

# Assessing the Success of Risk Assessment and Factors Affecting Its Success

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## **ABSTRACT**

Evaluating the success of a risk assessment is demanding, and a clear description of a correctly performed risk assessment is lacking. To deepen understanding of this significant topic, ten occupational health and safety specialists and managers were interviewed, and a Delphi survey was completed by 13 respondents. The participants were from various industries, public authority, and consulting. The interviewees acknowledged the importance of evaluating risk assessment although they infrequently assessed the process or the results. Based on the Delphi survey, individual features affecting the risk assessment are, for example, understanding of the entity and communication and interaction skills. Organizational features influencing risk assessment include the organization's commitment to safety and safety management, and risk assessment being a part of the safety management system. Future research topics include constructing a model for evaluating the quality and success of the risk assessment.

**Keywords:** Individual Feature, Occupational Health and Safety, Organizational Feature, Risk Assessment, Risk Evaluation, Quality

## INTRODUCTION

In promoting occupational health and safety (OHS) and preventing accidents, risk assessment is an important factor (Työturvallisuuslaki 23.8.2002/738, 2002; ISO-45001:2018, 2018). However, there is no clear definition of when a risk assessment is successful or instructions for how to evaluate it. Inadequate risk assessments lead to ineffective safety prevention programs, inefficient use of resources, and criticism of risk assessment (Pinto et al., 2013). If decisions are based on misleading results, or the recognized risks are not actual, significant sources of risks may not be eliminated or reduced (Backlund and Hannu, 2002; Nenonen et al., 2018).

In literature, certain factors affecting the quality of a risk assessment (including factors related to the process and methods, and to the team and individuals) have been recognized. Among others, the design phase, quality of the background knowledge, chosen method, hazard identification, accuracy of frequency and consequence analysis, resources, documentation completeness, and consultation and collaboration of relevant stakeholders, affect the quality of risk assessment results (Arunraj and Maiti, 2007; Kumasaki and Shoji, 2013; Pinto et al., 2013; Langdalen et al., 2020). Furthermore, the composition of the assessment team is important; the number of participants and their competence, knowledge, and skills influence the results (Pinto et al., 2013). Individuals on the risk assessment team have initial assumptions, and individual qualities (Pinto et al., 2013; Hrica and Eiter, 2020).

In evaluating the quality of a risk assessment, it is suggested in previous studies to examine the completeness (having all the required characteristics), accuracy (being correct and exact), fidelity (representing the workplace system), and fitness (satisfying the formulated objectives and requirements) of the risk assessment results (Pinto et al., 2013). Different approaches have been identified for use in the evaluation, such as carrying out a parallel analysis of the system, comparing the results with accidents occurring in corresponding systems, and examining the process (Pinto et al., 2013).

This study aims to add knowledge of when a risk assessment is successful and which factors influence its success.

## METHODS AND MATERIALS

This qualitative study was conducted to broaden understanding of the success of a risk assessment. Data were collected from OHS specialists and managers ( $n = 10$ ) in interviews. In addition, a Delphi survey with three rounds was emailed to OHS specialists and managers ( $n = 17$ ). The interviews and the Delphi survey focused on when a risk assessment can be said to be successful, and which individual and organizational features affect its success. The respondents represented companies from the following industries and authorities: a) manufacturing, b) transportation and storage, c) electrical power generation, transmission and distribution, d) other technical testing and analysis, e) public authority, and f) consulting. The distribution of the companies, interviews, and Delphi survey are summarized in Table

1.

The semi-structured form of the interview was based on a previous study (Nenonen et al., 2018) and current research questions. The topics included questions such as how to evaluate the success of a risk assessment, how the residual risks have been assessed, and who evaluates or could evaluate the success of the risk assessment. Interviews were recorded for transcription and analyzed by classifying themes. The job titles of the interviewees varied from safety engineers to health, safety, environment, and quality managers. All interviews were conducted in autumn 2020.

A Delphi survey (Linstone and Turoff, 1975; Stewart, 1987) was used to gather opinions from OHS specialists and managers about when a risk assessment is successful, and which personal and organizational factors affect the success of the risk assessment. It was assumed that OHS specialists and managers are, by definition, aware of the risk assessment principles. Requests to participate was emailed to 17 individuals; eight participated in the first round, 12 in the second round, and 13 in the third round, yielding a response rate of 47.1%, 70.6%, and 76.5%, respectively.

In the first round, participants were asked to describe when a risk assessment can be said to be successful and to describe individual features that affect the risk assessment. A qualitative analysis was then performed, and the participants ( $n = 8$ ) received feedback. Thematic categorization of the first-round qualitative material was conducted by applying open coding analysis (Flick, 2009) identifying 10 factors that indicate a successful risk assessment and 10 individual features affecting risk assessment. In the second round, the respondents were asked to comment on the results and add factors missing from the list or remove factors if they were not necessarily based on the respondents' opinion. In addition, they were asked to describe organizational features affecting risk assessment. After the second round, a qualitative analysis was performed to modify the lists based on the answers ( $n = 12$ ), and the participants again received feedback. In the third round, respondents were asked to choose at most eight factors that indicate a successful risk assessment, at most five individual features affecting risk assessment, and at most eight organizational features affecting risk assessment. Before each round ended, reminders were sent. The third round answers were analyzed using IBM SPSS 27.

Table 1: Background information about the interviews ( $n = 5$ ) and the Delphi survey ( $n = 17$ )

Interview	
Companies	Manufacturing (companies A and D), transportation and storage (company C), electrical power generation, transmission and distribution (company B), other technical testing and analysis (company E)
Interviewees per company	Company A ( $n = 2$ ), company B ( $n = 1$ ),

	company C (n = 3), company D (n = 3), company E (n = 1)
Interview medium	Teams interviews (n = 5)
Interview type	Individual interviews (40%), group interviews (60%)
Duration of the interviews	Average 73 minutes, range 63–84 minutes
Experience in occupational safety	Average 7 years, range 2–15 years
<b>Delphi survey</b>	
Companies and stakeholders	Manufacturing (companies A and D), transportation and storage (company C), electrical power generation, transmission and distribution (company B), other technical testing and analysis (company E), public authority (company F), and consulting business (company G)
Delphi surveys responders per company / authority	Company A (n = 2), company B (n = 1), company C (n = 3), company D (n = 3), company E (n = 2), public F (n = 4), company G (n = 2)
Survey	Created with Lime Survey, three rounds
Response percentage	1st round, 47.1%; 2nd round, 70.6%; 3rd round, 76.5%
Experience in occupational safety	Average 13 years, range 2–30 years

## RESULTS

According to the interviews, companies do not systematically evaluate the quality of risk assessments or their success. Instead, the companies check whether risk assessments have been completed. However, they acknowledged the importance of and need for evaluating the risk assessment processes and results. Residual risks are mainly assessed at the same time as the risk assessment and planning of the corrective actions. The interviewees noted this deficiency, but at present, there is no systematic return to risk assessment after the actions have been taken. To improve the treatment of residual risks, the interviewees stated that the residual risks should be assessed after corrective actions are completed. In addition, employee awareness of residual risks was weak in some companies; therefore, adding awareness was seen as an area that clearly needs improvement.

Because in the companies the quality of neither the risk assessment nor the corrective

actions were evaluated, a third question was formulated: “Who could evaluate the success of the risk assessment?” Interviewees described the line organization’s responsibility and suggested that the organization could evaluate risk assessments like safety audits. If the quality of risk assessments is ensured through audits, it could save resources compared to going through all risk assessments individually.

In the Delphi survey, the following points were included in a successful risk assessment as presented in Table 2; the risk assessment represents reality, the results are utilized in planning and developing work tools, instructions, and operations, the employees are aware of the residual risks and able to acknowledge them while working, the risk assessment is utilized in educational and orientation material, and the measures have been focused and carried out so that the risk is removed or reduced.

Table 2. Factors included in a successful risk assessment

<b>Risk assessment is successful when</b>	<b>%</b>
the risk assessment represents reality	92
the results are utilized in planning and developing work tools, instructions, and operations	77
the employees are aware of the residual risks and able to acknowledge them while working	69
the risk assessment is utilized in educational and orientation material	69
the corrective actions have been focused and carried out so that the risk is removed or reduced	62
the progress of the results and measures is visible to employees	54
participants find it motivating to carry out a risk assessment	54
risk assessment is planned (schedule, resources)	38
risk assessment helps to prioritize corrective actions (they can also be targeted cost-effectively)	38
residual risks are utilized in the orientation	38
all stages of the risk assessment are systematically reviewed	31
human factors and errors have been identified	31
changes and results are monitored	31
the results will be used to develop tools and instruments (such as a risk list)	31
after corrective actions, the re-examination of the risk assessment shows that the risks have been correctly identified and that no new risks have arisen	23
risks are under control (no deviations or accidents)	8

Finally, the most important characteristics of the individual features affecting the risk assessment were understanding of the entity, communication and interaction skills, and understanding of the interdependencies (Table 3). Organizational features influencing risk assessment included the organization's commitment to safety and safety management, risk assessment being a part of the safety management system, and the line organization understanding its responsibilities and operating accordingly (Table 3).

Table 3. The most important characteristics of the individual and organizational features affecting the risk assessment

<b>Individual characteristics</b>	<b>%</b>	<b>Organizational characteristics</b>	<b>%</b>
Understanding of the entity	92	Organization's commitment to safety and safety management	92
Communication and interaction skills	85	Risk assessment being a part of the safety management system	85
Understanding of the interdependencies	69	Line organization understanding its responsibilities and operating accordingly	62
Competence and expertise (own work, basics of occupational safety), experience	62	Orientation and engagement of supervisors	54
Identifying and understanding human factors	62	The risk assessment process is well thought out and described	54
Logical reasoning/analytics	38	Participatory approach	54
Open attitude to change	23	Safety culture	54
Objectivity	23	Resources available for risk assessment (people, skills, time, money, tools)	38
Knowledge of the historical data of the assessment object	23	Willingness to change and ability to change	38
Knowledge of business and processes	15	Clear responsibilities for individuals and groups	31
		Information flow	23
		Personal dynamics (attitude, ability to evaluate activities openly/conversationally)	23

	Work atmosphere/social factors	23
	Utilizing the results of risk assessment in the organization when creating strategies and operating models	23
	Impact of previous decisions on the current situation	15
	Software and a network of experts	15
	Planned implementation	15
	Monitoring procedures	15
	Identification of organizational structure and decision-making hierarchy	8
	Identifying the impact of different units' activities	8
	Management assesses the adequacy of the corrective actions	8
	Safety indicators defined	0

## DISCUSSION

In this study, the success of a risk assessment was examined. When asked to choose a maximum of eight factors in a successful risk assessment, respondents were almost unanimous on the first factor. Otherwise, the scores were evenly distributed, with the latter selected no more than once. “The risk assessment represents reality” was chosen by 92% of the respondents, which is in line with literature, as the quality of the occupational safety risk assessment depends on real data, in other words, actual workplace data instead of assumptions that do not reflect reality (Pinto et al., 2013). However, a question arises: How is it verified that the risk assessment on paper corresponds to the practical operation? If the factor was not chosen, are there eight more important points on the list than the fact that risk assessment is in line with practice? In addition, two factors, “the risk assessment is utilized in educational and orientation material” and “the employees are aware of the residual risks and able to acknowledge them while working”, were selected as the third most important. Similarly, the interview results showed that adding awareness of residual risk is a major development target.

When selecting a maximum of the five most important characteristics of individual features affecting the risk assessment, after the two most notable factors, the following options received each more than 50% of the votes: “Understanding of the dependencies,” “Competence and expertise,” and “Identifying and understanding human factors”. Similarly

to the Delphi survey, in the literature, relevant competence, knowledge about methodologies for identifying hazards, “real-world” tasks and the relevant technical systems, and experience have been emphasized as individual features affecting risk assessment (Kumasaki and Shoji, 2013; Pinto et al., 2013).

While respondents chose a maximum of eight organizational features influencing risk assessment, the seven most frequently selected options received each more than 50% of the votes. Furthermore, the last eight received each 0–15% of the votes which indicates quite wide variation in the answers. Compared with the question of individual features, “communication and interaction skills” were considered an important factor influencing risk assessment, in contrast to the organizational level where “information flow” and “work atmosphere/social factors” were considered less important characteristics.

Regarding the response rate for the Delphi survey, response rates for e-mail surveys vary widely (Leong and Austin, 2005; Dillman et al., 2014). In this case, the Delphi survey was sent to OHS specialists and managers in different industries and authorities, and sending reminders in each round increased the number of responses. Slight variations in the words used in a questionnaire or the context of a question can also affect the results which became concrete; therefore, a question was added to the second round to clarify organizational factors in addition to individual factors (Strauss and Corbin, 1998). Carelessly executed, poorly worded, and ambiguous questionnaires and superficial analysis of responses are likely to undermine the Delphi method (Linstone and Turoff, 1975; Stewart, 1987). In the present study, the fact that respondents continued to answer throughout the three rounds reflects well on the questions and analysis, with 8 responding in the first round, 12 in the second, and 13 in the third.

As can be seen from the results, the opinions regarding factors affecting risk assessment and factors included in a successful risk assessment vary, although some options unanimously received the most votes. Further research is needed to formulate a model guiding the evaluation of the quality and success of risk assessment.

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