

1 **Analysis of safety culture maturity in two Finnish companies**

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4 **Abstract**

5 **Objective:** The aim of this study was to analyze perceptions of safety culture in two Finnish
6 industrial companies. **Background:** The link between safety culture and safety performance
7 has been investigated in many studies. However, understanding of the status of safety culture
8 and the specific needs for development is still limited. **Method:** A recently developed safety
9 culture maturity model was used to analyze the level of safety culture through a survey of two
10 Finnish companies. A questionnaire was sent to 1109 respondents, 289 of whom completed it
11 (26% response rate). **Results:** The state of safety culture was rather advanced in both case
12 companies, and the personnel in both companies were overall satisfied with it. However, the
13 analysis indicated considerable differences in safety culture perceptions within the companies.
14 Particularly, top management and safety experts perceived the state of safety culture as more
15 advanced than employees did. **Conclusion:** There are differences in perceptions of safety
16 culture, especially between top management and employees, which might hinder the
17 development of safety culture in organizations. By understanding such differences within an
18 organization, it is possible to identify appropriate managerial actions for different levels.

19 **Keywords:** Safety Culture, Safety Performance, Maturity Model, Maturity Analysis, Self-
20 Evaluation Survey

21 **Introduction**

22 Many studies have shown that safety culture (or safety climate) is linked to safety performance
23 (e.g., Carder & Ragan, 2003; Lee, 1998; Stemn et al., 2019; Vinodkumar & Bhasi, 2009). Safety
24 climate scores have been suggested as the most important safety performance indicators (e.g.,
25 Hoffmeister et al., 2014). However, safety culture can be difficult to measure, as it concerns

26 individual and group attitudes, beliefs, values, and behaviors related to health and safety in an
27 organization (Hale, 2000), which are difficult to quantify. To measure the level of safety culture
28 in an organization, maturity models are often used (Goncalves Filho & Waterson, 2018).
29 Maturity models represent an anticipated, desired, or typical evolution path shaped in discrete
30 stages (Becker et al., 2009). They are valuable measurement instruments because they allow
31 the assessment of the current situation of a company, as well as the identification of obvious
32 development needs (Becker et al., 2009). Maturity of safety can be defined as a certain level of
33 effectiveness and performance in the management of safety and occupational health and safety
34 (Kaassis & Badri, 2018). Recently, Jääskeläinen et al. (2020) analyzed the maturity and
35 performance implications of safety performance measurement practices in industrial companies.
36 Several maturity models have been developed for safety culture evaluation. Goncalves Filho
37 and Waterson (2018) identified 41 different models. Typically, maturity models provide one
38 overall maturity score for an entire organization and do not assess differences between
39 organizational levels (e.g., Goncalves Filho et al., 2010; Jespersen et al., 2016; Tappin et al.,
40 2015). This is probably the result of earlier safety literature, which suggested that a company
41 should have a uniform safety culture across all levels (Hale, 2000). However, it is highly
42 questionable whether attitudes are the same at all levels (Guldenmund, 2000). Several studies
43 have identified differences in safety culture between organizational levels (e.g., Clarke, 1999;
44 Findley et al., 2007; Prussia et al., 2003; Tear et al., 2020). Accordingly, some maturity models
45 attempt to measure the state of safety culture between groups within an organization (e.g.,
46 Parker et al., 2006). However, relevant studies are still limited.

47 To contribute to this research, this study aimed to analyze the state of safety culture in two
48 Finnish industrial companies and to identify differences between organizational levels. To that
49 end, the study employed a recently designed maturity model for safety culture and related
50 survey tool (Tappura et al., in press), which is a synthesis of previous maturity models with
51 verified validity and/or reliability. The model encompasses five main themes: (1) *communication*,

52 (2) *training*, (3) *organizational learning*, (4) *management and supervisor commitment*, and (5)
53 *employee commitment and involvement*. Unlike previous maturity models, this model evaluates
54 maturity by combining written descriptions of best practices and the perceived satisfaction of
55 employees in the evaluated aspects.

56 **Material and Methods**

57 A self-evaluation survey was conducted in two participating Finnish companies. Company 1 is
58 an infrastructure builder (approximately 1400 staff). Company 2 operates in the chemical
59 industry (approximately 200 staff). The survey tool was assessed by fellow safety researchers
60 and safety experts at the participating companies. Based on their feedback, minor changes
61 were made to the questionnaire to improve clarity and ease of responding. The survey tool was
62 based on a recently designed maturity model for safety culture (Tappura et al., in press).

63 Invitations to complete an online questionnaire were sent to 1109 respondents, and 289
64 completed responses were received (26% response rate). Of those, 252 (87%) were from
65 Company 1, and 37 (13%) were from Company 2. The respondents were from all organizational
66 levels of the participating companies, from the operative employee level to top management.
67 The responses by respondent group were as follows: top management: 10 (3%); middle
68 management: 41 (14%); supervisors: 60 (21%); safety experts: 9 (3%); administrative
69 employees: 28 (10%); and other employees: 141 (49%).

70 The questionnaire consisted of 29 items organized in five main themes: (1) *communication*, (2)
71 *training*, (3) *organizational learning*, (4) *management and supervisor commitment*, and (5)
72 *employee commitment and involvement*. Each item was measured on a four-level maturity scale
73 with written evaluation criteria of company practices in the questionnaire. The answers were
74 scaled from 1 to 4, where 1 represented the lowest and 4 represented the highest level of
75 maturity (see example in Table 1). Also, in each theme, satisfaction was rated on a 5-point

76 Likert scale, where 1 represented *very dissatisfied* and 5 represented *very satisfied* (satisfaction
77 scores).

78 **Table 1.** Example of the maturity levels of a questionnaire item

Level	Item: “working under pressure”
Level 1	It is common for employees to take shortcuts at the expense of safety when under pressure.
Level 2	Employees rarely take shortcuts at the expense of safety when under pressure.
Level 3	Employees do not take shortcuts at the expense of safety when under pressure but rarely intervene when someone else does.
Level 4	Employees do not tolerate any unsafe behavior even when under pressure.

79
80 Based on the safety culture levels and satisfaction scores, the final responses were visualized in
81 a maturity matrix (Jääskeläinen & Roitto, 2015). In this matrix, the closer an organization is to
82 the top right corner, the higher its safety culture level is, and the more satisfied with it the
83 organization’s members are. The results were discussed with the company representatives, but
84 the further development actions were out of the scope of this study.

85 **Results**

86 The positions of the two companies in the maturity matrix according to the survey results are
87 shown in Fig. 1. The averages of the two companies were very similar. Both companies had
88 fairly advanced safety practices and were overall satisfied with their respective safety cultures.
89 However, the results showed that there was still room for development regarding the overall
90 safety culture maturity in both organizations. The observed overall safety culture level was
91 slightly below Level 3—that is, below the levels that typically represented a more proactive
92 attitude toward safety (i.e., Levels 3 and 4). The overall satisfaction scores were between 3 and
93 4, which represented *neither satisfied nor dissatisfied* and *satisfied*, respectively. Taken

94 together, the results indicated not only that there was room for improvement but also that the
95 staff perceived a need for development, as suggested by the moderate level of satisfaction.



96

97 **Figure 1.** Overall safety culture maturity levels and satisfaction scores of the two case
98 companies (maturity matrix adapted from Jääskeläinen & Roitto, 2015).

99 When the safety culture levels were calculated separately for each theme, the results showed
100 that most themes were at a similar level (Fig. 2). The *training* theme scored the lowest. Within
101 this theme, the items “training of supervisors” and “training systematization” had the lowest
102 scores. However, satisfaction with training was not lower than the levels of satisfaction in other
103 themes. The *employee commitment and involvement* theme had the second lowest safety
104 culture level and the lowest satisfaction score. The lowest-scoring items were “employees’
105 actions for safety” and “working under pressure.” These results indicated that employees
106 participated in safety development mostly through incident reporting and rarely intervened when
107 others took shortcuts at the expense of safety.

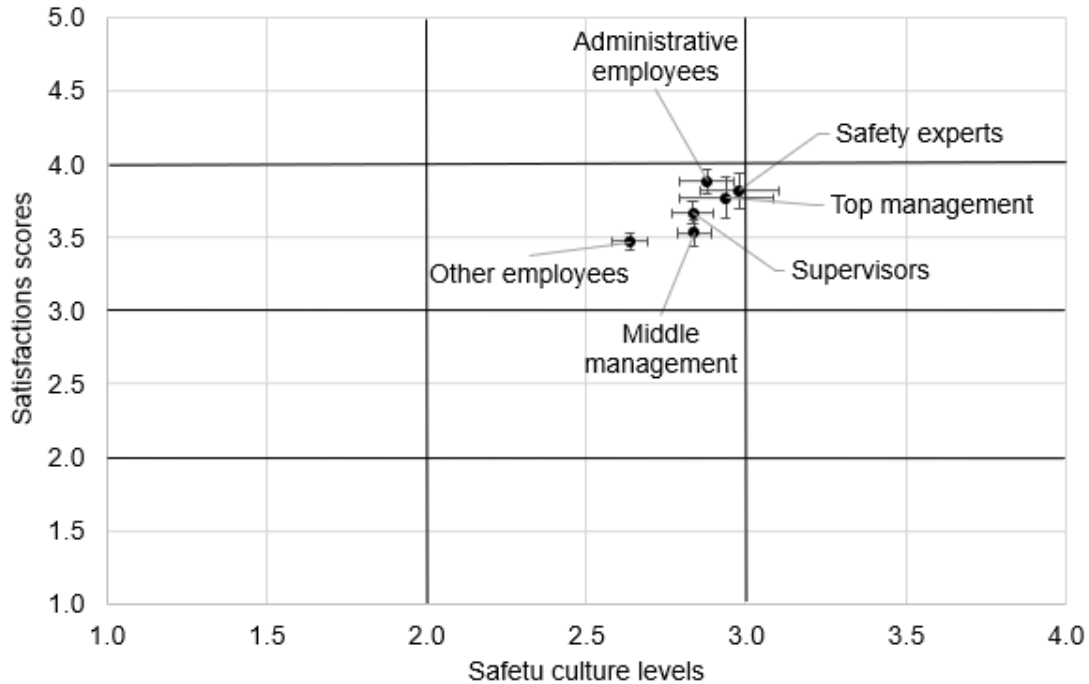
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110 **Figure 2.** Average safety culture levels and satisfaction scores for each theme. The error bars
 111 represent standard errors.

112 When the maturity levels were analyzed according to the respondent groups (Fig. 3), a clear
 113 trend emerged. Safety experts and top management were closest to the top right corner of the
 114 matrix, supervisors and middle management were in the middle, and employees were
 115 separated from the rest and located more on the left. Safety experts and top management
 116 clearly had more positive perceptions of safety culture than the other respondent groups did,
 117 whereas employees perceived safety culture as less advanced than the other groups did and
 118 were less satisfied with it. Thus, perceptions of safety culture seemed to follow the
 119 organizational hierarchy.



120

121 **Figure 3.** Overall safety culture maturity levels and satisfaction scores by respondent group.

122

The error bars represent standard errors.

123

124 These differences were also visible in the responses to the individual items. For example, in the
 125 *communication theme* (Fig. 4), the trend was seen especially in the “supervisors’ interest in
 126 communicating safety issues to the workforce” and “organization’s way of sharing safety-related
 127 information” items. Top management and safety experts perceived a greater interest on the part
 128 of supervisors in communicating safety issues than the other groups did. Likewise, top
 129 management perceived the way in which safety-related information was shared to be more
 130 advanced than the other groups did. These results suggest that the approach to information
 131 sharing might be quite advanced at higher organizational levels, but the information does not
 132 reach the lower levels. The same trend was observed in most other themes, except for the
 133 *employee commitment and involvement theme*, where the differences between respondent
 groups were not as large.

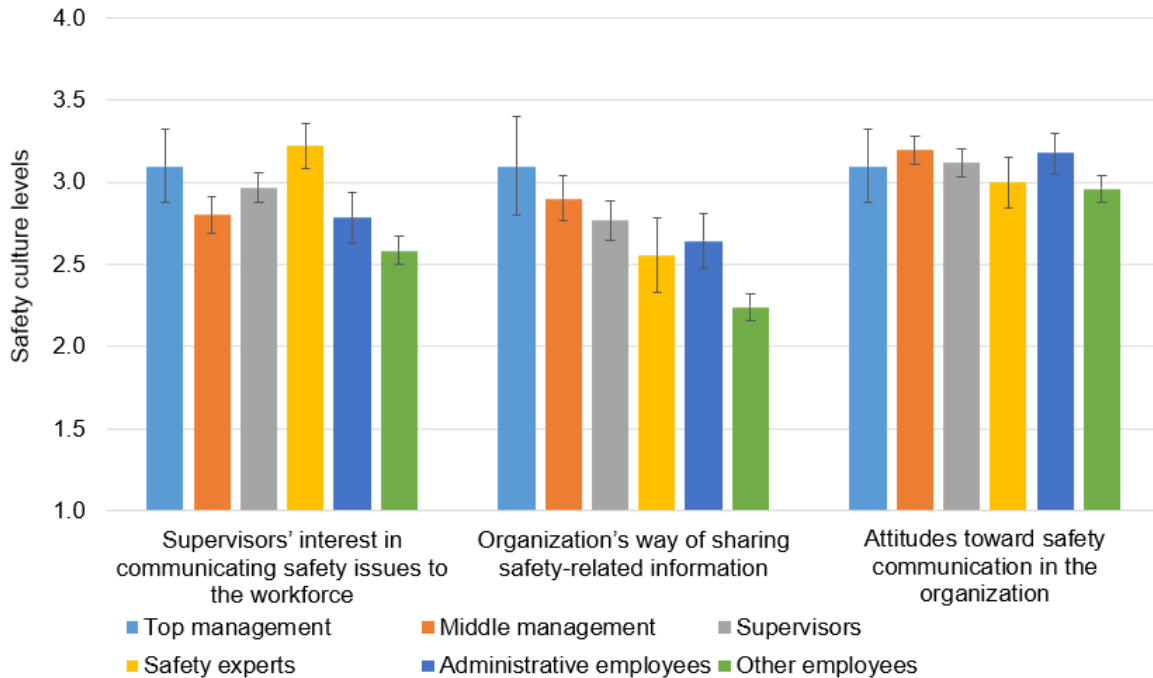


Figure 4. Average safety culture maturity levels by respondent group in the *communication* theme. The error bars represent standard errors.

The results of each company were also analyzed separately. As seen in Fig. 1, the overall results and the results of each theme were similar. In both companies, top management clearly had a more positive perception of safety culture than the other respondent groups did, and the overall score corresponded to the respondents' position in the hierarchy.

Discussion

This study investigated the level of safety culture in two Finnish industrial companies. A recently developed safety culture maturity model (Tappura et al., in press) was used for the analysis. The results showed that the level of safety culture was relatively high, and the participating companies were overall satisfied with it. Nevertheless, the findings suggest that both companies could further develop their respective safety cultures. Particularly safety training practices were not very advanced, even though respondents were quite satisfied with them. Employee

148 commitment and involvement, which is often considered the most safety-critical theme (e.g.,
149 Hamid et al., 2008), had the lowest satisfaction score and the second lowest safety culture level.
150 The results also shed light on the differences in safety culture between organizational levels.
151 The analysis by respondent group revealed significant differences in the perception of safety
152 culture aspects, especially between top management and safety experts on the one hand and
153 employees on the other. The perception of and satisfaction with safety culture seemed to reflect
154 the respondents' hierarchical level. Top management tended to overestimate the state of
155 current practices, especially practices for which top management is responsible (e.g.,
156 communication and employee training), whereas employees were the most critical and least
157 satisfied with the safety culture. These results are in line with Clarke (1999), Findley et al.
158 (2007), and Tear et al. (2020), who also reported significant differences in safety culture
159 between organizations' hierarchical levels. A maturity analysis of safety performance
160 measurement practices by Jääskeläinen et al. (2020) indicated the same phenomenon.

161 Our findings suggest that all organizational levels should be included in safety culture
162 evaluations, and the results should be analyzed separately. When it is not possible to cover an
163 entire organization, the results of one organizational level should not be generalized to the
164 overall state of safety culture in the organization. By understanding the differences within an
165 organization, it is possible to identify more specific ways of improving the safety culture for
166 different organizational levels. For example, by identifying differences in safety communication
167 perceptions between top management and employees, this issue could be addressed with a
168 specific plan to improve the flow of information between levels. Treating safety cultures as
169 uniform across organizational levels may conceal important issues. Although Taras et al. (2009)
170 highlighted this aspect when describing the best practices for culture measurements, this issue
171 remains underexplored in the safety culture literature.

172 The similar results of the two case companies suggest that the state of safety culture is not
173 industry-dependent. Previous research (e.g., Hale et al., 2010; Killimett, 2006; Veltri et al., 2013;

174 Yorio & Wachter, 2013) has also indicated that contextual factors (such as the industry or the
175 competitive environment) do not predict safety culture. Other factors, such as leadership, seem
176 to influence safety culture and distinguish successful from unsuccessful organizations.
177 This study has certain limitations. First, although the results are based on two companies, most
178 responses (87%) were from Company 1. Therefore, the findings may be more representative of
179 that company than of Company 2. Second, both companies were from Finland, which may limit
180 the generalizability of the results. Further qualitative studies using the same maturity model in
181 different regions and with more case companies could enhance the reliability of the results.
182 Finally, the results were concurred with the company representatives, but no further
183 interpretations were made. In further studies, the results could be statistically analyzed to better
184 understand the division of the scores in the different groups, as well as the relationships
185 between different dimensions and overall satisfaction related to safety culture in an
186 organization.

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