently in a phase of dramatic changes. The success and survival of a company depends more and more on motivated, skilled and healthy employees. The impacts of workplace prevention measures (occupational safety and health protection measures) boost productivity. They increase job satisfaction as well as employee motivation, and facilitate product innovation, better quality products and prevent as many stoppages as possible. These factors have not yet appeared on any balance sheet. For this reason, this project – “Prevention balance sheets form a theoretical and empirical point of view” – will attempt to determine, if corporate investments in prevention work, not only fulfil statutory regulations but are also “worthwhile” economic investments. This research project is designed to set out the return on prevention work on a prevention balance sheet. This is based upon a comparison of company spending on prevention work and its benefits.

Company analyses on investments in prevention work are not easily conducted because the impacts are difficult to assess and the monetary benefits cannot be directly calculated. Attempts to analyse and evaluate prevention work from a business point of view are therefore scarce and those which do exist are often debatable. A company analysis is however a requirement if evidence of its success is to be produced. Prevention work will not receive sufficient credit and support, until sufficient comprehensible evidence can be produced to prove its corporate benefits.

Traditionally, investment balance sheets compare the income and expenditure of investment alternatives. They are limited to using monetary values regardless of whether they are describing static or dynamic balances. Impact analyses take things a step further. They facilitate the evaluation of the efficiency of measures and contribute to a rational-efficient allocation of corporate resources. Impact analyses can also use both monetary and non-monetary values. Prevention balance sheets are based on impact analyses, even the final value should be a monetary one.

The prevention balance sheet will be subsequently developed and then empirically tested. To ensure the most extensive description possible of the effects of corporate

prevention work, a preliminary survey will be carried out to analyse the non-monetary values and a main survey to analyse the monetary values. Those companies involved in the survey participated voluntarily and were chosen by means of positive selection, which will have a favourable impact on the representativity of the results.

2 Accounting theory status

2.1 Business accounting

Business accounting describes the financial success of a company at the end of the year. It is one of the components of a business' accounting system. A corporate accounting system uses tried and tested modelling, which is oriented towards the accounting targets and information demands of the accountants.

According to static accounting theory, the annual balance of accounts should describe the assets and arrears of the company as of a specific date, by means of a balance sheet. By comparing the evaluated assets on one side and the arrears on the other side, the existing net assets can be calculated and the composition of such can also be shown. The dynamic accounting theory was discovered by Eugen Schmalenbach. It mainly shows a balance sheet and respectively the profit and loss account of the annual balance of accounts within comparable timeframes. To evaluate profit for the period, receipts and expenditures are divided up into periods which then leads to the evaluation of revenue and expense.

The aim of a profitable company is reflected in its accounting system; the aim being to achieve the best possible financial success. Due to this biased focus of the accounting system on financial success, which is a profit or loss, the targets and provision of benefits of a company, for example, remain unconsidered. On account of a lack of focus on societal factors, the company's increasingly important social responsibility will be considered questionable.

2.2 Societal accounting

Societal accounting proves that corporate activity can have both beneficial (social benefits) and disadvantageous (social costs) impacts on society as well as the environment, in monetary terms which are not covered by the conventional method of business accounting (Eichhorn 1974). An estimation of payment reserves would be a possible method to evaluate the monetary value of these external effects.

The concept of a balance sheet containing company social factors, highlights that a company needs to disclose not only its financial results but also its societal results (social net benefits and net losses), in the interest of its social responsibility. Business accounting can therefore be extended to include societal aspects. However, this initiative founded in the 1970s, remains to be primarily a theory. An underlying reason for this could be that the aim of a (capital market oriented) company is not to achieve social success but rather to achieve financial profit. Increasingly though, consistent backing of social responsibility is required. Methodical problems as well as complex and ambiguous cause and effect relationships make the compilation and evaluation of such external effects even more difficult. Furthermore, on the overall economic scale, there is not only a lack of incentives but also of internalisation and externalisation strategies, these being strategies which support the desired social behaviour of a company.

2.3 Environmental accounting

On an environmental balance sheet (relevant developments since the 1980s), there is a breakdown of input and output quantities for a particular object of study, within a fixed period. The amounts of material and energy used are listed under inputs and the products, as well as material and energy emissions, are documented under outputs. Further monetary evaluations of environmental use and consumption (environmental costs) as well as environmental benefits are conceptually more oriented towards societal accounting.

3 Corporate return on prevention

3.1 Return on prevention categories

3.1.1 Direct and indirect categories

The return on prevention can be divided into direct and indirect categories (see Table 1). The net return on prevention crops up, for example, in the changing productivity of the company. Productivity is a matter of a dimensionless (and value-free) ratio, which is why it's ideal for inter-company and cross-industry observations. The monetary evaluation of the net return on prevention can result directly from business costs and benefits or indirectly on a basis of changing productivity.

(Net) Return on Prevention	
Direct Categories (Examples)	Indirect Categories (Examples)
Prevention of accidents in the workplace Prevention of occupational illnesses Prevention of work-related health risks	Promotion of sustained focus on quality and better quality products Promotion of product innovation Increased employee motivation and satisfaction Prevention of wastage and a reduction of time spent catching up after stoppages Prevention of stoppages
Changing company productivity / monetary return on prevention	

Table 1: Direct and indirect categories of return on prevention

3.1.2 Hard and soft categories

A differentiation between “hard” (monetary) and “soft” (non-monetary) categories is also possible (see Table 2). Without the need of an evaluative comparison and irrespective of any consideration of operationalisation, the return on prevention can be examined from a different perspective.

(Net) Return on Prevention	
“Hard” Categories (Examples)	“Soft” Categories (Examples)
Costs avoided through a reduced number of accidents in the workplace	Development of human resources
Costs avoided through a reduced number of occupational illnesses	Promotion of sustained focus on quality and better quality products
Costs avoided through a reduced number of work-related health risks	Promotion of product innovation
Costs avoided through a reduced number of stoppages	Increased employee motivation and satisfaction
Costs avoided through less wastage and a reduction of time spent catching up after stoppages	Improved communication
Changing company productivity / monetary return on prevention	

Table 2: Hard and soft categories of return on prevention

3.2 Performance Indicators

3.2.1 Qualitative return on prevention

The qualitative return on prevention is measured using non-monetary values (e.g. a points system). For instance, those indirect, soft performance indicators, which are used in the interview (see Section 5), can be evaluated using a graded scale. Whether it is better to use an even or odd number of answer options, cannot be determined empirically. The advantage of an even scale is that a “tendency towards the centre” and therefore the interviewees’ indecisiveness can be avoided. The disadvantage of an even scale is that nothing can be evaluated as having a middle value, if that’s how the interviewee’s opinion should actually be communicated. An even scale works particularly well for a survey on soft categories, as it helps bring about decision-making moments and prevents obvious “comfortable” answers, which tend towards the centre.

3.2.2 Quantitative return on prevention

The quantitative return on prevention is calculated using monetary values. In order to calculate the monetary values of the direct, hard performance indicators, a willingness-to-pay approach is used. This approach uses an evaluation technique,

which determines the maximum amount of money an individual is prepared to pay, to achieve a specific benefit from workplace prevention measures (Graf von der Schulenburg et al. 1998, p.194). Those companies selected for interview (see section 5) must prove themselves to be open and willing to give information in order to calculate the willingness-to-pay figure. Furthermore, the interviewees must have a certain ability to think abstractly. This is so that they are able to express those changes which have resulted from prevention measures, in monetary values. In this context, this opened ended interview technique is helpful because an open question can be posed, determining a value of money which does not have a preset limit (Johansson 1993, p.52 et seq.). Where necessary, a guideline can be provided to help guide the figure. Ideally, the answers given in the interview will directly reflect the maximum sum one is willing to pay (Johannesson/Jönsson 1991).

3.3 Productivity and return on prevention

Optimum use of available resources is necessary to increase company value. Resources could be understood to mean favourable working conditions, which would mean that employees remain capable of the task at hand, despite pressures in the workplace. A difference could be noted between inner resources (e.g. physical and mental skills, specialist skills, human skills) and outer resources (e.g. ergonomic, organisational, social and technical actions). Inner and outer resources are not to be considered independent from one another. For the establishment, adoption and maintenance of helpful and trusting relationships, inner and outer resources are necessary. Workplace resources hold a lot of significance in the areas of condition oriented job design and behavioural oriented health promotion.

The productivity ratio can be used to describe the performance ratio of resources. Productivity illustrates the yield of the corporate factor combination. It is calculated from the relationship between quantitative profits (output) and required quantities (input). Value and labour productivity describe the relationship between output and the input of capital and employment. "Prevention productivity" could be an appropriate term used to describe the ratio of quantitative prevention benefits to prevention input.

The ratio “return on investment” (ROI) measures return on invested capital. This leads to the term “return on prevention” (ROP) being coined for the use of this project. The use of this ratio to describe the return on prevention illustrates how worthwhile it is for a company to spend additional capital on prevention work. Spending denotes the investment volume. The return on prevention is calculated as follows:

$$\text{Return on Prevention} = \frac{\text{Returns on Prevention Work (Prevention Benefits)}}{\text{Spending on Prevention Work (Prevention Costs)}}$$

4 Prevention balance sheet theory

4.1 Theoretical balance sheet funding

Theoretical balance sheet funding is the discussion of the accounting purpose, accounting target groups and the accounting and evaluation standards as well as the interpretation of the closing figures. The purpose of calculating the return on prevention is to be able to justify the benefits of prevention work, with the aim of motivating companies to invest in this work. The recipients of a prevention balance sheet are primarily the employers, but also the employees, the work councils, safety officers and safety experts as well as official accident insurers. Prevention accounting takes into account, corporate prevention work as a whole. An integrated perspective on the company increases the significance of prevention work within the company. Accounting and assessment imply a monetary evaluation of quantitative and qualitative impacts. This results in a monetary return on prevention, set out as a comparison of prevention costs¹ and prevention benefits², which in turn results in a relative return as opposed to an absolute return. It depends on the economic framework requirements, how this will compare on the markets, in terms of expense and cost. This means the return on prevention does not express a financial profit or loss, but rather the bearing and power that the prevention work has on the company's success.

4.2 Accounting and evaluation

The prevention balance sheet is defined as a comparison of a company's spending on prevention (input), against the benefits a company gains from prevention work (outcome), within a fixed period. It does not take the form of a traditional balance sheet, but rather that of a special type of balance sheet. It determines the return on prevention within a fixed period. There are no costs or income for prevention benefits. Therefore they need a unique method of "prevention" accounting and evaluation. The prolonged impacts of corporate prevention work and the resulting benefits cannot be divided up over multiple periods. Due to a lack of cardinal

¹ Prevention costs: company spending on prevention work

² Prevention benefits: monetary benefits within a company, resulting from prevention work

measurability, the prevention benefits have to be estimated using a previously approved method.

Corporate prevention costs are the amounts of money spent on occupational safety and health protection. Table 3 shows the most significant components of a company's spending on prevention work. This statement of costs was confirmed by previously conducted interviews. In doing so, problems arose in trying to differentiate between primary and secondary costs of prevention. Primary prevention costs fall directly on occupational safety and health protection (e.g. purchase of protective equipment). Secondary prevention costs are more so internalised (primary) prevention costs (e.g. purchase of safety certified machinery). Secondary prevention costs are not so easily noted because they are generally costs, which are considered standard to maintain the normal level of security, without incurring additional costs for the need of occupational safety and health protection. If possible, it would be best to carry out a second survey, which would make a cost comparison between comparable safety-certified and non-safety-certified equipment. By way of example, the components of company prevention benefits are detailed in Table 4.

Workplace prevention costs	Costs in € per employee per year
Cost of personal protective equipment (e.g. ear defenders, boots, work clothes)	_____
Cost of company medical support and guidance on safety technology (e.g. in-house/external safety experts, in-house/external occupational physician, documentation)	_____
Payroll costs of safety officers excluding company medical support and guidance on safety technology	_____
Cost of specific prevention training measures (e.g. initial and ongoing training of safety experts and officers, safely securing loads, forklift trucks, time-off for first-aid training)	_____
Cost of preventive medical check-ups	_____
Organisational costs (e.g. additional costs associated with ensuring that production methods meet health and safety requirements, percentage of health and safety management system costs)	_____
Investment costs (e.g. percentage written off for safety technology and workplace organisational measures required for prevention measures)	_____
Start-up costs (additional health and safety costs involved during production start-up or during introduction phase of prevention measures)	_____

Table 3: Overview of company prevention costs

Workplace prevention benefits	Value in € per employee per year
Cost savings through prevention of stoppages (e.g. productive working days gained, prevention of delayed deliveries and high costs due to production downtime)	_____
Cost savings through prevention of wastage and reduction of time spent catching up after stoppages (e.g. prevention of high wastage and high costs due to catching-up time, generated by the reduction of working days lost due to accidents or illnesses)	_____
Added value generated by increased employee motivation and satisfaction (e.g. employee driven initiatives to purchase better personal protective equipment, resulting in a more positive working climate and increased motivation)	_____
Added value generated by sustained focus on quality and better quality products (e.g. occupational safety as cross-sectional task and catalyst for extensive quality management)	_____
Added value generated by product innovation (e.g. technological development of products according to safety-related demands)	_____
Added value generated by better corporate image (e.g. positive perception among customers and distributors)	_____

Table 4: Overview of company prevention benefits

Figure 1 demonstrates the general composition of a prevention balance sheet. In the models used up until this point, the prevention costs have been differentiated from the prevention benefits. Prevention benefits can be quantitatively or qualitatively measured. Direct and indirect impacts should also be differentiated from one another. Quantitative impacts (e.g. change in hazard awareness) lead to directly measurable prevention benefits. This arises, for example, due to changing wastage and catching-up rates or due to the number of stoppages. Businesses which have the appropriate figures available in their business statistics, can express the prevention benefits in monetary values, through the monetary evaluation of the changes of these figures. Qualitative impacts (e.g. changing business culture) lead only to indirectly measurable prevention benefits. Examples of this, are that employee motivation and satisfaction increases, product quality improves, there is more product innovation and corporate image is improved. The corresponding monetary benefit values can only be measured indirectly, by willingness to pay, for example.

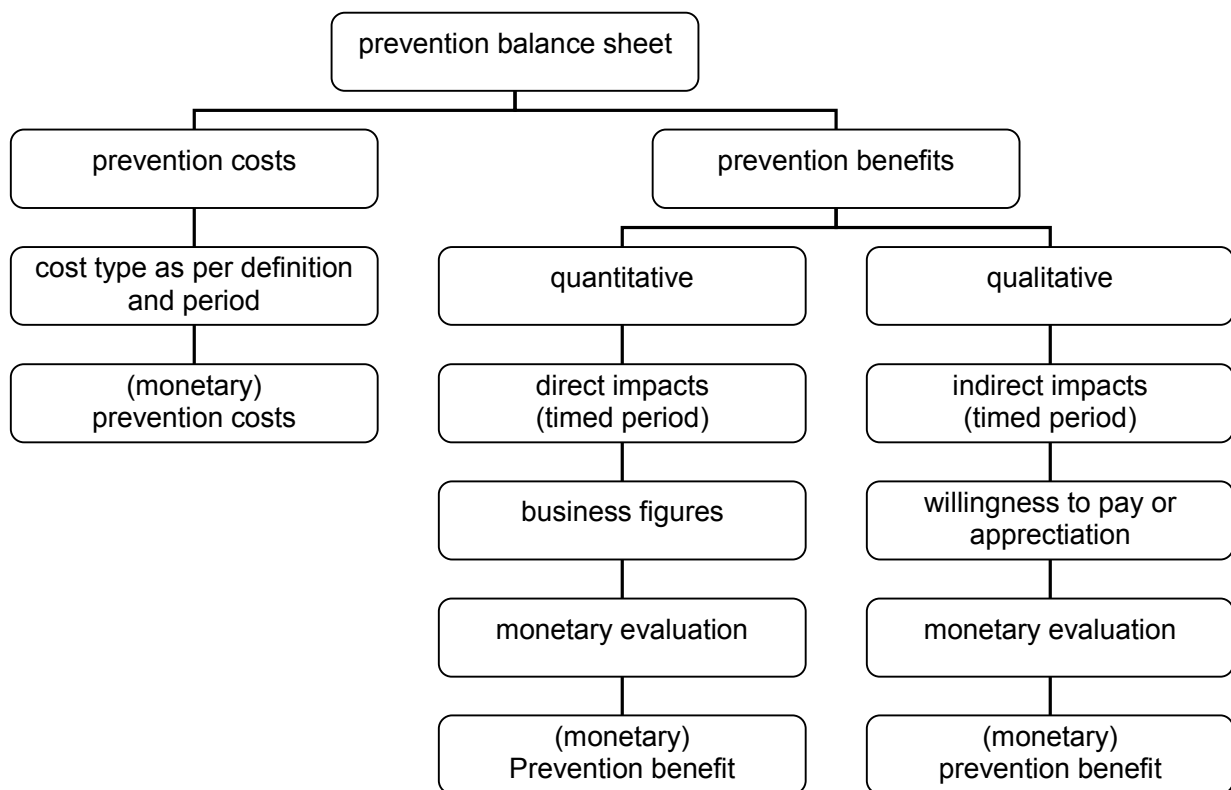


Figure 1: General composition of a prevention balance sheet

The determination of qualitative prevention benefits sways towards the contingent valuation method. The main objective of this method is to monetarily evaluate soft factors (e.g. among non-marketable goods). It is achieved by calculating the willingness to pay or rather appreciation, on the basis of subjective valuations. Standard hypothetical questions used for this method, are to be implemented on the basis of their highly abstract nature and concentrated as much as possible on facts. An important question on the study of willingness to pay, could read: "Preventive measures for occupational safety and health protection cause qualitative impacts in your company (e.g. reduction of fluctuations, better quality products, better adherence to schedules, increased number of innovation and improvement suggestions, better customer satisfaction, better corporate image). What proportion (estimation) of relative and absolute return is represented by these impacts?" The sum of quantitative and qualitative prevention benefits results in a prevention benefit with a monetary value, which will then be compared to the prevention costs. The prevention balance sheet describes the results according to the gross coverage principle and calculates the return on prevention as a bottom line figure. Further evaluations could become a future part of prevention controlling.

4.3 Accounting problems

Incidents can only be recorded and described if they have actually taken place. However, through company prevention work, these incidents (e.g. accidents, occupational illnesses, stoppages, time spent catching up after stoppages) can be prevented. Therefore, the compilation, measuring and evaluation of the impacts of company prevention work (as a basis for hypothetical feedback on the prevention net benefits as well as the return on prevention) can only be indirectly carried out and with the help of compensation values (e.g. by means of subjective estimates). In the case that a cardinal figure cannot be listed under the benefits side, then an ordinal description of the impacts is advisable. The results of a prevention balance sheet must be respectively analysed in accordance with the model-specific conditions.

Technical and temporal attribution problems arise in prevention accounting; these problems can be attributed to an ambiguous causal nexus between corporate

prevention work and return on prevention. For example, they could correspond to interaction with recognised safety standards and to economies of scope of technological advances. Furthermore, the long-term nature of the impacts of corporate prevention work makes the allocation of prevention benefits to individual periods more complicated. To solve these attribution problems, it is necessary to use a goal-oriented model again. However, this method must be treated with caution, in order that the simplification of complex relations does not lead to distortion.

4.4 Accounting methods

The use of objective and subjective evaluation methods comes into question, to be used as a theoretical basis for the monetisation of the effects of prevention work.

Both the human capital approach and the friction costs approach are counted among the objective evaluation methods. Both approaches are based on the evaluation of the loss of productivity due to stoppages. With the human capital approach, manpower is considered to be an economic good. The evaluation is carried out using the opportunity cost principle. Earned income is used as a gauge for opportunity costs. An alternative form of the human capital approach is the friction costs approach. It tends to prevent the overassessment of productivity loss, by assuming a productivity loss per absent employee and period of illness for the average duration that a position remains unoccupied (Graf von der Schulenburg et al 1998, p.42 et seq.). Within the domain of prevention accounting, both approaches could be implemented to assess savings made by prevention work through the reduced number of stoppages. On the one hand, an advantage of these approaches is their simple application in the workplace. Income statistics allow for a quick calculation of opportunity costs. On the other hand, these approaches are still disputed because the economic benefits of manpower are evaluated according to income. However, it is often the case that income does not justly reflect the efforts of individuals and the work they do. An example of such is the differences in rewards which still exist between men and women, despite their having identical qualifications and professions (Graf von der Schulenburg et al 1998, p.56 et seq.). For this reason it is preferable to use the subjective method for prevention accounting.

Two subjective approaches are the contingent valuation method and the revealed preference method. The contingent valuation method is a survey or rather an interview technique (Johansson 1998, p46). It attempts, in contrast to the revealed preference method, to more or less interview persons directly. In this way, the contingent value method uses direct approximation and asks how much one is prepared to pay for the benefits achieved by prevention work (e.g. benefits generated by hypothetical safety improvements), as well as how much financial compensation one would expect to receive for the tolerance of disturbances (e.g. increased risk) (Johannesson et al 1991, p8). The revealed preference method deduces an individual's preferences through observable activity (anon. 1988, p.1939). To determine the preferences of the individuals, the hedonic demand theory can be used (Pearce/Turner 1992, p.10 et seq.). This method also attempts to find situations in which persons use income and capital to reduce physical risks. This can lead to the rejection of information on a risk and reward premium in relation to the willingness-to-pay for the reduction of physical risks (Jones-Lee 1993, p.916). The revealed preference method relies on factual information, unlike the contingent valuation method, which is based on hypothetical activity. This is empirically advantageous for the revealed preference method, as it is likely to positively affect its approval as a valid approach. It does however have a disadvantage, an example being that wage rates are not only dependent on job risk. Therefore it is necessary to monitor other influencing factors (e.g. availability and shortage of labour with differing qualification) when evaluating these relationships. The contingent value method and revealed preference method are suited to prevention accounting and therefore come into use, but only once they have been slightly modified.

A problem that occurs often in prevention accounting is that of temporally undetermined, complex cause and effect relationships. These require an analysis of impact dimensions. Therefore a horizontal analysis with a comparative static view (differing methods of implementing prevention work) is required as well as a vertical analysis with a comparative dynamic view (temporal development of the effects of prevention work). This outlines the former cross-sectional study based on an intercompany comparison and the latter longitudinal study based on time comparison.

The relationship between corporate prevention work and the prevention benefits requires an impact-based analysis of causal dependencies between defined characteristics (variables). Thereby on the basis of a hypothesis system, theoretically constructed relationships can be empirically examined and relationships between returns on prevention can be identified, with the help of exploratory statistics. As a multivariate analysis method, correlation analysis comes into operation. Correlations (e.g. between prevention work and productivity, costs or qualities) are gauges for linear relationships. For regression analysis, the relationship between one dependent and one or more independent variables, is observed. Thereby it is assumed that all variables can be measured on a metric scale. A variance analysis is applied, if the dependent variable is measured on a metric scale and the independent variables on a nominal scale. A discriminant analysis is implemented, if the dependent variable is measured on a nominal scale and the independent variables on a metric scale. Another group of methods, which analyse relationships between variables which are solely nominal, is known as contingency analysis. With the help of further procedures, for example logit analysis, the dependency of a nominal variable from several nominal influencing variables can be examined.

The fore mentioned analysis methods all assume that all variables are observable and measurable. However among many theory-assisted questions, unobservable variables emerge. These are the so-called hypothetical constructs or latent variables. In such cases, a LISREL-analysis comes into play (Backhaus et al 1994).

Independent of the determination of dependencies, performance indicators can also be identified with the use of the Poisson regression model. It is suited to the gathering of incident data, for incidents which have not take place. Poisson distribution is effective for rare incidents, which independently take place. Such models are important for the developing prevention balance sheet because the decrease in accidents due to prevention work must be noted, in order that such rare incidents can be discussed. In a study entitled “Zero-inflated Poisson regression with random effects to evaluate an occupational injury prevention programme”, this method is demonstrated (Yau/Lee 2001).

4.5 Accounting principles

The general accounting principles of corporate accounting (e.g. clarity and completeness) can fundamentally also be assumed for a prevention balance sheet. However, the transfer of specific corporate accounting principles (e.g. cost method principle, recognition of loss principle and realisation principle) is not possible due to lacking financial orientation. As specific accounting principles for prevention accounting, the interview and operating principles for assessment and evaluation of prevention costs and benefits is recommended. These procedures recall social accounting approaches.

5 Empiricism of prevention accounting

5.1 Preliminary survey

5.1.1 Purpose

Companies “invest” in corporate prevention work. The term “corporate prevention work” will be used here to mean anything from prevention measures to occupational safety and health protection. Measures of occupational safety and health protection should directly prevent breaches of health and safety regulations, potential hazards as well as the resulting accidents and illnesses. This does not only have a positive effect on employees, but also indirectly on productivity and the company’s operational success.

The aim of a preliminary survey should be to determine the primary direct and indirect effects of corporate prevention work. For this purpose, a non-monetary description is sufficient. The following main survey will then build on the findings of the preliminary survey as well as pursuing the ongoing target of monetising the return on prevention.

5.1.2 Methodology

The interview-style preliminary survey identifies how companies evaluate their prevention work. The main emphases of the questionnaire (see Appendix 4) are:

- the assessment of the influence of corporate prevention work in individual areas of operation within the company,
- company statements on direct and indirect returns on prevention,
- the evaluation of current prevention work taking place within the company.

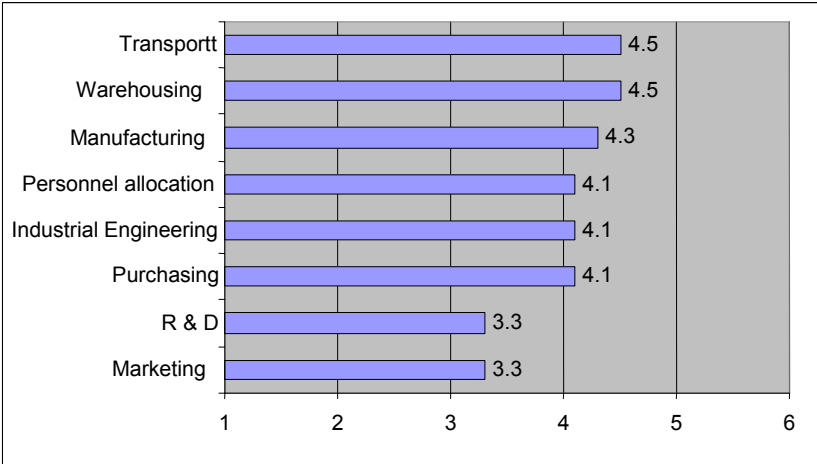
At the beginning of 2007, with the collaboration of the Berufsgenossenschaft for the precision engineering and electrical industry in Cologne (Berufsgenossenschaft der Feinmechanik und Elektrotechnik, Köln), 390 sets of data were collected. The interviewees were made up of the following: 64% safety experts, 24% personnel (members of staff who do not belong to any other group), 6% safety officers, 5%

members of the works council and 1% employers. They work in the following industries: 73% industry, 18% construction and 9% trade.

5.1.3 Findings

a) Strength of impact of corporate prevention work

The first topic to be examined is the strength of impact of workplace prevention measures in the individual areas of operation within the company. The answers were based on an ordinal scale ranging from 1 to 6 (1 = no impact, 2 = small, 3 = more than small, 4 = less than strong, 5 = quite strong, 6 = very strong). Figure 2 illustrates that corporate prevention work is most influential in the transport and warehousing areas of operation, whereas in the research and development (R & D) areas as well as marketing, it has least impact.



Annotation: 1 = no impact ... 6 = very strong impact

Figure 2: Impact of corporate prevention work in company areas of operation (preliminary survey)

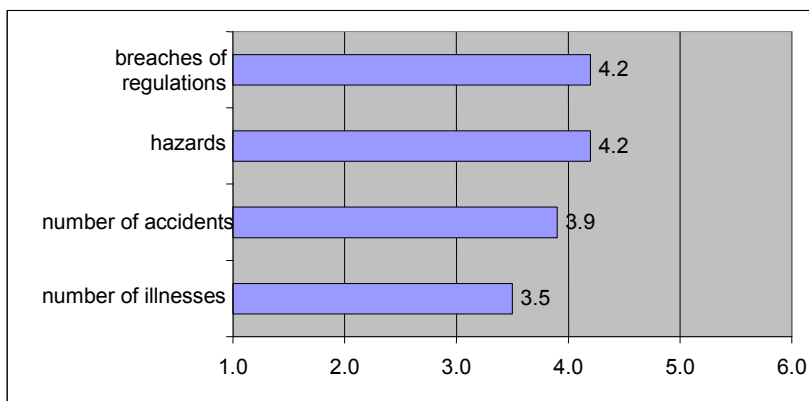
As a further example, the relationship between the significance of prevention work in the transport operations area and its evaluation throughout the company is examined. This appears as a statistically provable relationship ($r=0.45$), that translates as the greater the influence of prevention work in the transport operations area, the better the evaluation of prevention work in that area.

b) Return on prevention

a) Direct return on prevention

To investigate the direct returns on prevention, interviewees were asked to evaluate the following statement: “Due to corporate prevention work, the number of hazards, accidents, illnesses and breaches of regulations has been directly reduced.” In order to evaluate the statement, interviewees were again asked to use the ordinal scale ranging from 1 to 6 (see above).

Figure 3 shows that workplace prevention measures mainly lead to a reduction of breaches of regulations and hazards. Moreover, it can be proved using Spearman’s correlation analysis that all four direct returns on prevention are related positively to the current prevention work taking place within the company. The greater the direct return on prevention, the more positive the evaluation of the corporate prevention work within the company.



Annotation: 1 = no impact ... 6 = very strong impact

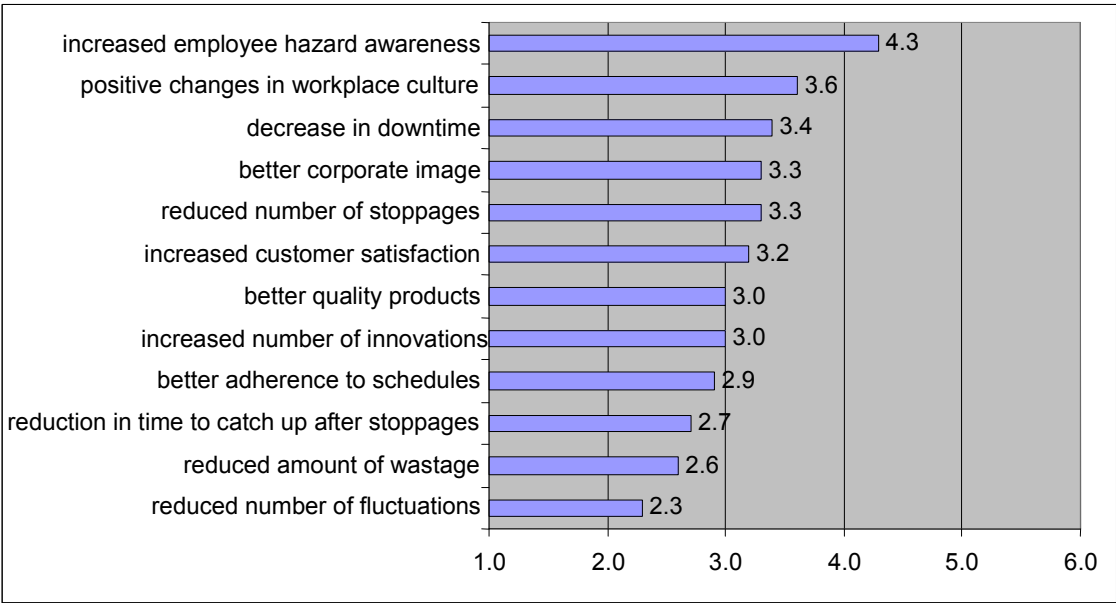
Figure 3: Direct return on prevention (preliminary survey)

β) Indirect return on prevention

To investigate the indirect return on prevention, interviewees were asked to evaluate the following statement: “Due to corporate prevention work, a number of indirect changes have taken place, such as a reduced number of fluctuations, a reduced number of stoppages, a decrease in downtime, a reduction in the amount of wastage,

a reduction in the time needed to catch up after stoppages, better quality products, better adherence to schedules, an increase in the number of innovations and suggestions for improvements, increased customer satisfaction, better corporate image, a positive change in workplace culture as well as increased employee hazard awareness.” Answers are again scaled on an ordinal scale from 1 to 6 (see above).

Figure 4 illustrates the significance of prevention work, in particular for the improvement of hazard awareness. Positive effects on company atmosphere, downtime, corporate image, stoppages, customer satisfaction, product quality and innovation are also evident.



Annotation: 1 = no impact ... 6 = very strong impact

Figure 4: Indirect return on prevention (preliminary survey)

c) Evaluation of current prevention work

The next topic of interest is how current prevention work is valued within a company. The answers are scaled using the terms “very good”, “good”, “satisfactory”, “sufficient”, “insufficient”, and “poor”. Afterwards, interviewees are asked in what way additional investments in prevention work could impact company costs in the long-term. The answers are recorded using the terms “increase”, “remain constant” and “decrease”. Following this, the changes (decrease or increase) in company costs are assessed. The scaling of these responses are again based on an ordinal scale, this

time using the terms “very low”, “low”, “more than low”, “less than high”, “high” and “very high”.

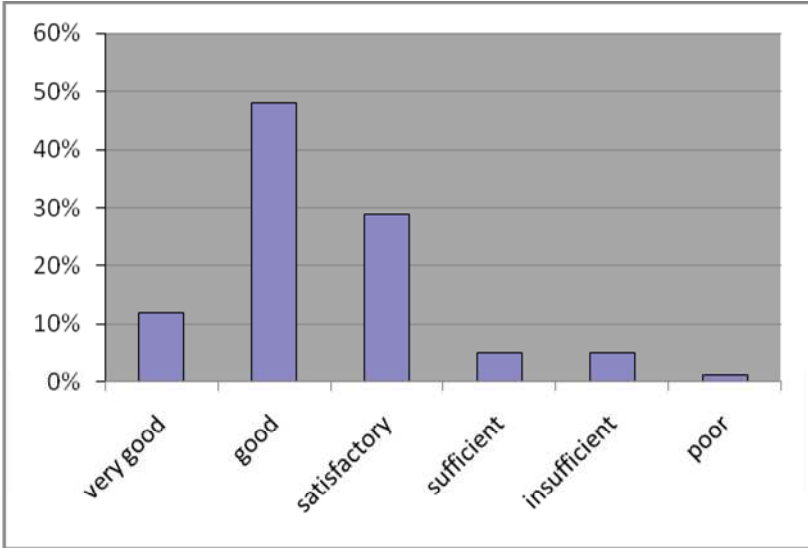


Figure 5: Evaluation of prevention work within the companies (preliminary survey)

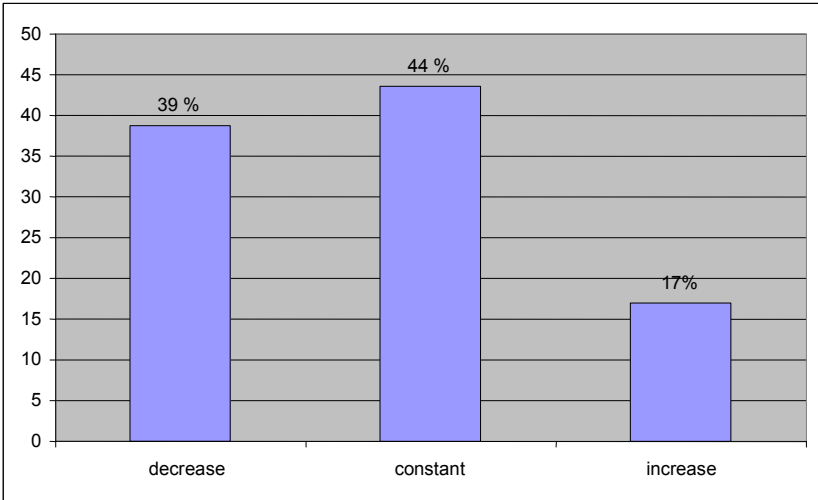


Figure 6: Long-term changes in company costs with additional investments in prevention work (preliminary survey)

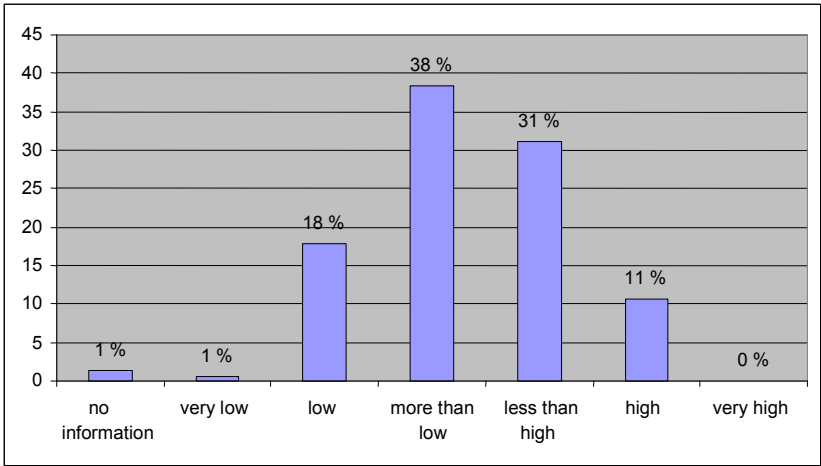


Figure 7: Reduction in company costs (preliminary survey)

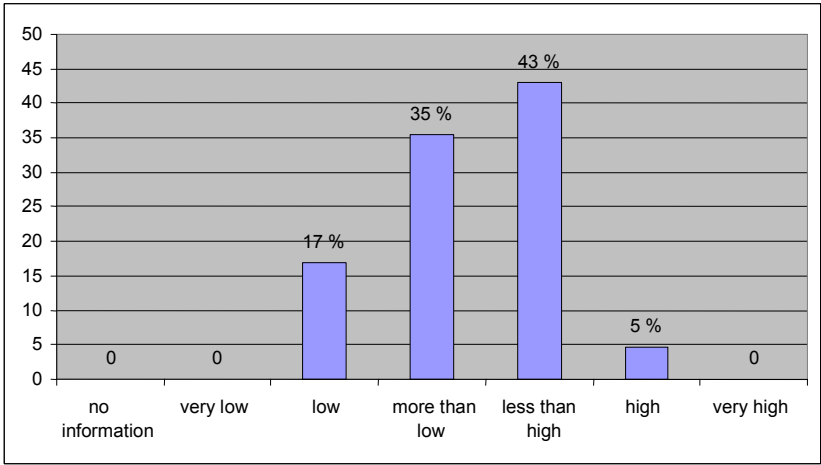


Figure 8: Increase in company costs (preliminary survey)

Figure 5 shows that more than half of the interviewed companies, rate prevention work as very good or good. According to figure 6, 44% of the interviewees assume that with additional investments in prevention work, company costs will remain constant, whereas 39% believe costs will decrease and 17% think costs will increase. Figure 7 provides information on the magnitude of the expected cost decreases. According to figure 7, 57% reckon cost decreases will be very low, low or more than low and 42% reckon they will be less than high or high. Figure 8 shows that 52% of interviewees assume an increase that will be low or more than low and 48% count on a less than high or high cost increase.

Prevention work is a major cornerstone for occupational safety and health protection within a company. These facts confirm the non-monetary results of the preliminary survey. In particular, they are clear proof of the intended effects of corporate

prevention work within the companies. However, to investigate the monetary return on prevention, further empirical studies are required.

5.2 Main survey

5.2.1 Purpose

The aim of the main survey is to statistically determine a concrete return on prevention work. The calculated return on prevention, monetary or non-monetary can result in either a positive or negative value. By means of interviews, it should be empirically determined. The return on prevention expresses an economic potential for success. It's a matter of a generalised value which can also be calculated for a company within a certain industry, individual companies or firms. A further key requirement of the survey is the development of a methodically grounded and empirically tested procedure for the accounting of the return on prevention.

5.2.2 Methodology

The interview-form main survey describes how companies value their prevention work. Personal interviews are a suitable form of questioning technique to be used, due to the complexity of the questions. Although the interview is abstractly addressed at a company (and not at individual persons or groups within the company), for practical reasons, selected company members have to be interviewed. These selected personnel can either be controlling employees, safety experts, employers, and their representation. In an ideal situation, all of these people take part in a collective interview. The questionnaire from the preliminary survey (see Appendix 4) will be used as well as one of the interviews based on the needs for monetisation (see Appendix 5). The interviewees belong to companies from different industries and of different sizes and structures and they voluntarily agreed to take part in the interview. The main survey therefore is a type of cross-sectional survey with positive selection.

In a statistical procedure, the representative size and composition of a control sample can be determined against the basic population. An ideal sample would be a layered random sample according to the size of the firm and if necessary, according to further

criteria. The sample for this project is however limited due to capacity and temporal reasons. All the same, the survey proves itself to be significant because thanks to positive selection, companies taking part in the survey are companies who are fully aware of corporate prevention work. Self-explanatory is the fact that the significance and representativeness of the survey results would improve with increasing survey coverage.

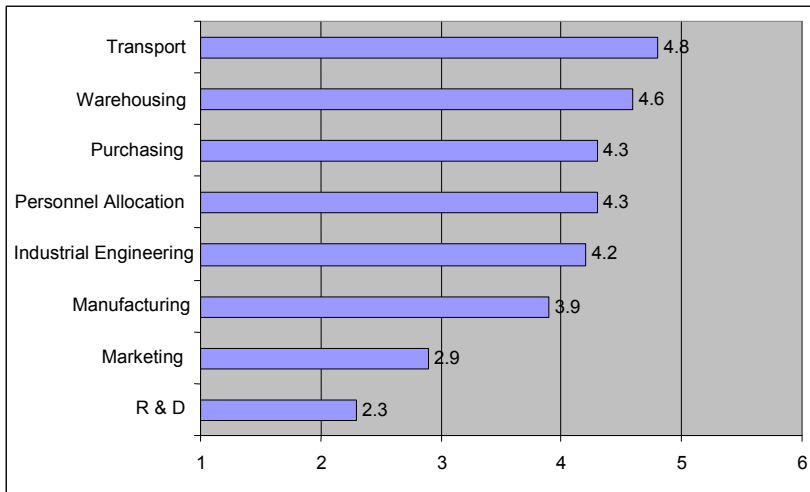
The main survey is made up of a sample from 39 large, middle-sized and small companies. They work in the following industries: construction (n=5), services (n=5), precision and electrical engineering (n=16) and the metal industry (n=13). Out of these 39 companies, 15 received personal visits. During six of the company visits, controlling employees, safety experts and employers were personally available to be interviewed. At nine of the companies, not all of the employees were available for interview. For the remaining 24 companies, the interviews took place via email and/or by telephone. All companies received interview guidelines before the interviews took place, so that they could be internally agreed and clarified.

Following this, the companies were then sent copies of the interview. The interviews took place from the beginning to the middle of March 2008. The interviewees were made up of the following professions: 52% safety experts, 23% employees, 14% employers, 9% works council members and 2% safety officers. The interviewed companies are from the following sectors: 59% manufacturing, 25% trade and 16% construction.

5.2.3 Findings

a) Strength of impact of corporate prevention work

Figure 9 shows the strength of influence of corporate prevention work within the areas of operation of the 39 surveyed companies. Answers are based on an ordinal scale ranging from 1 to 6 (1 = no impact, 2 = small, 3 = more than small, 4 = less than strong, 5 = quite strong, 6 = very strong).



Annotation: 1 = no impact ... 6 = very strong impact

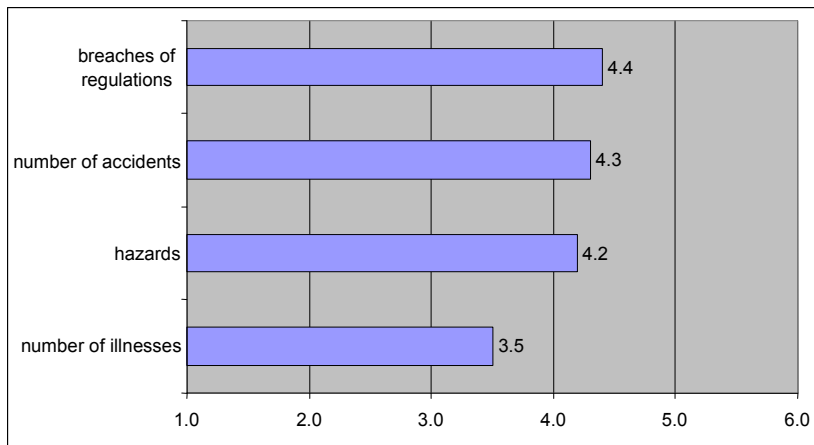
Figure 9: Strength of impact of corporate prevention work in company areas of operation (main survey)

The results of the preliminary survey (see figure 2) have been confirmed. Corporate prevention work is most influential in the areas of transport and warehousing. Its influence is weakest in the operational areas of marketing as well as research & development.

b) Non-monetary return on prevention

α) Direct return on prevention

As already carried out in the preliminary survey, interviewees were asked to evaluate the following statement: “Due to corporate prevention work, the number of hazards, accidents, illnesses and breaches of regulations has been directly reduced.” In order to evaluate the statement, interviewees were again asked to use the ordinal scale ranging from 1 to 6 (see above). Figure 10 summarises the results.



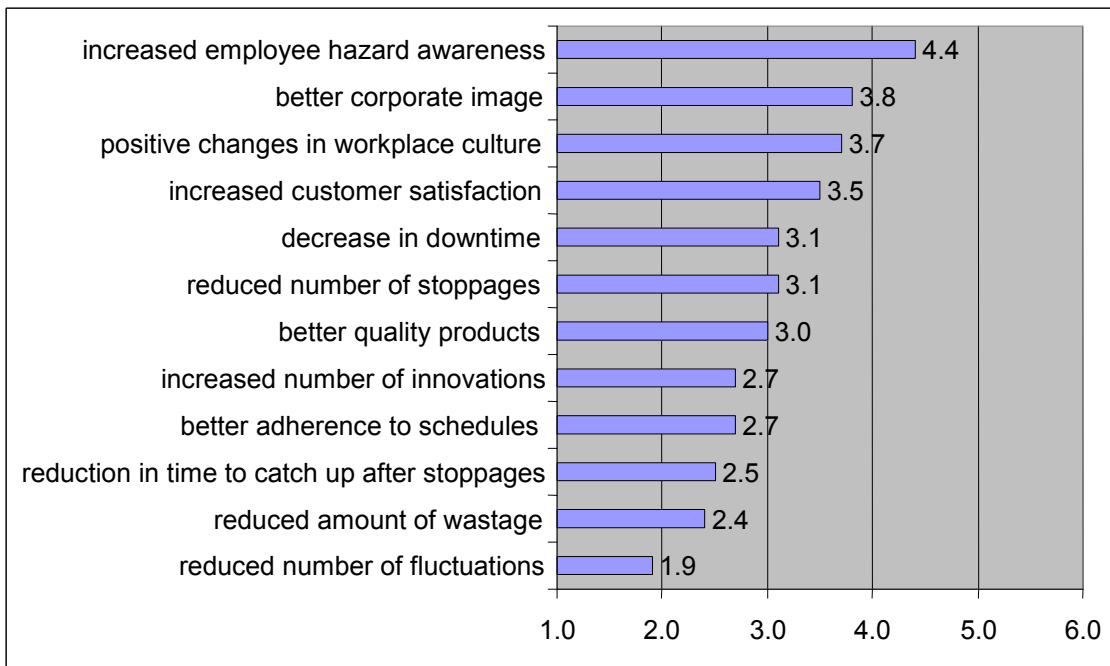
Annotation: 1 = no impact ... 6 = very strong impact

Figure 10: Direct return on prevention (main survey)

Figure 10 shows that above all, workplace prevention measures lead to a reduction in breaches of regulations and accidents, which was to be expected, according to previous results (see figure 3).

β) Indirect return on prevention

As already carried out in the preliminary survey, interviewees were asked to evaluate the following statement: “Due to corporate prevention work, a number of indirect changes have taken place, such as a reduced number of fluctuations, a reduced number of stoppages, a decrease in downtime, a reduction in the amount of wastage, a reduction in the time needed to catch up after stoppages, better quality products, better adherence to schedules, an increase in the number of innovations and suggestions for improvements, increased customer satisfaction, better corporate image, a positive change in the workplace culture as well as increased employee hazard awareness.” Answers are again scaled on an ordinal scale from 1 to 6 (see above). Figure 11 gives an overview of the results of the survey.



Annotation: 1= no impact ... 6 = very strong impact

Figure 11: Indirect return on prevention (main survey)

Figure 11 illustrates the significance of prevention work, in particular for the improvement of hazard awareness. Better corporate image, positive effects on company atmosphere, improved customer satisfaction etc. are also evident in the results. Therefore there are slight changes in the order of the given indirect returns on prevention, i.e. in comparison to the preliminary survey (see Figure 4).

c) Evaluation of current prevention work

As in the preliminary survey (see figures 5, 6, 7 and 8), an evaluation of current prevention work within the companies is now carried out. The answers are scaled using the terms “very good”, “good”, “satisfactory”, “sufficient”, “insufficient”, and “poor”. Afterwards, interviewees are asked in what way additional investments in prevention work could impact company costs in the long-term. The answers are recorded using the terms “increase”, “remain constant” and “decrease”. The magnitude of changes of corporate prevention costs is then evaluated with the terms “very low”, “low”, “more than low”, “less than high”, “high” and “very high”.

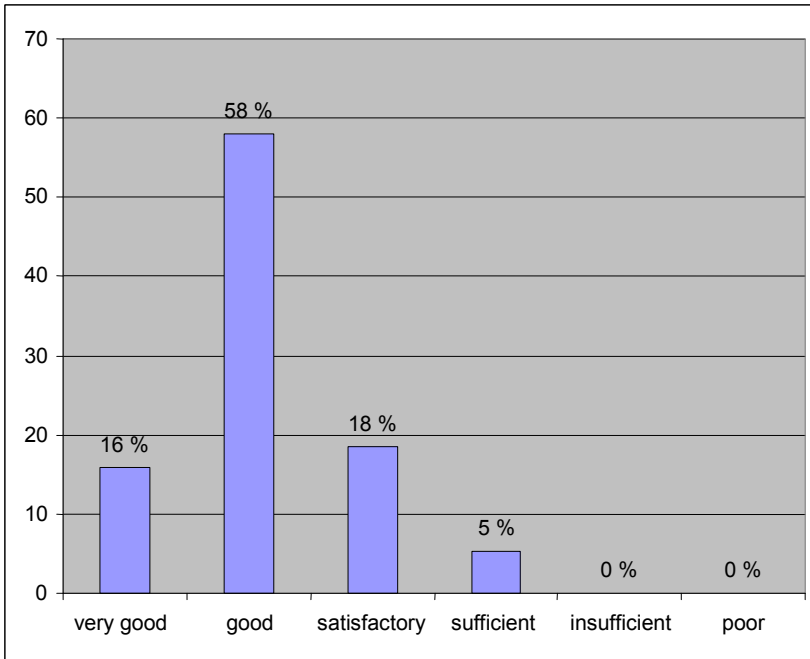


Figure 12: Evaluation of prevention work within the companies (main survey)

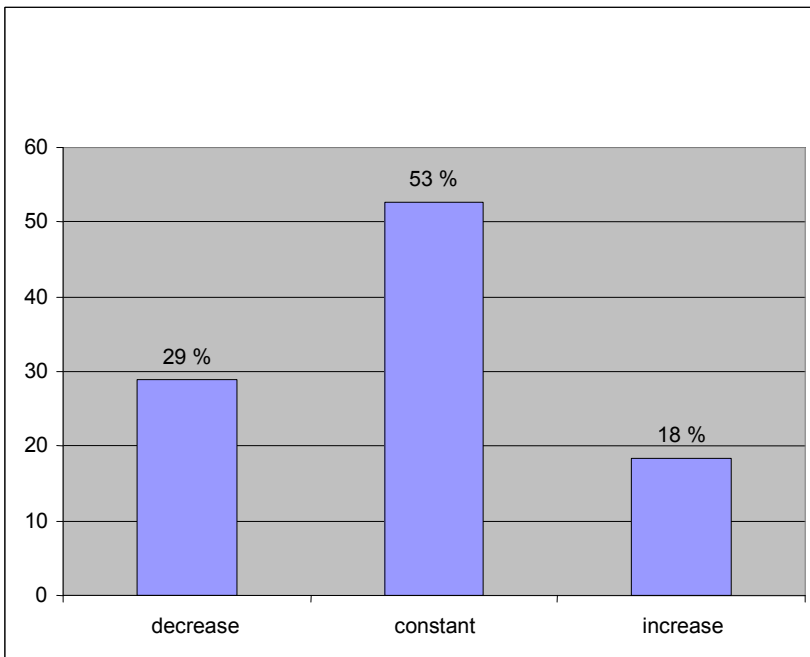


Figure 13: Long-term changes in company costs with additional investments in prevention work (main survey)

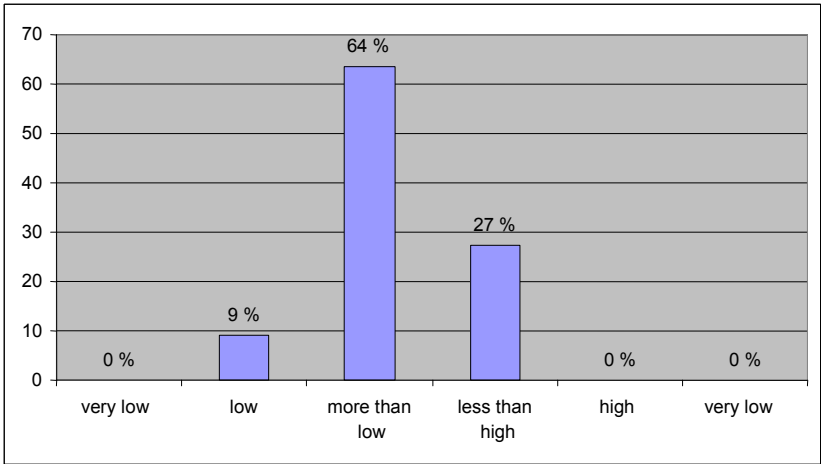


Figure 14: Reduction in company costs (main survey)

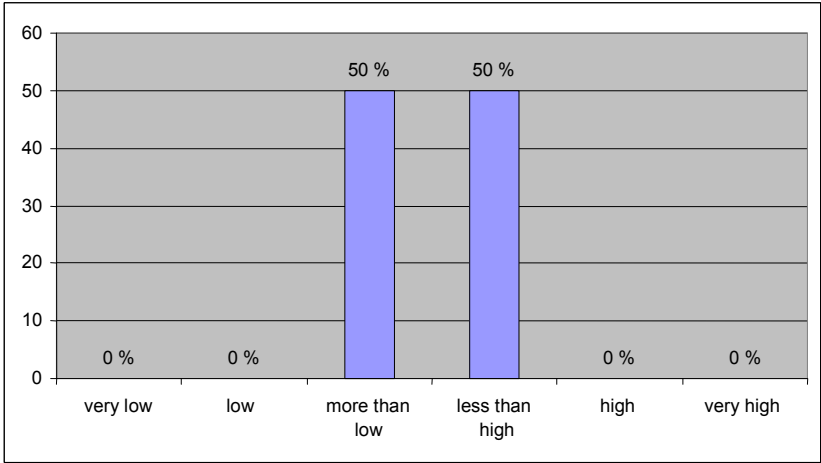


Figure 15: Increase in company costs (main survey)

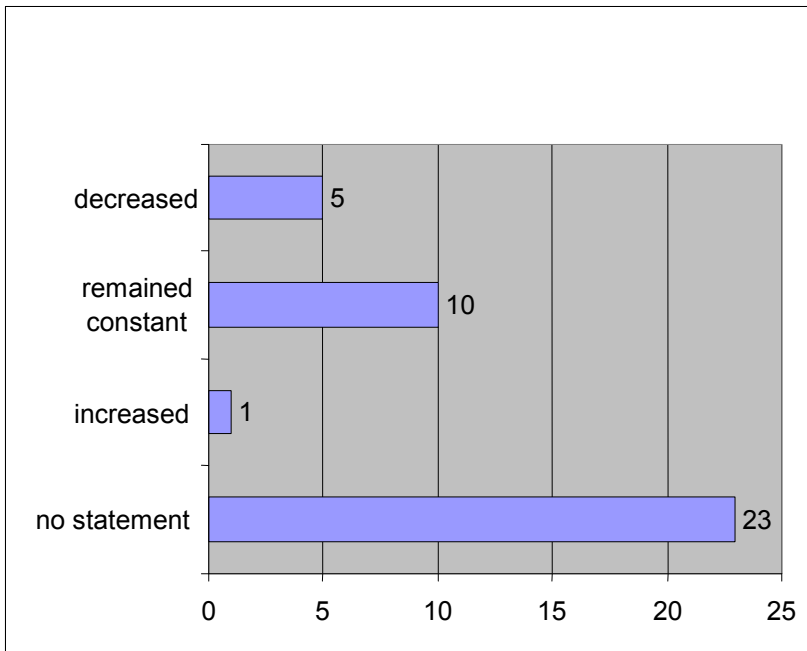
Figure 12 clearly shows that among the given positive selection, almost 75 % of all surveyed companies rate prevention work as very good or good. According to figure 13, 53% of surveyed companies assume that additional investments in prevention work will cause business costs to remain constant, 29% expect costs to decrease and 18% expect increased costs. Figure 14 illustrates that among those companies who expect decreasing business costs, 73% expect the decrease to be low or more than low and 27% believe it will be less than high. Figure 15 shows that among companies who assume business costs will increase, that 50% expect the increase to be more than low and 50% expect it to be less than high.

d) Monetary return on prevention

Corporate prevention costs are the money which a company pays out for occupational safety and health protection. Table 3 highlights the different components (types of costs) of these costs, which are relatively easily determined through means of a survey (see below). However the corporate prevention benefits prove more difficult to determine, due to their highly abstract nature. It is most favourable for the company to quote an aggregate benefits value, which encompasses all impacts of prevention work. Therefore a differentiated method is required. In the cases, where the interviewees are unable to quote a prevention benefit figure, an operationalisation will be targeted with the help of benchmarks.

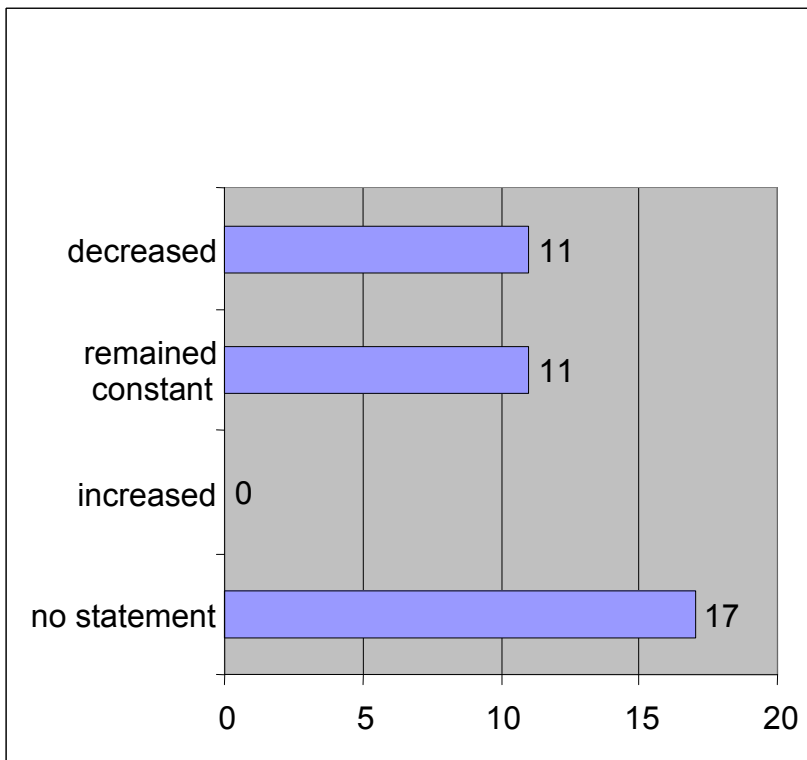
As a first approach to determine the prevention benefit, it is recommended to consider those relevant corporate ratios (e.g. wastage and catching-up quota, number of stoppages, labour productivity) which have changed due to corporate prevention work. Interviewees will be asked about relative ratio changes and the monetary value of these changes for the company. The desired monetisation cannot be generated from any of the 39 surveyed companies, however this intermediate stage still proves to be helpful because among the interviewees, it develops a feeling for the effects and economic significance of corporate prevention work.

Figures 16 and 18 illustrate the expected impact of corporate prevention work among the surveyed companies. These are impacts on wastage and time spent catching up after stoppages, the number of stoppages and the development of labour productivity. On the whole, a significant positive effect of corporate prevention work can be noted. It is certainly noticeable that a majority of the surveyed companies are not able to (or do not want to) give statements. Only one company expects a reverse effect. This implies it considers prevention work to be inexpedient for the improvement of the mentioned ratios within the company.



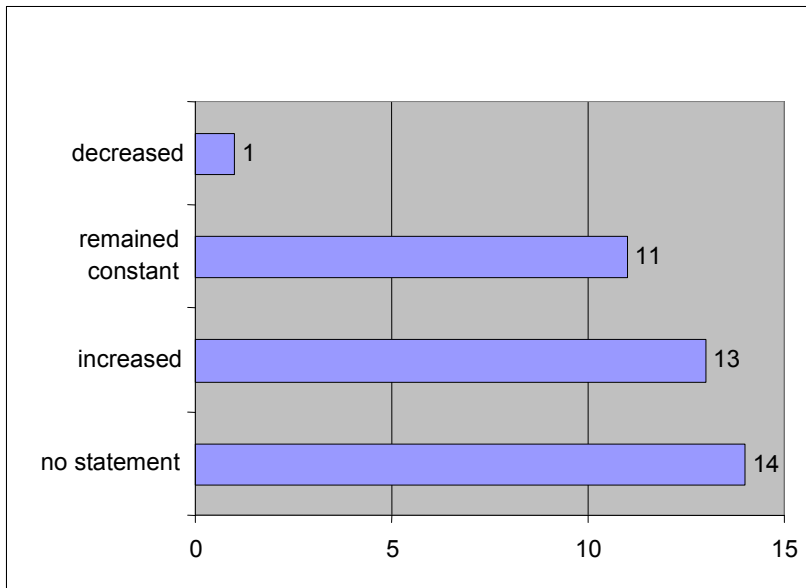
Annotation: Indication of the (absolute) number of answers given

Figure 16: Progression of wastage and catching-up quotas



Annotation: Indication of the (absolute) number of answers given

Figure 17: Progression of number of stoppages



Annotation: Indication of the (absolute) number of answers given

Figure 18: Progression of labour productivity

The following question posed in the interview is: “Preventive measures within your company (not only those for occupational safety and health protection) lead to, for example, a reduced number of fluctuations, better quality products, better adherence to schedules, an increased number of innovations and suggestions for improvement, improved customer satisfaction and better corporate image. How would you estimate your target costs saved and increase in turnover per year, based on the impact of prevention work?” Five of the 39 surveyed companies responded to this question with the following answers: 1%, 1-2%, 5%, 10-12% and 10-15%. Due to the low number of responses and the variation in values, it is not possible to carry out any further resilient analyses. Therefore the answer pattern shows a certain direction and scale for the estimation of the prevention benefit.

To make the practical manipulation more comprehensible, it is possible, with the help of a characteristic (and anonymously published, approved form) example, to illustrate the answer pattern in an interview (see guidelines in appendix 5).

Sample Company: In response to the question, how much significance does prevention work have in your company, the following answer was given: “Due to training, motivation training events and training vehicles, prevention work is very significant. As a result, the number of accidents has decreased. Discussions

between quality management and the safety experts and engineers regularly take place. Furthermore, department meetings take place with the use of different medias.

The sample company evaluated its prevention costs per employee and per year as follows:

- 150.00€ for personal protective equipment,
- 20.00€ for company medical support and guidance on safety technology,
- 50.00€ for specific prevention training measures,
- 210.00€ organisational and documentation costs as well as payroll costs of occupational physician, safety officers and safety experts,
- 10.00€ start-up costs during introduction phase of prevention measures.

It estimates the following prevention benefits per employee and per year:

- 400.00€ of cost savings through prevention of stoppages.
In the past, the number of accidents was very high. After an increase in the amount of prevention work within the company, this figure could be significantly decreased. Thanks to these measures productive working days could be gained and high costs for quality assurance or due to loss of production can be avoided.
- 200.00€ of added value generated by increased employee motivation and satisfaction.

For example, employees suggested the purchase of better quality (and relatively more expensive) personal protective equipment. When this was provided by the company, a significant improvement was noticeable in the company atmosphere.

- 200.00€ of added value generated by better corporate image.
For example, the supplier evaluation for the company turned out to be above average. Company efforts and the implementation of prevention work in an integrated quality management context were appreciated within the branch and positively assessed.

As a result, prevention costs per employee per year amount to 440.00€ and prevention benefits amount to 800.00€, producing a net profit of 360.00€ per employee per year.

By surveying all 39 companies and statistically evaluating the results, significant average values are produced. Table 5 (see also the fictitious sample dataset in appendix 6) summarises the results of the prevention costs. The index “n” shows, how many companies responded to questions concerning the respective types of cost. The median value, the mean value and the minimum-maximum interval are calculated separately according to cost type.

Workplace prevention costs (Costs in € per employee per year)	n	median value	mean value	minimum/ maximum
Cost of personal protective equipment	38	116.00	166.80	0.00/ 700.00
Cost of company medical support and guidance on safety technology	34	72.00	114.40	5.00/ 464.00
Payroll costs of safety officers (excluding company medical support and guidance on safety technology)	24	100.00	199.70	5.00/ 1071.00
Cost of specific prevention training measures	30	60.00	95.10	2.00/ 500.00
Cost of preventive medical check-ups	13	20.00	22.50	4.00/ 84.00
Organisational costs	9	60.00	91.20	10.00/ 374.00
Investment costs	10	26.00	68.00	6.00/ 303.00
Start-up costs	7	25.00	82.90	5.00/ 282.00

Table 5: Empirically determined corporate prevention costs

The most common and second most common costs for companies are the cost of personal protective equipment (n=38) and the costs of company medical support and guidance on safety technology (n=34). The third and fourth most common costs are the cost of specific prevention training measures (n=30) as well as payroll costs of safety officers (excluding company medical support and guidance on safety technology) (n=24). Only a third of surveyed companies present costs of preventive medical check-ups (n=13), which could be because these costs are often not listed separately from the costs of company medical support and guidance on safety technology. Investment costs (n=10), organisational costs (n=9) and start-up costs (n=7) are not very significant for most companies.

The amount of individual cost types incurred per employee per year can first of all be shown with the help of the median value. The median value is the middle, or central value in a row of values. Unlike the mean value, it is not influenced by outliers and extreme values. It is statistically viewed as a robust value and is therefore placed first. Its values for the individual cost types result in the following descending order:

1. Cost of personal protective equipment (116.00€ per employee yearly),
2. Payroll costs of safety officers excluding company medical support and guidance on safety technology (100.00€ per employee yearly),
3. Cost of company medical support and guidance on safety technology (72.00€ per employee yearly),
4. Cost of specific prevention training measures (60.00€ per employee yearly),
5. Organisational costs (60.00€ per employee yearly),
6. Investment costs (26.00€ per employee yearly),
7. Start-up costs (25.00€ per employee yearly),
8. Cost of preventive medical check-ups (20.00€ per employee yearly).

For the mean value, the following results appear:

1. Payroll costs of safety officers excluding company medical support and guidance on safety technology (199.70€ per employee yearly),
2. Cost of personal protective equipment (166.80€ per employee yearly),
3. Cost of company medical support and guidance on safety technology (114.40€ per employee yearly),
4. Cost of specific prevention training measures (95.10€ per employee yearly),
5. Organisational costs (91.20€ per employee yearly),
6. Start-up costs (82.90€ per employee yearly),
7. Investment costs (68.00€ per employee yearly),
8. Cost of preventive medical check-ups (22.50€ per employee yearly).

Prevention benefits should also preferably be determined directly through evaluations in the form of an interview. At best, the interviewees should respond spontaneously. If they hesitate or have problems with the operationalisation of the benefit, they will receive a starting figure to help them get started. The theoretical conclusive estimate of willingness-to-pay encounters comprehension and common operationalisation problems on practical implementation. Therefore it is not surprising that only four out

of the 39 surveyed companies are able to quote a prevention benefit. The results (median value, mean value, minimum/maximum) are laid out in table 6. The index “n” represents the number of responses received corresponding to each benefit type.

Company prevention benefits (Value in euro per employee per year)	n	median value	mean value	minimum/ maximum
Cost savings through prevention of stoppages	3	75.00	175.00	50.00/ 400.00
Cost savings through prevention of wastage and reduction of time spent catching up after stoppages	2	65.50	65.50	10.00/ 121.00
Added value generated by increased employee motivation and satisfaction	4	56.00	80.25	10.00/ 200.00
Added value generated by sustained focus on quality and better quality products	3	31.00	47.00	10.00/ 100.00
Added value generated by product innovation	3	31.00	47.00	10.00/ 100.00
Added value generated by better corporate image	4	21.00	60.25	0.00/ 200.00

Table 6: Empirically determined direct corporate prevention benefits

The interviewees and surveyed companies often have problems evaluating a direct monetary benefit. They appear over-challenged or indecisive and withhold their answers. As an alternative, a survey with an indirect approach can be used. The interviewees are asked to imagine prevention accounting as a balance scale. They should estimate whether the (total) costs of prevention work or the (total) prevention benefits would hold the balance level or whether either the costs or the benefits would tip the scales. In the case that the costs turn out to have a greater value, or vice versa, an operating ratio beginning at 1.0 and increasing at intervals of 0.2 would be used as a means of assessment. The interviewees choose to stop the enumeration, when a ratio is no longer acceptable³. Using this procedure, the relationship between prevention benefits and prevention costs can be illustrated. It is also possible to deduce the total prevention benefit from the given total prevention costs. Figure 19 shows the spread of the benefit-cost-quotients. As before the survey ranges over the 39 companies. 34 companies took part in the indirect estimation procedure and stated relevant ratios.

³ cf. Jones-Lee (1989), p.155 et seq.

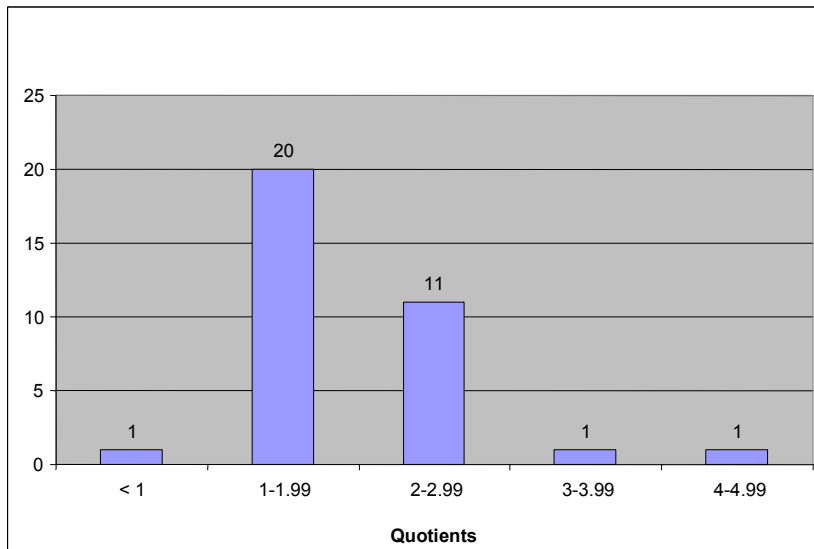


Figure 19: Distribution of company benefit-cost-quotients

20 of the 34 companies declare a prevention benefit-cost relationship between 1.00 and 1.99. 13 out of the 34 companies estimate a ration larger as 2.00 and only one company states a benefit-cost-quotient less than 1.

The following question asks how the total prevention benefits are divided among the individual prevention benefit types. To determine the distribution values and how much each prevention benefit contributes, a “1/0 decision analysis” (referring to the Delphi method) can be used. The interviewees are encouraged, to respond to the following (corresponding) questions with a simple “yes” or “no” answer:

- Has your company made cost savings through the prevention of stoppages?
- Has your company made cost savings through the prevention of wastage and the reduction of time spent catching up after stoppages?
- Has your company experienced an increase in value through increased employee motivation and satisfaction?
- Has your company experienced an increase in value through sustained focus on quality as well as better quality products?
- Has your company experienced an increase in value due to product innovation?
- Has your company experienced an increase in value due to an improved corporate image?

The interviewees are to identify those benefits which are relevant for their company with a “yes-answer”. Subsequently, the total number of “yes-answers” for each type of benefit will be calculated. The weightage for each type of benefit will be determined by comparing the total number of “yes-answers” given for each question with the overall number of “yes-answers” given by all companies. The following are the results expressed as percentages:

- Benefits through the prevention of stoppages: 20%,
- Benefits through the prevention of wastage and the reduction of time spent catching up after stoppages: 8%,
- Benefits due to increased employee motivation and satisfaction: 25%,
- Benefits due to sustained focus on quality and better quality products: 17%,
- Benefits due to product innovation: 8%,
- Benefits due to an improved corporate image: 22%.

Fundamentally, the benefit distribution should be relevant for each company. However, in the case that not all benefits are relevant for a company, the weightage of those which prove to be relevant have to be accordingly scaled up. The total monetary profit of a specific type of prevention benefit (see also the fictitious sample datasets in appendix 6) is calculated by adding the individual monetary profits of each type of benefit (in considering the directly gained benefit values in table 6). Table 7 summarises the results, separated according to median value, mean value and minimum/maximum interval.

Company prevention benefits (Value in euro per employee and per year)	n	median value	mean value	minimum/maximum
Cost savings through prevention of stoppages	21	245.80	304.80	50.00/ 974.30
Cost savings through prevention of wastage and reduction of time spent catching up after stoppages	8	73.20	98.60	10.00/ 331.10
Added value generated by increased employee motivation and satisfaction	30	306.60	375.70	10.00/ 1274.00
Added value generated by sustained focus on quality and better quality products	18	98.80	150.00	10.00/ 477.30
Added value generated by product innovation	8	41.10	62.00	10.00/ 144.90
Added value generated by better corporate image	25	186.40	285.50	0.00/ 1071.70

Table 7: Empirically determined corporate prevention benefits

Irrespective of the average values (median or mean value), the prevention benefits result in the following order:

1. Added value generated by increased employee motivation and satisfaction (306.60 or 375.70€ per employee yearly),
2. Cost savings through prevention of stoppages (245.80 or 304.80€ per employee yearly),
3. Added value generated by better corporate image (186.40 or 285.50€ per employee yearly),
4. Added value generated through sustained focus on quality and better quality products (98.80 or 150.00€ per employee yearly),
5. Cost savings through prevention of wastage and reduction of time spent catching up after stoppages (73.20 or 98.60€ per employee yearly),
6. Added value generated by product innovation (41.10 or 62.00€ per employee yearly).

Prevention benefit-cost-relationships can be determined using the above benefit (Table 7) and cost values (Table 5). They will initially be calculated for each company and then as a mean or median value. Sometimes “paired” relationships are mentioned because the prevention benefits and prevention costs of each company

make up one calculation and subject matter. They result in benefit-cost-relationships with a mean value of 1.67 and a median value of 1.54.

The actual prevention balance sheet is a comparison of company prevention costs (Table 5) and company prevention benefits (Table 7). It can also be arranged according to the median values (Table 8) and/or the mean values (Table 9). Of particular interest is the (monetary net) return on prevention as a bottom line figure.

Prevention balance sheet (Basis: median value)			
Corporate prevention costs	Value in € per employee per year	Corporate prevention benefits	Value in € per employee per year
Cost of personal protective equipment	116.00	Cost savings through prevention of stoppages	245.80
Cost of company medical support and guidance on safety technology	72.00	Cost savings through prevention of wastage and reduction of time spent catching up after stoppages	73.20
Payroll costs of safety officers (excluding company medical support and guidance on safety technology)	100.00	Added value generated by increased employee motivation and satisfaction	306.60
Cost of specific prevention training measures	60.00	Added value generated by sustained focus on quality and better quality products	98.80
Cost of preventive medical check-ups	20.00	Added value generated by product innovation	41.10
Organisational costs	60.00	Added value generated by better corporate image	186.40
Investment costs	26.00		
Start-up costs	25.00		
Total	479.00	Total	951.90
(monetary net) return on prevention: 472.90 € per employee per year			

Table 8: Prevention balance sheet based on median value

Prevention balance sheet (Basis: mean value)			
Corporate prevention costs	Value in € per employee per year	Corporate prevention benefits	Value in € per employee per year
Cost of personal protective equipment	166.80	Cost savings through prevention of stoppages	304.80
Cost of company medical support and guidance on safety technology	114.40	Cost savings through prevention of wastage and reduction of time spent catching up after stoppages	98.60
Payroll costs of safety officers (excluding company medical support and guidance on safety technology)	199.70	Added value generated by increased employee motivation and satisfaction	375.70
Cost of specific prevention training measures	95.00	Added value generated by sustained focus on quality and better quality products	150.00
Cost of preventive medical check-ups	22.50	Added value generated by product innovation	62.00
Organisational costs	91.20	Added value generated by better corporate image	285.50
Investment costs	68.00		
Start-up costs	82.90		
Total	840.50	Total	1276.60
(monetary net) return on prevention: 436.10 € per employee per year			

Table 9: Prevention balance sheet based on mean value

Benefit-cost-relationships for the prevention balance sheet amount to 1.99 (median value) and 1.52 (mean value). It concerns unpaired relationships because the total prevention benefit and total prevention costs are compared. Investments in corporate prevention work not only fulfil legal regulations but also lead to a net benefit for companies and prove to be financially profitable. The procedure of prevention accounting makes it possible for individual companies to measure the profitability of prevention work.

The above prevention benefit-cost-relationships were calculated according to different statistical procedures (paired or unpaired, median or mean values). They identify the return on prevention (see section 3.3). The rounded down mean value of the four single values is 1.6.

Return on prevention (ROP) = 1.6

The return on prevention expresses an economic potential for success in an abstract manner. The underlying positive selection of companies in the survey supports the representativeness of the calculated value. Companies which more or less have prevention work anchored in their system of corporate aims recognise the profit contribution of the prevention measures to occupational safety and health protection. Companies which have previously “invested” little in prevention work, tend to receive a higher return on prevention.

Bibliography

- Backhaus, K., Erichson, B., Plinke, W., Weiber, R. (1994), *Multivariate Analysemethoden – Eine anwendungsorientierte Einführung*, 7. Auflage, Springer-Verlag, Berlin und Heidelberg
- Eichhorn, P. (1974), *Gesellschaftsbezogene Unternehmensrechnung*, Verlag Otto Schwartz & Co, Göttingen
- Graf von der Schulenburg, J.-M., Kielhorn, A., Greiner, W., Volmer, T. (1998), *Praktisches Lexikon der Gesundheitsökonomie*, 1. Auflage, Asgard-Verlag Dr. Werner Hippe GmbH, Sankt Augustin
- Johannesson, M., Jönsson, B. (1991), *Economic Evaluation in Health Care: Is There a Role for Cost-Benefit Analysis?*, in: *Health Policy*, Vol. 17, pp. 1-23
- Johansson, P.-O. (1993), *Cost-Benefit Analysis of Environmental Change*, Cambridge University Press
- Jones-Lee, M. W. (1993), *Personal Willingness to Pay for Prevention: Evaluating the Consequences of Accidents as a Basis for Preventive Measures*, in: *Addiction*, Vol. 88, pp. 913-921
- O. V. (1988), *Gabler Wirtschaftslexikon*, 12. Auflage, Verlag Dr. Th. Gabler GmbH, Wiesbaden
- Pearce, D. W., Turner, R. K. (1992), *Benefits Estimates and Environmental Decision-Making*, Head of Publications Service, OECD
- Yau, K. K. W., Lee, A. H. (2001), *Zero-inflated Poisson regression with random effects to evaluate an occupational injury prevention programme*, in: *Statistics in Medicine*, Vol. 20, Issue 19, pp. 2907-2920

Summary

The implementation of occupational safety and health protection measures is a statutory requirement. An important question is whether the investments in prevention are beneficial for a company or to what extent they are beneficial. The focus here is on prevention work as a whole, rather than individual prevention services. The financial return of prevention measures within an individual company cannot be assessed using traditional business accounting methods or indeed societal and environmental accounting, therefore a new type of balance sheet needs to be developed to illustrate the return on prevention. The current research report developed conceptual approaches to prevention accounting. Furthermore, it designed a prevention balance sheet using empirical data.

The direct return on prevention measures in the workplace consists of the prevention of work-related accidents, occupational illnesses and work-related health risks. The indirect return expresses secondary impacts which result from occupational safety and health protection measures. The success of prevention measures may be expressed as a qualitative, non-monetary value or as a quantitative, monetary value. The “Return on Prevention” indicator describes the relationship between the returns of prevention work (prevention benefits) and spending on prevention work (prevention costs).

The prevention balance sheet is not a traditional financial balance sheet but a means of calculating the economic return of prevention measures. It uses the balance sheet format to compare prevention benefits in the workplace and companies’ prevention costs. The return on prevention is expressed as the bottom line figure on the balance sheet. Company prevention costs include the cost of personal protective equipment, company medical support and guidance on safety technology, deployment of safety officers, specific prevention training measures and preventive medical check-ups as well as organisational, investment and start-up costs. Corporate prevention benefits refer to cost savings through the prevention of stoppages, the prevention of wastage and a reduction of time spent catching up after stoppages and added value

generated by increased employee motivation and satisfaction, a sustained focus on quality and better quality products, product innovation and a better corporate image.

The project began with a preliminary survey aimed at identifying the direct and indirect effects of prevention measures in the workplace. Companies in one particular industry were sent a written questionnaire, in which they were asked to evaluate the qualitative, non-monetary impact of prevention in the workplace. The results showed that the most important direct effects include the reduction of hazards and accidents, while the most significant indirect effects include increased hazard awareness and a positive change in workplace culture. Furthermore, a high proportion of the surveyed companies assumed that further investment in prevention work would result in a long-term reduction in operational costs.

The main project survey was designed to gather empirical data in order to calculate the return on prevention's monetary value. In this survey, several companies within different industries were interviewed. The costs of prevention and their categories proved relatively easy to determine. However, as expected, it was more difficult for respondents to assess the value of different types of prevention benefits, owing to the highly abstract nature of these judgements. Therefore, for most companies, it proved useful to develop an indirect approach to the survey. The first step was to ask interviewees to estimate the total prevention benefit (e.g. in relation to the total prevention costs) for their own company. The next step used decision theory techniques to analyse how the total prevention benefits could be assigned to the individual prevention benefit categories. By setting a company's prevention costs against the monetary benefits of prevention work per employee per year, it is possible to generate the actual (monetary) prevention balance sheet based on median or mean values. The bottom line calculates the (net monetary) return on prevention per employee per year.

To increase the practical and normative value of the prevention balance sheet, it is useful to calculate the prevention cost-benefit ratio, which expresses the return on prevention of prevention work. The return on prevention for this study was 1.6. The return on prevention describes an abstract potential for economic return. This survey was limited to positive selection, which in turn justifies the relatively limited scope of

the survey. In view of the positive selection of survey participants, it may be expected that the return on prevention would tend to be better for companies who have not yet invested in prevention work.



Prevention accounting from a theoretical and empirical point of view



Purpose of this INFO-leaflet

This information leaflet details the current status of sub-project 5, "Prevention accounting from a theoretical and empirical point of view". The developing prevention balance sheet uses a special method of accounting to compare workplace prevention costs against prevention benefits, from the point of view of the individual company. This research project discusses the theoretical fundamentals of prevention accounting. Furthermore, it is empirically tried and tested.

Status of the accounting and balance sheet theories

The aim of a profitable company is reflected in its accounting system; the aim being to give the best possible insight into its financial success. Due to this biased focus of the accounting system on financial success, which for operational companies turns out to be a profit, the goals and benefits of a company, for example, remain unconsidered. On account of a lack of focus on societal and environmental factors, the company's social responsibility will be considered questionable.

Societal accounting proves that corporate activity can have both beneficial and disadvantageous

impacts on society as well as the environment, which are not covered by the conventional method of business accounting.

The concept of a balance sheet containing company social factors, highlights that a company needs to disclose not only its financial results but also its societal results, in the interest of its social responsibility. Business accounting can therefore be extended to include societal aspects. However this approach remains to be primarily a theory.

Prevention accounting falls to some extent under the umbrella of societal accounting. Until now, impacts of prevention work in the form of a return on prevention have only been noted in individual cases. This research project adopts the task of developing a method to describe these impacts on a balance sheet.

Corporate return on prevention

The return on prevention can be divided into direct and indirect categories. A difference between a qualitative ("soft", non-monetary) and a quantitative ("hard", monetary) return on prevention is also conceivable. The qualitative return on prevention is measured in non-monetary values (e.g. using a point system) and the quantitative return on prevention is measured using monetary values.

To calculate the net return on prevention, productivity within a company can be altered.

In this project "Quality in Prevention", the Berufsgenossenschaften (Institutions for statutory accident insurance and prevention) are working together with their head branch, to examine the **effectiveness and profitability of their prevention services**. The project should form a basis for the improvement of prevention services provided by the social accident insurance. It is divided into sub-projects. This section presents approaches and findings of the sub-projects.

Productivity is a dimensionless ratio. It is linked to a value-free conclusion. Productivity illustrates the productiveness of a company's factor combination. It is calculated from the relationship between quantitative returns (output) and required quantities (input). This means for prevention accounting, that "prevention productivity" can be described as a performance indicator using a quotient from prevention costs and prevention benefits.

Prevention balance sheet theory

The prevention balance sheet is defined as an impact-based comparison of a company's spending on prevention (input), against the benefits a company gains from prevention work (outcome), within a fixed period. As a dynamic balance sheet, its main purpose is to describe the return on prevention within a fixed period. The prolonged impacts of prevention work cannot be divided over multiple periods. Tables in this article illustrate the structural composition of the prevention balance sheet.

PREVENTION COSTS	PREVENTION BENEFITS
Company prevention costs	Company prevention benefits
Number of negative prevention impacts	Number of positive prevention impacts
Net prevention benefit expressed as a balance	Net prevention loss expressed as a balance

Table 1: Structural composition of prevention balance

Appendix 1

From the structural composition of the prevention balance sheet, it is noticeable that it concerns corporate prevention work “as a whole”. The impacts of individual prevention measures cannot be described using a prevention balance sheet. For

prevention-based safety standards) and economies of scope (e.g. prevention work and technological advances). To solve these attribution problems, a simplified, goal-oriented model for complex relationships.

coined for the use of this project. The use of this ratio to describe the return on prevention illustrates how worthwhile it is for a company to spend additional capital on prevention work. The ROP is defined as a quotient of the returns

CORPORATE PREVENTION COSTS	Costs in EUR
Cost of personal protective equipment	_____
Cost of company medical support and guidance on safety technology	_____
Payroll costs of safety officers excluding company medical support and guidance on safety technology	_____
Cost of specific prevention training measures	_____
Cost of preventive medical check-ups	_____
Organisational costs	_____
Investment costs	_____
Start-up costs	_____

Table 2: Sample overview of prevention costs

CORPORATE PREVENTION BENEFITS	Value in EUR
Cost savings through prevention of stoppages	_____
Cost savings through prevention of wastage and reduction of time spent catching up after stoppages	_____
Added value generated by increased employee motivation and satisfaction	_____
Added value generated by sustained focus on quality and better quality products	_____
Added value generated by product innovation	_____
Added value generated by better corporate image	_____

Table 3: Sample overview of prevention benefits

example, the composition of company prevention costs and benefits, per company employee within a defined timeframe (e.g. a year), are quoted in tables 2 and 3.

Incidents can only be described if they take place. However, through the implementation of prevention work within a company, these incidents (e.g. accidents, occupational illnesses, stoppages, time spent catching up after stoppages) are prevented. The gathering, calculation and evaluation of the impacts of corporate prevention work can therefore only be indirectly carried out (e.g. evaluation by means of subjective estimates) and with the help of equivalent variables.

Attribution problems arise in prevention accounting. The cause and effect relationship between corporate prevention work and its impacts is temporally limited (due to period accruals). There is also evidence of interaction (e.g. with

As special evaluation principles for a prevention balance sheet, the survey and impact principles are used. The survey principle is implemented to calculate and evaluate costs and benefits. Through the use of the impact principle, relationships between prevention work and company target values (e.g. prevention work and cost efficiency, prevention work and quality, prevention work and productivity) can be examined, in order to determine prevention benefits. Using a hypothetical system, it can also be examined, whether the theoretically constructed relationships with the empirically gathered data correspond. In the case that these dependents can be statistically proven, it is also recommended that a corresponding informative ration is developed.

The ratio “return on investment” (ROI) measures return on invested capital. This leads to the term “return on prevention” (ROP) being

of prevention work and company spending on prevention work.

In the interest of its employees, it is a statutory requirement that a company implements measures of prevention, as well as all necessary measures for health and safety in the workplace.

Workplace prevention measures are however also put in place in the interest of the company. Therefore new ground must be broken, in order to be able to convey the return on modern prevention measures in the workplace. The prevention balance sheet is therefore an ideal instrument.

Contacts for sub-project 5:
Prevention balance sheet from a theoretical and empirical point of view

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Impact of workplace prevention measures within the company



AIM OF STUDY

Companies “invest” in workplace prevention measures. The term “workplace prevention measures” is used here to relate to those prevention measures put in place for occupational safety and health protection. The study doesn’t look into individual prevention measures but rather prevention work as a whole. Measures of occupational safety and health protection should directly prevent breaches of regulations, hazards, accidents and illnesses. These factors don’t just have a positive effect on the employees but also indirectly on the productivity and corporate success of the company. The results of a survey which focused on qualitative factors, illustrates how prevention work functions. These results will be introduced in this INFO-leaflet.

SURVEY

The questionnaire-based survey determines how companies evaluate their own prevention work. The following is a small selection of the points focused on within the questionnaire:

- Strength of the impact of workplace prevention measures within individual operational areas of the company.

- Opinions on direct and indirect prevention benefits.
- Evaluation of current prevention work within the company.

With the help of the Berufsgenossenschaft for the precision and electrical engineering industries (BG der Feinmechanik und Elektrotechnik) in Cologne, a total of 390 datasets were collected. The interviewees are made up of the following professions:

- 64% security experts,
- 24% employees,
- 6% safety officers,
- 5% works council members,
- 1% employers.

The interviewees work in the following industries:

- 73% manufacturing,
- 18% construction,
- 9% trade.

QUALITATIVE IMPACTS

1. Strength of the impacts of workplace prevention measures

The first question to be asked focuses on the strength of the impacts of workplace prevention measures in the

In this project “Quality in Prevention”, the Berufsgenossenschaften (Institutions for statutory accident insurance and prevention) are working together with their head branch, to examine the **effectiveness and profitability of their prevention services**. The project should form a basis for the improvement of prevention services provided by the social accident insurance. It is divided into sub-projects. This section present approaches and findings of the sub-projects.

individual operational areas within a company. An ordinal scale from 1 to 6

(1=no impact, 2=small, 3=more than small, 4=less than strong, 5=quite strong, 6= very strong) is presented, which the interviewees should use to respond to the question.

Figure 1 illustrates that corporate prevention work is most influential in the transport and warehousing areas of operation, whereas in the research and development (R & D) areas as well as marketing, it has least impact.

As a further example, the relationship between the significance of prevention work in the transport operations area and its evaluation throughout the company is examined. This appears as a statistically provable relationship ($r=0.45$), that translates as the greater the influence of prevention work in the transport operations area, the better the evaluation of prevention work in that area (see section 3).

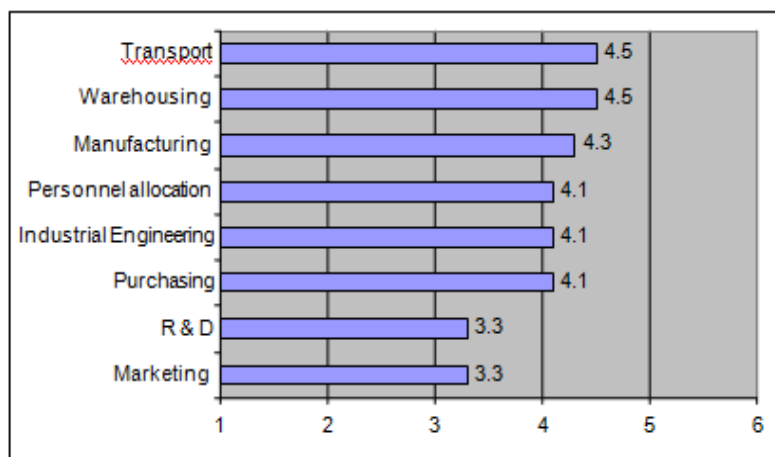


Fig. 1: Strength of impact of workplace prevention measures within areas of operation within a company (Results of survey – tested with 390 data sets)

Appendix 2

2. Opinions on direct and indirect prevention benefits

Direct returns on prevention: "Due to corporate prevention work, the number of hazards, accidents, illnesses and breaches of regulations has been directly reduced." In order to evaluate the statement, an ordinal scale is used again, ranging from 1 to 6.

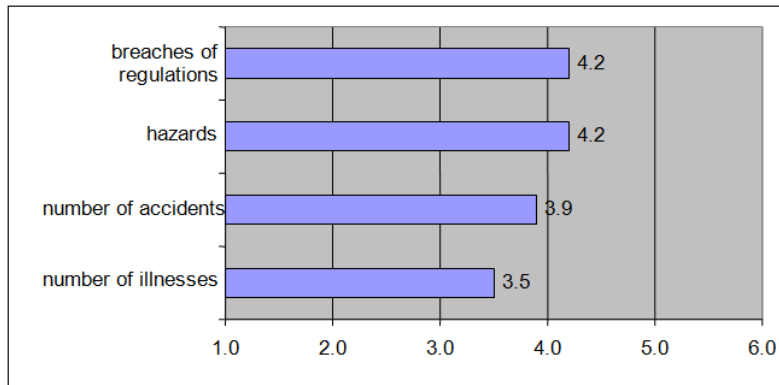


Fig. 2: Bar chart showing the direct return on prevention generated by workplace prevention measures. (Findings of survey – based on 390 data sets.)

From figure 2, it can be seen that the number of hazards and breaches of regulations has been most greatly reduced thanks to workplace prevention measures. Using statistical methods, it can be empirically proven that all four direct returns on prevention have a positive relationship in connection with the current evaluation of prevention work within the company.

of innovations and suggestions for improvements, increased customer satisfaction, better corporate image, a positive change in the company atmosphere as well as increased employee hazard awareness." The ordinal scale is to be used again to respond to this statement.

With regard to indirect returns on

prevention, figure 3 helps illustrate that through the implementation of workplace prevention measures, an increase in employee hazard awareness can be achieved. Also to be noted is a positive change in workplace culture.

3. Evaluation of current prevention work

This section is an evaluation of current

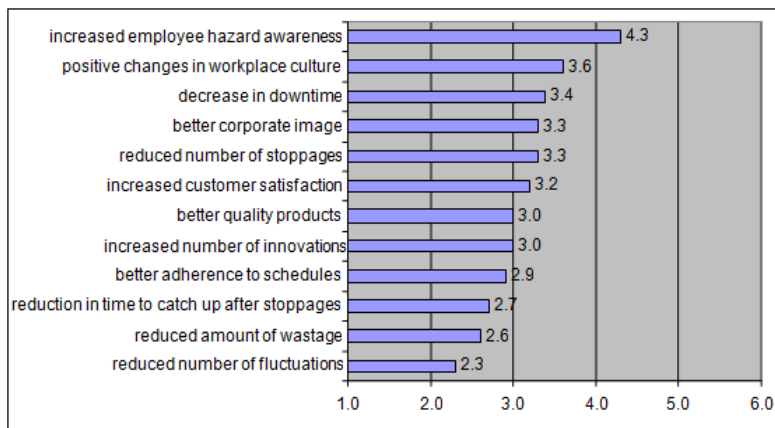


Fig. 3: Bar chart showing the indirect return on prevention generated by workplace prevention measures. (Findings of survey – based on 390 data sets)

Indirect returns on prevention: "Due to corporate prevention work, a number of indirect changes have taken place, such as a reduced number of fluctuations, a reduced number of stoppages, a decrease in downtime, a reduction in the amount of wastage, a reduction in the time needed to catch up after stoppages, better quality products, better adherence to schedules, an increase in the number

prevention work within the company in the areas of occupational safety and health protection.

Figure 4 shows that all most half of all interviewees (48% = 187 interviewees) rate their company's prevention work as good. On this point, they are also asked their opinions on how additional investments in long-term prevention measures could affect company costs. 44% of those asked think that in the long-term, company costs will remain

the same. According to 39% of those interviewed, additional investments in prevention work would lower company costs in the long-term and only 17% think that company costs would increase. From Figure 5, it can be concluded that the majority of those interviewed are of the opinion that prevention measures are a worthwhile investment.

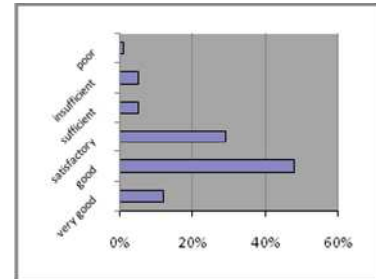


Fig. 5: Responses to question, "How would you evaluate the current prevention measures within your company, in the areas of occupational safety and health protection?" (Findings of survey – based on 390 data sets)

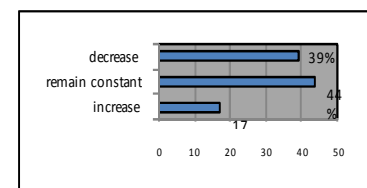


Fig. 6: Responses to question, "In your opinion, how would additional investments in workplace prevention measures for your company affect company costs in the long-term?" (Findings of survey – based on 390 data sets.)

Summary and Outlook

Prevention work is a major cornerstone for the development of occupational safety and health protection within a company. The outcome of this study only focuses on the direct and indirect returns on prevention but further research is needed to determine to what extent prevention work can provide a return on prevention and what methods can be used to illustrate this.

Contacts for sub-project 5: Prevention balance sheet from a theoretical and empirical point of view

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Appendix 3

Dietmar Bräunig, Thomas Kohstall, Katrin Mehnert

Quality in Prevention

Quantitative Impact of Workplace Prevention Measures

▪ 1. Project Aim

The most recently developed form of prevention balance sheet sets company spending on health and safety in the workplace against its benefits, all from the point of view of an individual company. In this way, the effects of prevention work should be structured in the form of a corporate return on prevention. This project discusses the theoretical elements and applies empirical testing of prevention accounting.

▪ 2. Project

A prevention balance sheet is defined as a impact-based comparison of prevention costs (input) and prevention benefits (outcome). As a means of calculating the economic return of prevention measures, it describes the return on prevention within a certain period of time. Impacts which occur over several periods can be divided up into periods. The prevention balance sheet describes the impact of prevention work within a specific timeframe.

Incidents can only be described if they take place. However, through the implementation of prevention work within a company, these incidents (e.g. accidents, occupational illnesses, stoppages, time spent catching up after stoppages) are prevented. Therefore, the measurement and evaluation of the impact of corporate prevention work can only be indirectly (e.g. through the evaluation of subjective estimates) carried out and with the help of equivalent variables (e.g. through the reduction in the number of stoppages). The evaluation method takes the form of a survey (e.g. in the form of an interview). To be able to compile the benefits of prevention work, impact relationships between the prevention work and the company target values need to be examined.

▪ 3. Quantitative Impact

To be able to analyse the relationship between prevention work and company target values, it is necessary to calculate the share (estimate) of turnover, for which the impacts of workplace prevention measures are

accountable. According to initial measures within a company and the corresponding interview-based survey, it can be assumed that there will be a positive impact on the company.

The following are details from a sample company. In response to the question asking how important prevention work is within the company, the following answer was given: "Due to training and qualification, staff motivation events and training vehicles, the company rates prevention work very highly. Thanks to prevention work, the accident rate has strongly dropped and meetings with the quality management team and safety experts and engineers regularly take place. Furthermore, department meetings take place with the use of different medias.

This company evaluated its spending on prevention, per employee annually, as follows:

- 150 EUR for personal protective equipment
- 20 EUR for company medical support and guidance on safety technology
- 50 EUR for specific prevention training measures
- 210 EUR for organisational and documentation costs as well as payroll costs of company doctor, safety officer and safety experts
- 10 EUR for start-up costs during the introduction phase of prevention measures

The following is the estimated prevention benefit per employee annually:

- 400 EUR cost savings generated through prevented stoppages. The accident rate was previously very high. After having intensified the prevention work within the company, the rate was strongly reduced. Through the implemented measures, productive working days could be gained and costs due to loss of production and spending on

quality management could be prevented.

- 200 EUR added value generated by increased employee motivation and satisfaction. For example, it was suggested by employees that better (and more expensive) personal protective equipment should be purchased. The company supplied the new equipment, which resulted in a notably positive effect on the working atmosphere within the company.

- 200 EUR added value generated by a better corporate image. For example, supplier evaluations of the company gave above average results. Company efforts to implement prevention work as in integrated aspect of quality management, was greatly appreciated and favourably looked upon within the company.

As a result, the company spends 440 EUR on prevention costs per employee annually but makes a total saving of 800 EUR through prevention benefits. That implies a net profit of 360 EUR per employee on a yearly basis.

▪ 4. Summary and Outlook

In the interest of its employees, it is a statutory requirement that a company implements measures of prevention, as well as all necessary measures for health and safety in the workplace. In light of this example it is obvious, that corporate prevention should also be implemented in the interest of the company itself.

Brief summary of the project can be found at www.dguv.de/bgag/de/forschung/forschungsprojekte/qdp/index.html

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**Prevention balance sheet
from a theoretical and empirical point of view**

- Preliminary Survey Questionnaire -

Justus-Liebig-Universität Gießen &
BGAG – Institute Work and Health of the
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2007

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Appendix 4

I. Introduction

Dear Sir/Madam,

The Professor of Public Services Management from Justus-Liebig-University in Gießen, is carrying out a research project to examine the significance of workplace prevention measures (occupational safety and health protection) for companies. The effects of prevention work have not yet been set on a balance sheet and therefore do not appear on any statements. We are taking on board, the task of designing a balance sheet to describe the effects of prevention work.

Enclosed you will find a questionnaire. The following questions are subdivided according to master data and a qualitative analysis. May we ask you to take the time to complete the questionnaire? We would like to cordially thank you in advance and look forward to your response.

We would like to assure you that any completed data received from you will be treated confidentially. The results will be anonymous and they will be evaluated as a whole. The project is for research purposes only. Many thanks once again.

Yours faithfully
Dietmar Bräunig and Katrin Mehnert

II. Master data

(1) What position do you hold within your company?

<input type="checkbox"/> Employee	<input type="checkbox"/> Employer	<input type="checkbox"/> Works council member
<input type="checkbox"/> Company doctor	<input type="checkbox"/> Safety expert	<input type="checkbox"/> Safety officer
<input type="checkbox"/>		

(2) Into which of the following categories does your company fall?

<input type="checkbox"/> Manufacturing	<input type="checkbox"/> Construction	<input type="checkbox"/> Trade
<input type="checkbox"/>		

(3) What hazards/dangers exist within your company? (Multiple answers are possible)

<input type="checkbox"/> mechanical (e.g. injuries)	<input type="checkbox"/> thermal (e.g. heat)	<input type="checkbox"/> electrical (e.g. electricity)
<input type="checkbox"/> chemical (e.g. gases)	<input type="checkbox"/> physical (e.g. noise)	<input type="checkbox"/> mental (e.g. stress)
<input type="checkbox"/>		

Appendix 4

III. Qualitative Analysis

(1) How strong is the impact of workplace prevention measures (occupational safety and health protection) in the following areas of operation within your company?

	no impact	quite small	more than small	less than strong	quite strong	very strong
Purchasing (e.g. purchase of safe working appliances and personal protective equipment)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Work preparation (e.g. consideration of hazards and organisation of occupation safety and health protection)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Personnel allocation (z. B. taking into consideration experiences of company employees)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Research & Development (z. B. development of new products with regard to occupational safety)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Manufacturing (z. B. consideration of hazards and restructuring of workflows and working practices)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transport (z. B. use of safe transport equipment)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Warehousing (z. B. stability, breadth of transport routes and signposting)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Marketing (z. B. consideration of workplace prevention measures for public relations and the sale of safe investments)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix 4

(2) What significance do the following factors have on workplace prevention measures within your company?

	none	quite small	more than small	less than strong	quite strong	very strong
Prevention services of the social accident insurance, e.g.						
• guidance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• surveillance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• tested and certified work equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prevention services provided by, for example						
• trade supervisory boards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• customer demands	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• quality management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• environmental management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• property insurer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(3) Please comment on the following statements, which take into account the direct effects of prevention work.

The implementation of workplace prevention measures has directly reduced the following:	none	quite small	more than small	less than strong	quite strong	very strong
number of hazards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
number of accidents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
number of illnesses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
breaches of regulations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix 4

- (4) Please comment on the following statements, which take into account the indirect returns of prevention work.

As is the case for improved customer satisfaction or the positive change in workplace culture, the reduced number of fluctuations is largely due to workplace prevention measures. It can therefore be assumed that workplace prevention measures bring about such indirect changes. Consider which indirect changes could have been triggered by prevention work within your company and subsequently evaluate them in the following table!

The implementation of workplace prevention measures has indirectly resulted in the following:	none	quite small	more than small	less than strong	quite strong	very strong
reduced number of fluctuations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
reduced number of stoppages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
decrease in downtime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
reduced amount of wastage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
reduction in time needed to catch up after stoppages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
better quality products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
better adherence to schedules	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
increased number of innovations and employee suggestions for improvement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
increased customer satisfaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
better corporate image	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
positive changes in workplace culture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
increased employee hazard awareness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix 4

(5) Please answer the following questions.

Please note: You do not need to respond to the third question if your response to the second one states that additional investments in workplace prevention measures will cause company costs to remain constant in the long-term.

How would you evaluate current prevention measures within in your company, with regard to occupational safety and health protection?	very good <input type="checkbox"/>	good <input type="checkbox"/>	satisfactory <input type="checkbox"/>	sufficient <input type="checkbox"/>	insufficient <input type="checkbox"/>	poor <input type="checkbox"/>
In your opinion, how would additional investments in prevention work affect company costs in the long-term?	increase <input type="checkbox"/>		remain constant <input type="checkbox"/>		decrease <input type="checkbox"/>	
To what extent would the company costs change?	very low <input type="checkbox"/>	low <input type="checkbox"/>	more than low <input type="checkbox"/>	less than high <input type="checkbox"/>	high <input type="checkbox"/>	very high <input type="checkbox"/>

**Prevention balance sheet
from a theoretical and empirical point of view**

- Interview Guidelines -

Justus-Liebig-Universität Gießen &
BGAG – Institute Work and Health of the
German Social Accident Insurance
2007

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Appendix 5

I. Introduction

Dear Sir/Madam,

Before I begin, I'd like to introduce myself. My name is Katrin Mehnert. I am a colleague of Prof. Dr. Dietmar Bräunig, Professor of Public Services Management at Justus-Liebig University in Gießen.

In our research project, we are examining, whether prevention work in the form of occupational safety and health protection returns results for a company. According to current knowledge and speculation, it can be assumed that the answer to this question is a positive one. However, up until now, possible, positive effects of workplace prevention measures have not been noted on a balance sheet and therefore do not appear on any accounts. The positive or negative effects of workplace prevention measures could be very significant for the competitiveness of a company. On the one hand, a company can choose to present itself in such a manner to its internal and external target groups and (with the aid of its advantageous position caused by regular prevention measures) provide sustained support for future added value. On the other hand, prevention accounting presents an instrument, which collects immaterial, in particular "soft" factors as the actual assets of a company. The aim of the research project is to develop a method to describe the return on prevention, using a comparison of company costs and benefits related to prevention work. The resulting net value can be a positive or negative one.

I will treat the interview and all my written notes confidentially according to current data protection acts. Under no circumstances will any company-related data be forwarded or published.

In order that I do not forget anything in the course of the interview, I have attached the questions with these guidelines. Some questions should be answered according to your own opinion. These aspects will again be mentioned in the same conversation and discussed in more detail. It may also be the case that you do agree with my questions. If this does occur, please tell me immediately because your personal (or team-developed, as the case may be) opinion on these topics is also of importance.

Appendix 5

II. Master data

- (1) Name of the company
- (2) Name and position of participant
- (3) Contact
- (4) Number of permanent employees (based on full-time workers) in 2007
- (5) Legal form
- (6) Industry
- (7) Location
- (8) Date of interview

III. Workplace prevention measures

- (1) Workplace prevention measures
 - (1a) What significance does prevention work hold within your company?
 - (1b) What triggered an interest in increased prevention work?
- (2) Returns on prevention
 - (2a) Do you feel or sense the success of the prevention work?
 - (2b) If yes, please describe!
 - (2c) To what can the success be attributed?
 - (2d) What expectations/desires do you have, in terms of the future success of prevention work?
- (3) How would you evaluate the current prevention work within your company?

	very good	good	satisfac- tory	suffici- ent	insuffic- ient	poor
current situation						

Appendix 5

IV. Company specific characteristics and willingness to pay

(1) How have the following company specific characteristics changed with time?

Rates of wastage and time spent catching up after stoppages			
In your opinion, how have the rates of wastage and the time spent catching up after stoppages developed with the implementation of prevention work?	increased	remained constant	decreased
	2003	2005	2007
Wastage in € in year ...	_____ €	_____ €	_____ €
Catching up in € in year ...	_____ €	_____ €	_____ €
Number of stoppages			
How do you estimate the number of stoppages to have developed since implemented prevention measures?	increased	remained constant	decreased
	2003	2005	2007
Number of stoppages (converted into €) in year ...	_____ €	_____ €	_____ €
Productivity			
In your opinion, how has labour productivity developed since the implementation of prevention work?	increased	remained constant	decreased
	2003	2005	2007
Monetary value of the change in labour productivity	_____ €	_____ €	_____ €

(2) Preventive measures within your company (not only those in the areas of occupational safety and health protection) lead to, for example, a reduced number of fluctuations, better quality products, better adherence to schedules, an increased number of innovations and suggestions for improvement, increased customer satisfaction and better corporate image. How would you estimate your target costs saved and increase in turnover per year, based on the impact of prevention work?

Appendix 5

V. Workplace prevention costs and benefits

(1) Estimate prevention costs which have accrued for your company within the last year.

Workplace prevention costs	Costs in € per employee per year
Cost of personal protective equipment (e.g. ear defenders, boots, work clothes)	_____
Cost of company medical support and guidance on safety technology (e.g. in-house/external safety experts, in-house/external occupational physician, documentation)	_____
Payroll costs of safety officers excluding company medical support and guidance on safety technology	_____
Cost of specific prevention training measures (e.g. initial and ongoing training of safety experts and officers, safely securing loads, forklift trucks, time-off for first-aid training)	_____
Cost of preventive medical check-ups	_____
Organisational costs (e.g. additional costs associated with ensuring that production methods meet health and safety requirements, percentage of health and safety management system costs)	_____
Investment costs (e.g. percentage written off for safety technology and workplace organisational measures required for prevention measures)	_____
Start-up costs (additional health and safety costs involved during production start-up or during introduction phase of prevention measures)	_____

(2) Estimate the value of prevention benefits accrued in your company within the last year.

Workplace prevention benefits	Value in € per employee per year
Cost savings through prevention of stoppages	_____
Cost savings through prevention of wastage and reduction of time spent catching up after stoppages	_____
Added value generated by increased employee motivation and satisfaction	_____
Added value generated by sustained focus on quality and better quality products	_____
Added value generated by product innovation	_____
Added value generated by better corporate image	_____

Appendix 6

Fictitious sample data set for interview guidelines

Variable term	Explanation	Sample data	Comment
Company		data protection	
Participant		data protection	
Employees		data protection	
Legal structure		data protection	
Industry		data protection	
Location		data protection	
Date		data protection	
Geg. PA	Current prevention work	2	good
ANQ	wastage and catch-up rates	data missing	
ABS	number of stoppages	-1	decrease
AP	(labour) productivity	1	remain constant
WS	added value	data missing	
KPSA	cost of personal protective equipment	68.00 €	
KSAB	cost of company medical support and guidance on safety technology	70.00 €	
KSB	payroll costs of safety officers excluding company medical support and guidance on safety technology	85.00 €	
KBPQ	cost of specific prevention training measures	30.00 €	
KV	cost of preventive medical check-ups	25.00 €	

Appendix 6

-KO	organisational costs	7.00 €	
KI	investment costs	8.00 €	
KA	start-up costs	data missing	
Summe K	Sum of all costs	SUM	
NBS	benefit/cost savings through prevention of stoppages	200.00 €	
NAN	benefit/cost savings through prevention of wastage and reduction of time spent catching up after stoppages	80.00 €	
NMZ	benefit/added value generated by increased employee motivation and satisfaction	25.00 €	
NQP	benefit/added value generated by sustained focus on quality and better quality products	60.00 €	
NPI	benefit/added value generated by product innovation	30.00 €	
NI	benefit/added value generated by better corporate image	data missing	
Sum N	Sum of all benefits	SUM	