METHODOLOGY FOR MEASURING THE OCCUPATIONAL HEALTH AND SAFETY RISKS IN TOURISM COMPANIES

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The methodology for measuring the occupational health and safety risks in tourism companies by numerical risk coefficient is based on the achievements of several US and international research and innovation development programs is presented. The occupational health and safety risks are regarded as a function of three variable factors: $L_{(m)}$ - the likelihood of occurrence of a negative, risk event; $C_{(m)}$ - the consequences from the realization of the same risk event and $I_{(m)}$- the immediacy of occurrence of the risk event in respect of time. The values of each of these three variables can be measured by the score card estimation tables and can be presented in referent scale of 1 to 10 or of 1 to 100. Thus can be achieved the final estimation of the value of a certain occupational health and safety risk. The advantages and the opportunities for improving of this methodology on an enterprise level are discussed as well. It is pointed out that the main advantage of this methodology is that it can be used even by small tourism companies with low experience for evaluation of health and safety risks. In addition, it is presented a set of criteria for acceptance of the occupational health and safety risks. This includes: the usage of risk matrixes, the "f-N" curves as well as the "ALARP" principle. This methodology can be easily implemented for the needs of risk management within the process of the Macedonian travel and tourism companies.

Key words: risk measurement and quantification; risk components, numeric risk coefficients

INTRODUCTION

All business processes produce certain risks, which are usually regarded by managers in terms of technical performance, cost, and schedule. The risks within the organization are also regarded as "business risks". And according to a survey conducted by "Arthur Anderson" and "The Economist" and cited by Turner and Hunsucker (Turner, Hunsucker, 1999), "business risk" is defined as, "the threat that an event or action will adversely affect the organizations ability to achieve its business objectives and execute its strategies effectively" ("The Economist", 1996). The problem of measuring the occupational health and safety risks in tourism companies is a part of the broader problem of measuring the risk at business process level within the organizations.

The complex nature of the tourism product, which comprises a high percentage of service components, and is being consumed on the place of its production, requires tourism personnel to interact with the consumers in the process of production. The occurrence and eventual realization of occupational health and safety risks can increase the scope and scale of the negative, undesired risk consequences.

Methodologies for quantifying and measuring the business risks and their components can also be easily applied in tourism companies. Most of these methodologies suffer from one main disadvantage: they present risk either as a standard deviation of a certain indicator across an average value, or present some understanding for the risk components which is not clearly explicit and/or does not include all of these risk components.

This paper is focused on a particular methodology for measuring the occupational health and safety risks in tourism companies by numerical risk coefficients. The methodology was presented initially by John V. Turner and John L. Hunsucker in an article named "Effective risk management: a global based approach", published in "International Journal of Technology Management" (Vol. 17, No. 4, 1999, pp. 438 – 458). This methodology was adapted and implemented for the needs of risk management within the process of the Bulgarian travel and tourism companies, mainly from the sub-sector of the hotel industry (Dimitrov, 2003). The process of adaptation and implementation included 19 hotels which had accepted the proposed methodology. A similar methodology was also presented in 2003 by Dimitar Dimitrov and Erdoan Hadzhiev for the need of the risks analysis on the working place and in the labour processes in the transport sector. Dimitrov and Hadziev's methodology differs from Turner and Hunsucker's concept only in the names of the main variables comprising the risk function.

METHODOLOGY

The essence of the Turners and Hunsucker's methodology lies on the understanding of Brooks (1994), Stone (1996), and Brinkley (1996) that the risk magnitude can be expressed as a function of a three variables: likelihood, consequence and imminence (Turner, Hunsucker, 1999, p. 441):

$$R_{(m)} = L_{(m)} \cdot C_{(m)} \cdot I_{(m)} \quad (1)$$

where:

$R_{(m)}$ is the risk magnitude for risk event, risk action or risk scenario "m";
$L_{(m)}$ - the likelihood (the probability) of occurrence of the risk event, risk action or risk scenario "m";
$C_{(m)}$ - the integrated risk consequence score for the risk event, risk action or risk scenario "m";
$I_{(m)}$- the imminence score (the evaluation of the absence of time for reaction) for the risk event, risk action or risk scenario "m".

Each of the three variables within the risk magnitude equation (1) can be calculated and expressed in terms of numeric coefficients. The values of each of these three variables are being measured by the help of score card estimation tables and are being presented as per a zero-referent scale of 1 to 10 or of 1 to 100. Thus can be achieved the final estimation of the value of a certain occupational health and safety risk.

Determining and evaluating the likelihood of occurrence L(m) of the risk event, risk action or risk scenario "m"

Quite often managers tend to give directly a certain numeric value for the variable based only on their intuitive perception. The reliability is hard to be proved. Therefore, it is quite useful, in this case, a quantity approach to be applied for determining the numeric value (the estimation) of the variable L(m), even if there is a lack of a reliable information form the past. The F/A-18 program uses exactly such an approach (Hayan, 1996). In the F/A-18 likelihood evaluation system, the numeric coefficient of 1 to 5 is being assigned to each risk event, action or scenario as presented in table 1.

Table 1 -The F/A-18 Program Risk Likelihood Evaluation Method

Likelihood (probability) numeric coefficient (whole number)	Description
1	The current work process is sufficient to prevent this type of risk event, action or scenario from occurring
2	The current work process is usually sufficient to prevent this type of risk event, action or scenario from occurring
3	The current work process may prevent the risk event, action or scenario but additional actions will be required
4	The current work process cannot prevent this type of risk event, action or scenario but a different approach or process might
5	The current work process cannot prevent this type of risk event, action or scenario, no alternative approaches or process are available

There could be also a more direct approach to assessing the likelihood of occurrence. Thus scale should contain direct verbal description to each range of used probabilities as it is shown in table 2.

Table 2 – A modified example scale for evaluating likelihood of occurrence L(m)

Likelihood (probability) numeric coefficient (whole number)	Description
5	High probability (P0.1) The risk event, action or scenario may be expected to occur once in one year of operation or 60-100 production cycles (meal orders, room accommodations and etc.) The risk event, action or scenario may be expected to occur once time in the work process/program/project lifetime
4	Moderate probability (0.01 ≤ P <0.1) The risk event, action or scenario may be expected to occur once in 5 years operation or 300-500 production cycles (meal orders, room accommodations and etc.) The risk event, action or scenario may be expected to occur once, and could occur more than once in the work process/program/project lifetime
3	Unlike probability (0.001 ≤ P<0.01) The risk event, action or scenario may be expected to occur once in 10 years operation or 600-1000 production cycles (meal orders, room accommodations and etc.) The risk event, action or scenario could occur once in the work process/program/project lifetime, but multiple occurrences are extremely unlikely
2	Remote probability (0.000001 ≤ P < 0.001) The risk event, action or scenario may be expected to occur once in 10 years operation, or more than 1000 production cycles (meal orders, room accommodations and etc.) The occurrence of the risk event, action or scenario during the work process/program/project lifetime is extremely unlikely Normally outside the operation envelope, limited hardware and operational safeguard exist to prevent completion to failure
1	Improbable probability (P<0.000001) Occurrence of the risk event, action or scenario is theoretically possible but such an occurrence is far outside the operation envelope and robust hardware or operational safeguard exist to prevent completion

Determining and evaluating the imminence I(m) of occurrence of the risk event, risk action or risk scenario "m"

A special attention should be given on the measurement and the evaluation of the imminence I(m) of occurrence of the risk event, risk action or risk scenario "m". This indicator is extremely important in determining which occupational health and safety risks should receive primary attention from the management of the tourism companies (especially in cases of equal probabilities and consequences).
In this regard, method in the International Space Station Program (ISSP) supposes determining of numeric imminence coefficients based on the usage of a function which reflects the sensibility of the

tourism companies' managers to this factor. Table 3 provides a visual example of such an imminence function.

Table 3 – Example scale for determining numeric coefficient of imminence

Numeric Coefficient of Imminence I(m)	Description
10	Insufficient time for risk reduction action remains
7	Little time for risk reduction action remains
3	Moderate time for risk reduction action remains
1	Adequate time for risk reduction action remains

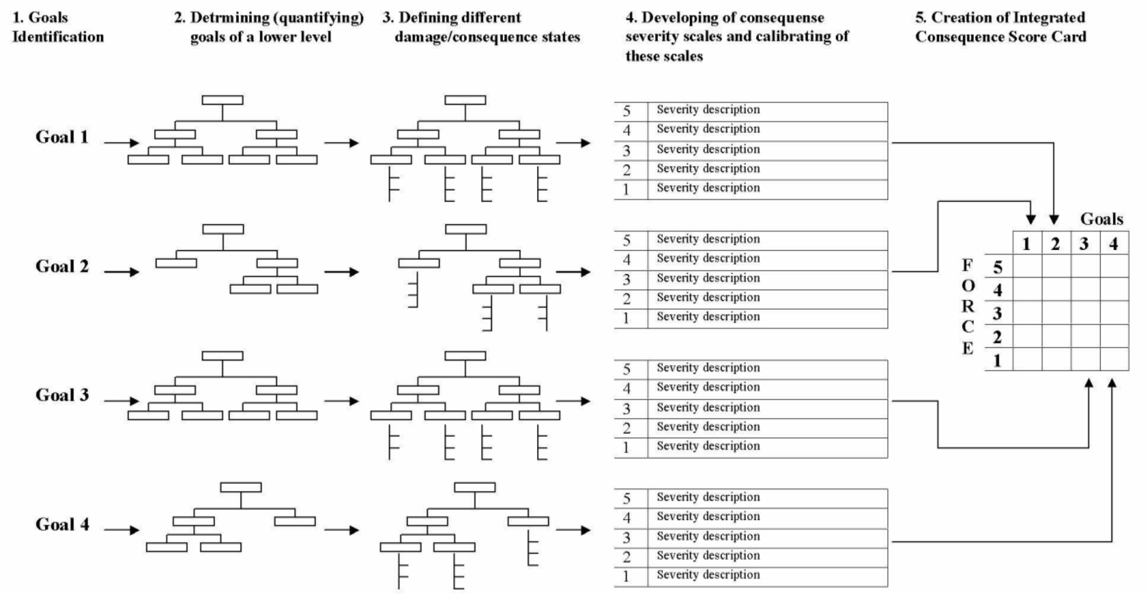
Similar to the case of determining and evaluating the likelihood of occurrence of the risk event, action or scenario "m", the numeric coefficient of imminence is being assigned by choosing the most appropriate and adequate to it description.

The descriptions should comply with the nature and content of the business processes within the travel and tourism companies. They should comply with the common requirement to reflect gradations in the time remaining for action.

Determining and evaluating the consequences C(m) from the occurrence of the risk event, risk action or risk scenario "m"

It is recommended that risk consequences should be assessed in such a way, which allows their impact to be accurately and fully determined to all the goals within the tourism organization. The main purpose here is to establish a risk consequence framework which identifies the impact of a risk event, action or scenario to top management in the organization arising in any of the tourism organization activities or processes. The risk scenarios may potentially include one or more type of risks. The goal of the risk consequences assessment framework is to capture the criteria and priorities used by the top management for every day decision making. This framework should be applied to all decision makers within the tourism companies. Without it the comparison of the different types of risk would be problematic (Figure 1).

Figure 1 – Developing of an Integrated Risk Consequence Score Card (Source: Turner, J. V. and Hunsucker, J. L., 1999:450)



CRITERIA FOR ACCEPTANCE OF THE OCCUPATIONAL HEALTH AND SAFETY RISKS

After the calculations for each of the risk components, for each of the risk variables are being achieved, different criteria for acceptance can be applied. This includes: the usage of risk matrixes; the “f-N” curves; and the “ALARP” principle.

Risk Matrixes. The arrangement of health and safety accident probability and corresponding consequence in a matrix (see Figure 2) may be a suitable expression of risk in cases where many accidental events are involved or where single value calculation is difficult (NORSOK Standard, Z-013, 1998). The matrix is separated into three regions as follows:

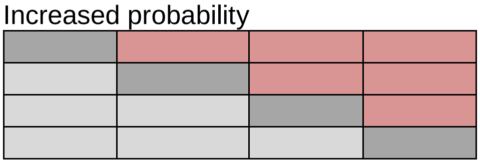
•Unacceptable risk

•Acceptable risk

•A region between acceptable and unacceptable risk, where evaluations have to be carried out in order to determine whether further risk reduction is required or whether more detailed studies should be done first of all.

Figure 2 - Risk matrix

Increased probability



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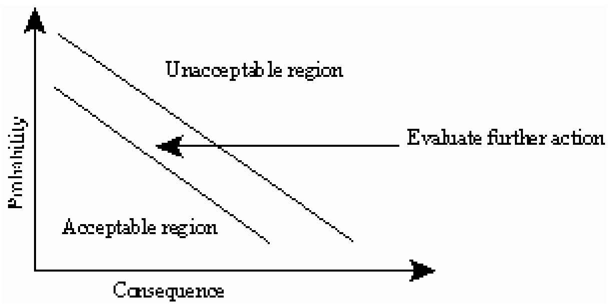
Increasing consequence

Unacceptable risk
Evaluate further attention
Acceptable risk

The limit of acceptability is set by defining the regions in the matrix which represent unacceptable and acceptable risk. The risk matrix may be used for qualitative as well as quantitative studies. If probability is classified in broad categories such as “rare” and “frequent” and consequences in “small”, “medium” and “catastrophic”, the results from a qualitative study may be shown in the risk matrix. The definition of the categories is particularly important in case of qualitative use.

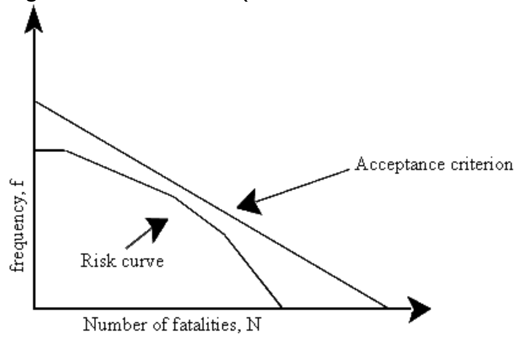
The categories and the boxes in the risk matrix may be replaced by continues variables, implying a full quantification (Figure 3).

Figure 3 - Risk matrix like presentation with continuous variables (Source: NORSOK Standard, Z-013, 1998)



f-N Curves. The f-N curve (f = frequency, N = number, i.e. measurement of consequence) expresses the acceptable risk level according to a curve where the frequency is dependent on the extent of consequences (such as number of fatalities per accident). The acceptance limit may be adjusted according to the resource which is exposed. The f-N curve used as an acceptance limit may reflect aversion to major accidents (with multiple fatalities), if the curvature is different from an "iso-risk" line (along which the product of f and N is constant). The calculation of values for the f-N curve is cumulative, i.e. a particular frequency relates to "N or more" fatalities. Figure 4 presents an illustration.

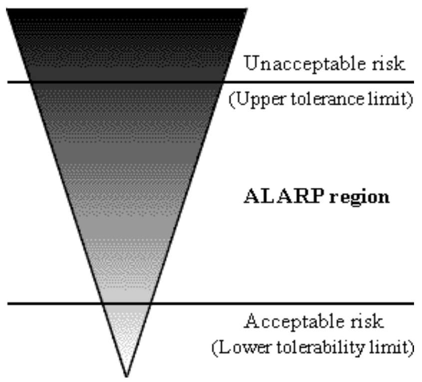
Figure 4 - f-N curve (Source: NORSOK Standard, Z-013, 1998)



The f-N curve may be used in relation to risk acceptance for personnel, environment and assets.

“ALARP” principle. The ALARP ("As Low As Reasonably Practicable", see Figure 5) principle is sometimes in the industry used as the only acceptance principle and sometimes in addition to other risk acceptance criteria.
The use of the ALARP principle may be interpreted as satisfying a requirement to keep the risk level "as low as possible", provided that the ALARP evaluations are extensively documented.
The risk level shall be reduced as far as possible in the interval between acceptable and unacceptable risk. The common way to determine what is possible is to use cost-benefit evaluations as basis for decision on whether to implement certain risk reducing measures.
The upper tolerability limit (see Figure 5) is almost always defined, whereas the lower tolerability limit may sometimes be left undefined. This will not prohibit effective use of the approach, as it implies that ALARP evaluations of risk reducing measures will always be required.
The ALARP principle used for risk acceptance is applicable to risk to personnel, environment and assets.

Figure 5 - The ALARP-principle (Source: NORSOK Standard, Z-013, 1998)



CONCLUSIONS

The main advantage which is pointed out is that the Turner and Hunsucker’s methodology can be used even by inexperienced tourism company which has small record of health and safety risk measurement. This methodology can be easily implemented for the needs of risk management within the process of the Macedonian travel and tourism companies.

The methodology can be used through a specially designed web interface for online risk monitoring, evaluation and management by the headquarters of tourism companies which have subsidiaries and facilities in remote destination. This can be achieved without a substantial financial burden especially via the existing corporate intranet and extranet information systems. Such an online approach to the application of risk measurement methodology is recommended in most of the guidelines (such as: The University of Queensland, Occupational Health & Safety Unit, 2009) to some of the existing national standards for risk management (AS/NZS 4360:1999; NORSOK STANDARD, Z-013:1998, Australian Risk Management Advisory Standard 2000).
The main disadvantage and shortcoming of the methodology for measuring occupational health and safety risks in tourism companies is that it relies heavily on subjective personnel or expert judgments. This shortcoming could be overcome to some extent by multiple repeated measurements and/or by using not a single but a group of evaluators.

REFERENCES

NORSOK STANDARD, “Risk and Emergency Preparedness Analysis”, Z-013, Rev.1, March 1998, Annexe A “Risk Acceptance Criteria”, Norwegian Technology Standards Institution, Oslo, Norway

Risk Management Advisory Standard 2000: Department of Employment, Training and Industrial Relations – Workplace Health and Safety

The Economist, (1996), A Game of Risk – The Economist Survey, Corporate Risk Management, 10th February, 1996;

The University of Queensland, Occupational Health & Safety Unit, (2009), Occupational Health & Safety Risk Assessment and Management Guideline Risk Management Advisory Standard 2000: Department of Employment, Training and Industrial Relations – Workplace Health and Safety

Andrews, H., (2005), “Health and safety as a strategic issue”, Managing Business Risk, 2nd Edition, Jonathan Reuvid (edit.), Kogan Page, London and Sterling, VA: 187-191

Australian Standard AS/NZS 4360:1999 – Risk management

Brinkley, R., Stone, D., (1996), “International Space Station Program Directive – Program Risk Management Emphasis System”, ISS-PD-011, NASA, Johnson Space Center, Houston, Texas, USA

Brooks, W. M., (1994), “Project Risk Management (a presentation given at Johnson Space Center, May 9-11, 1994)”, Johnson Space Center, Houston, Texas, USA

Cushway, B., (2005), “Creating a safe working environment”, Managing Business Risk, 2nd Edition, Jonathan Reuvid (edit.), Kogan Page, London and Sterling, VA: 179-185

Dimitrov, P., (2003), “Risk Management in Tourism Innovations”, Heron Press, Sofia, Bulgaria

Dimitrov, P., (2006), “Tourism Innovations”, “Neofit Rilski” University Press, Blagoevgrad, Bulgaria

Hayan, J. A., (1996), F/A-18 “Risk management plan”, Report MDC 960074, McDonnel Douglas Aerospace, St. Luis, USA

Lyons, S., (2005), “Managing your most valuable asset, protecting your most vulnerable resource”, Managing Business Risk, 2nd Edition, Jonathan Reuvid (edit.), Kogan Page, London and Sterling, VA: 192-197

Turner, J. V. and Hunsucker, J. L. (1999), “Effective risk management, a goal-based approach”, International Journal of Technology Management, Vol. 17, No.4: 438-458

Dimitrov, P. “Measuring occupational health and safety in tourism companies” Ege Academic Review 9 (3) 2009: 889-902