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**Measuring and improving safety culture in organisations:
An exploration of tools developed and used in Belgium**

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Measuring and improving safety culture in organisations:

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Abstract. *To support organisations in addressing their safety culture, practical tools have been developed worldwide. Based on such practical tools, it is possible to measure where an organisation is situated regarding its safety culture in order to identify priority areas, formulate appropriate improvement strategies, and determine changes over time. In this paper, it is examined which practical tools to measure and improve safety culture are provided on the Belgian market. In total, fifteen Belgian tools were identified, of which eight agreed to cooperate. Amongst the included tools, there is a lot of variation regarding the methods to diagnose the safety culture and the overall procedure to improve the safety culture. The importance to adapt the tool to the specific needs and context of organisations is acknowledged in most of the tools, as well as the importance to use a multi-method approach to measure the safety culture. Also, it is recognised that all hierarchic levels should participate during the process of diagnosing the safety culture. A point of attention is this overall participation during the validation of the results of the diagnosis, and the priority setting of the recommendations, which is mainly done by the higher management. The development of the Belgian tools is based on experience with a focus on direct practical application, which leads to the fact that none of the tools are validated through scientific evidence. Another point of attention is that organisations pay too little attention at the continuity of safety culture research. And finally, the question can be raised if the safety culture tools actually address the concept 'safety culture', or if they address only a subset of the concept. When safety culture is addressed, a comprehensive approach should be used, where technological, organisational, human and external aspects are taken into account as interacting and interrelating elements.*

Keywords. Safety culture, organisations, measuring, improving, Belgium

1. Introduction

Occupational safety figures have been improving for decades. Considerable progress has been made by advanced technology and engineering design (Cooper, 1994; Lee & Harrison, 2000), and through legislation and regulation (Choudhry, 2014). However, what can be achieved in safety improvements by merely using hardware and technical solutions is limited (Davies et al., 2001). Similarly, creating a safe working environment by establishing safety rules and procedures is impeded if compliance is lacking (Davies et al., 2001). Hence, despite the gains in occupational safety, the burden of occupational incidents, accidents and fatalities is still large worldwide (Mischke et al., 2013). According to some authors, the improvement of safety has somewhat stabilized (Step Change in Safety, 1999; Geller, 2005; Mitropoulos et al., 2005, Costella et al., 2009). To encourage and achieve further improvement, other approaches are thus needed.

One approach is the concept of safety culture, which has been introduced after the Chernobyl accident in 1986. In response of this disaster, it was acknowledged that safety should incorporate more than mere technology (Reiman & Rollenhagen, 2014). From then on, the concept of safety culture was enriched with organisational aspects, human or behavioural aspects, and external aspects such as the

social and economic environment (Reiman & Rollenhagen, 2014; Sgourou et al., 2014). However, despite the wealth of literature, consensus on the origin, the content and the consequences of safety culture does not exist to date (Edwards et al., 2013). Depending on the professional background of the authors, the concept has different meanings (Seo et al., 2004; Choudhry et al., 2007). Nevertheless, common to most definitions is that they emphasise safety culture as something holistic or comprehensive (Guldenmund, 2000; Richter & Koch, 2004, Reiman & Rollenhagen, 2014).

This comprehensive approach of tackling safety issues is not only recognised in the academic world, but also by organisations themselves. In order to enhance their organisational safety and to achieve safety goals and objectives, organisations tend to go some steps further than the mandatory rules imposed by law (which are mainly focussed on technological and organisational aspects and less on human aspects), like for example the mandatory investigation of severe occupational accidents, the creation of an emergency plan or the provision of collective and personal protective equipment. Many organisations acknowledge that focusing on behavioural and organisational aspects, both in measuring occupational safety and implementing improvement strategies, is important to improve their safety. However, it has not always been clear for organisations how this should be put into practice (Lee & Harrison, 2000; Davies et al., 2001).

To support organisations in measuring and improving their safety culture, practical instruments and tools have been developed worldwide by public institutions, research institutions and private organisations (see for example Flin et al., 2000; Davies et al., 2001; EU-OSHA, 2011 for an overview of these instruments and tools). Based on such practical tools, it is possible to measure where the organisation is situated regarding its safety culture (relative to a reference point) in order to identify priority areas, to formulate appropriate recommendations and improvement strategies, and to determine changes over time. In this paper, we examine which practical tools to address safety culture are provided on the Belgian market. Based on this overview, the practical needs and usages of Belgian organisations regarding safety culture are identified. In addition, the extent of a comprehensive approach by the tools to measure and improve safety culture will be explored, and it will be clarified to what extent these tools are based on scientific evidence.

2. Methodology

2.1. Inclusion criteria

In order to be included in the overview, the instruments and tools for measuring and improving safety culture have to meet following inclusion criteria.

Firstly, the tools have to concern safety in an organisational context, and more specifically safety culture. Tools that focus on security or on safety of clients or customers (for instance patient safety) are excluded. As previously mentioned, there exists no consensus on the definition and content of safety culture. As it is generally accepted that safety culture comprises more than technology alone, the tools included in this overview have to contain at least behavioural and/or organisational aspects. For example, a standard hazard identification and risk assessment is not included in the overview.

In Belgium, occupational health and safety is legislated in seven subdomains of well-being: occupational safety, occupational hygiene, health, ergonomics, embellishment of the workplace, psychosocial aspects and environment. The second inclusion criterion is that other subdomains may be included in the tool, but occupational safety has to be the main focus. Concretely, at least 50% of the tool has to be about occupational safety (background information about the organisation and/or the respondent not included). For instance, in the so called VOW/QFT (Vragenlijst Over Werkbaarheid/Questionnaire Facultés de Travail) – a Dutch assessment on work ability – occupational safety of employees is assessed, but is only a small part (14,4% of the questions) and not the main purpose of the assessment. Therefore, this tool is not included.

It is important to measure where the organisation is situated regarding its safety culture to identify priority areas, to formulate appropriate recommendations and improvement strategies, and to determine changes over time. Therefore, the third inclusion criterion is that the tools have to contain a diagnostic measurement (qualitative and/or quantitative) of safety culture. Tools that only include an intervention to improve safety culture are excluded. For example, a training that solely focuses on modification of safety behaviour at the workplace is excluded.

On the other hand, it is important that the diagnostic measurement is being followed by the formulation of recommendations and the implementation of improvement strategies (see Figure 1). Therefore, tools that only include a diagnostic measurement without formulating recommendations are excluded. For instance, the Safety Attitude Screening (developed by ISW Limits, a spin-off company of the Leuven University in Belgium) is a tool to measure safety attitudes. However, the tool does not imply specific recommendations to improve the detected problems and is therefore excluded in the overview.



Figure 1. Aspects that the included tools have to contain

Fifthly, to delineate the overview, the tools have to be developed by Belgian companies. Tools that are not specifically developed to be used in a Belgian context, but that are afterwards translated in order to be applicable in Belgian companies are excluded. For instance, the Hearts and Minds toolkit (Hudson, 2007) was developed on an international level, and was made available for Belgian companies by translating the toolkit into Dutch and French¹. Therefore, this tool to measure and improve safety culture is not included in the overview.

Sixthly, at least some information about the tool has to be available on the internet.

¹ Belgium consists of a Dutch speaking part (Flanders) and a French speaking part (Wallonia).

And finally, tools that are used within a particular organisation and that are not externally available are excluded. The tools have to be available free of charge or against payment.

2.2. Search strategy

Many of the tools for measuring and improving safety culture are commercial, i.e. not available free of charge. As these commercial tools are mostly developed by consultancy bureaus, information about these tools cannot be found in scientific databases. Therefore, an internet search (Google) was conducted using the following search terms in Dutch (for Flanders) and French (for Wallonia): [measuring OR measurement of OR determine OR determination of OR improving OR improvement of OR tool] AND [occupational safety OR safety culture OR safety climate OR safety behaviour]. The internet search was completed on March 10, 2015.

Also, following specific websites were screened for eligible tools: all websites from the Belgian external services for prevention and protection at work² (at the time of the search, eleven external services were active in Belgium) and LinkedIn (on this social network that is used for professional networking, information can be found on consultancy bureaus and the services they offer).

Additionally, experts in the field (e.g. several QHSE managers of large Belgian companies) were contacted to provide useful information.

2.3. Results of the search for Belgian tools to measure and improve safety culture

In total, 68 tools were identified. Based on the inclusion criteria, fifteen tools were identified as eligible to be included in this overview. As none of these fifteen tools were available free of charge, detailed information was not available in the public domain. Hence, the developers or providers of all fifteen tools were contacted by e-mail or by telephone to ask for their cooperation to provide detailed information about their tool. In total, eight of fifteen agreed to cooperate. Based on this cooperation, the required information about the tools that was not available in the public domain, could be completed. The information was provided by e-mail, telephone, or a face-to-face contact. Hence, 8 tools were included in this overview (see Figure 2). Non-response was either due to issues of protecting content and methodology of the tool, or due to a lack of interest and need of the developer of the tool into academic research.

² In Belgium, every employer is obligated to set up an internal service for prevention and protection at work consisting of one or more prevention advisors who are employees in the organisation. If the internal service for prevention and protection at work is not able to carry out its legal obligations, the employer must affiliate with a recognised external service for prevention and protection at work, or in other words an occupational health service. The task of a service for prevention and protection at work is mainly a preventive one and includes, amongst others, prevention of work-related disorders, assistance in the identification of risks, giving advice on preventive measures for occupational safety (or broader, occupational well-being), and participating at the investigation of occupational accidents

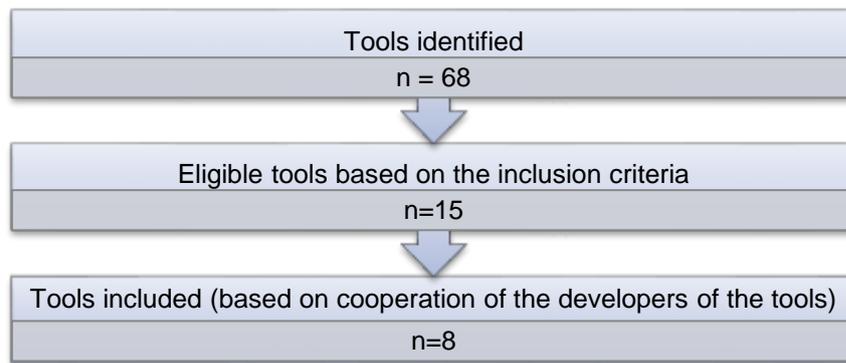


Figure 2. Results of the search for Belgian tools to measure and improve safety culture

2.4. Information collected per tool

For each tool, the following information is provided: (i) practical characteristics, (ii) the methodology to diagnose the safety culture, and (iii) the goal of the tool.

2.4.1. Information collected per tool: practical characteristics

Table 1 gives a description of the practical characteristics collected for the eight tools.

Table 1. Description of the practical characteristics collected per tool

a) Developer	Who is/are the developer(s): public institution(s), research institution(s) (e.g. university) and/or private organisation(s) (e.g. consultancy bureau)?
b) Year of publishing	In which year is the tool published?
c) Language	In which language(s) is the tool available?
d) Developed for which sector	For which sector(s) is the tool developed?
e) Applicable to other sectors	Is the tool applicable to other sector(s)?
f) Company size	For which company size(s) is the tool applicable: micro (1-9 employees), small (10-49 employees), medium-sized (50-249 employees), large (250 or more employees) ³ ?
g) Scientific evidence	Is the development and/or validation of the tool published in peer-reviewed article(s) or is the tool mentioned by other author(s) in peer-reviewed article(s)?
h) Price	Price of the tool? (VAT excluded)
i) Assessor (outsider/insider)	Can, next to an external assessor (the developer/provider of the tool, i.e. an outsider from the organisation), the tool also be used by an internal assessor (somebody from the organisation, i.e. an insider)?
j) Benchmarking	Is there a database with comparative data which allows benchmarking?
k) Website	Website where information about the tool can be found

³ This classification is based on the division by the European Commission.

2.4.2. Information collected per tool: methodology to diagnose the safety culture

Firstly (as displayed in Table 4), an overview is given of the methods used in the tools to diagnose the safety culture. A distinction is made between a quantitative method (questionnaires) and qualitative methods (observations, interviews, focus groups, working groups).

Table 2 gives a description of the additional information collected on the methodology to diagnose the safety culture.

Table 2. Description of the information collected per tool on the methodology to diagnose the safety culture

a) Questionnaire info	More information about the questionnaire (if applicable)
Type of questionnaire	Is the questionnaires self-administered or not?
Format of questionnaire	What is/are the format(s) of the questionnaire (e.g. paper-based, web-based, software application)?
Number of items	What is the number of the items questioned?
Type of answers	What is/are the type(s) of answers (e.g. open-ended, five point Likert-scale)?
b) Target population	Who is/are the target population(s) (e.g. employees, supervisors, middle management, higher management, human resources manager, prevention advisor)?
c) Time	What is the time needed to complete the diagnosis of the safety culture (approximately)?

2.4.3. Information collected per tool: goal of the tool

Regarding information on the goal of the tool, firstly a short explanation of the overall goal of the tool is given. Of course, the goal is to measure and improve the safety culture. However, the focus often varies between the tools. Secondly, it is elaborated how this goal is achieved. This achievement of the goal can be divided in three main parts (the three parts that can be found in Figure 1): (i) diagnosis of the safety culture, (ii) formulation of recommendations, and (iii) the implementation of improvement strategies.

3. Results

3.1. Results: practical characteristics

In Table 3, the practical characteristics for the eight tools can be found.

The developers of the Belgian tools are private organisations (except for one cooperation with a public institution), i.e. consultancy bureaus or external services for prevention and protection at work. Most of the tools are not developed for a particular sector but if so, they are also applicable to other sectors.

Almost all included tools are applicable in companies with different sizes. These sizes can vary widely. For instance, Fullmark's (Tool 5) smallest company counts 8 employees and their largest company counts more than 40.000 employees. The developers of all tools indicate however that most of their clients are medium-sized companies (50-249 employees) and large companies (250 or more employees). When smaller companies appeal on the tools, the providers assure that confidentiality issues are considered.

For none of the tools, scientific evidence is found.

Regarding the price of the tools, the providers seldom can give an 'all-inclusive' price, as this varies according to the needs of the companies.

Half of the included tools offer 'train the trainer' to allow people from within the organisation to perform the tool, i.e. diagnose the safety culture of the organisation and make recommendations to improve the safety culture. Many of the intervention strategies (the recommendations put into practice) are carried out by insiders. For instance, the diagnosis of the safety culture in the tool offered by Amelior (Tool 7) can only be done by an external assessor. However, the improvement strategies can be carried out by both external and internal assessors. Employees can for example follow a training 'coach your employees to safe behaviour'. These trained employees assure the continuity of the implemented intervention strategies to improve the safety culture in the diagnosed organisation.

3.2. Results: methodology to diagnose the safety culture

Table 4 gives an overview of the methods (quantitative and/or qualitative) used in the eight tools to diagnose the safety culture. In Table 5, additional information on the methodology to diagnose the safety culture is given.

It was not always easy for the developers of the included tools to give a standard methodology that is used to diagnose the safety culture. After all, many of the providers adapt their offer (methods used, sample size, sample composition, duration, questions,...) to the needs of the company. In this overview, the most inclusive and all-round method is given. In practice, it often happens that some parts are skipped or adapted. The time needed to complete the diagnosis of the safety culture is also strongly dependent on the needs of the company.

3.3. Results: goal of the tool

In Table 6, the goal of the eight tools and how these goals are achieved is shown.

The goal of all the tools is to measure and improve the safety culture in an organisation. However, the focus often varies between the tools. Three of the tools (Tool 3, 4 and 5) explicitly focus on safety behaviour. One tool (Tool 2) focusses on safety culture as a part of the organisational culture.

Regarding the diagnosis of the safety culture, six tools (Tool 1, 3, 4, 5, 6 and 7) explicitly state that they localise the organisation on a safety culture scale. For example, Tool 1 uses four subdivisions (from 'not mature' to 'high mature'), and Tool 5 uses five subdivisions (from 'a poor safety culture' to 'an excellent safety culture'). Tool 7 uses the same subdivisions as used in the Hearts and Minds toolkit (pathological, reactive, calculative, proactive, and generative) (Hudson, 2007).

All of the tools ensure that a wide spectrum of the organisation is taken into account when the safety culture is diagnosed. Also, the requirement that the higher management should participate is explicitly stated in most of the tools.

Looking at the formulation of recommendations to increase the safety culture level, half of the tools (Tool 2, 5, 7, 8) mention that they present and discuss the recommendations with the higher management. It is consequently the higher management that determines the priorities of the formulated recommendations. Only one tool (Tool 6) explicitly states that employees from several levels of the organisation are involved in the validation of the results and in defining the priorities of the formulated recommendations.

Concerning the implementation of the improvement strategies, the emphasis lies on the provision of trainings (in group) and coaching (individual) to increase the safety culture in the organisations. The improvement strategies are not always implemented by the providers of the tools themselves. Some of them indicate that they refer to other specialists or consultants when needed (Tool 1, 2 and 7).

Table 3. Practical characteristics of the tools

	Tool 1. MATURITY IN SAFETY	Tool 2. SAFETY CULTURE AUDIT	Tool 3. SAFETY CULTURE R-ACT	Tool 4. SIRK SEKUUR IN COMPANY
a) Developer	Private organisation ⁱ	Private organisation ⁱⁱ	Private organisation ⁱⁱⁱ	Public institution ^{iv} & private organisation ^v
b) Year of publishing	2009	2011	2009	2010
c) Language	Dutch	Dutch, English, French	Dutch	Dutch, French
d) Developed for which sector	Not developed for a specific sector; applicable to all sectors	Industry	Not developed for a specific sector; applicable to all sectors	Not developed for a specific sector; applicable to all sectors ^{vi}
e) Applicable to other sectors		Applicable to all sectors		
f) Company size	All company sizes	All company sizes	All company sizes	All company sizes
g) Scientific evidence	No	No	No	No
h) Price	€2.400 in total	€1.600 per day (giving an all-inclusive price is not possible, as the format and duration varies per company)	€1.000 per day (giving an all-inclusive price is not possible, as the format and duration varies per company)	- Preparation: €460 - Two training moments for a group of 15 persons: €1.100 - Aftercare: €460
i) Assessor (outsider/insider)	Outsider	- Outsider - Insider after training 'accredited safety culture auditor' (this training takes 3 days and costs €2.500 per person)	Outsider	- Outsider - Insider after train the trainer (this training takes 2 days and costs €1.440 per person)
j) Benchmarking	No	No	No	No
k) Website	www.ariadneconsult.be/ (in Dutch)	www.creativeinterchange.be (in Dutch)	www.blitsnv.eu (in Dutch and French)	www.idewe.be/wps/portal/nl/dienstverlening/ (in Dutch and French) www.sirksekuur.be (in Dutch)

Table 3 (continued). Practical characteristics of the tools

	Tool 5. SMART-SAFETY METHOD	Tool 6. THE 4D SAFETY BRAIN CONCEPT	Tool 7. TOTAL IMPROVEMENT PROJECT OF SAFETY CULTURE	Tool 8. WELL-BEING INDICATOR
a) Developer	Private organisation ^{vii}	Private organisation ^{viii}	Private organisation ^{ix}	Private organisation ^x
b) Year of publishing	2007	2005	2000	2014
c) Language	Dutch, English, French	Dutch, English, French	Dutch, English	Dutch, English, French, German
d) Developed for which sector	Industry (chemical, pharmaceutical)	Not developed for a specific sector; applicable to all sectors	Not developed for a specific sector; applicable to all sectors (except the healthcare sector)	Not developed for a specific sector; applicable to all sectors
e) Applicable to other sectors	Applicable to all sectors			
f) Company size	All company sizes	All company sizes	Mainly medium-sized and large companies	All company sizes
g) Scientific evidence	No	No	No	No
h) Price	<ul style="list-style-type: none"> - Safety culture diagnosis: €15.000 - €20.000 (dependent on the size of the company) - SMART-safety method: €1.950 per day (number of days dependent on the size of the company) 	A complete trajectory carried out by external assessors with inclusion of 20 - 25 people in the focus groups costs approximately €17.000	Giving an all-inclusive price is not possible, as the format and duration varies per company	<ul style="list-style-type: none"> - Price of screening: €1.050 - Price of next stages depends on the outcome of the screening
i) Assessor (outsider/insider)	<ul style="list-style-type: none"> - Outsider - Insider after train the trainer (this training takes 3 days and costs €1.950 per day) 	<ul style="list-style-type: none"> - Outsider - Insider after train the trainer (this training takes 1 or 2 days and costs €1.380 per day) 	Outsider	Outsider
j) Benchmarking	No	No	No	No
k) Website	www.fullmark.be/en (in Dutch, English, French and Spanish)	www.samuraiatwork.com/en/ (in Dutch, English and French)	www.amelior.be/eng/ (in Dutch, English and French)	www.securex.be/en/large-company/health-safety/model-approach/ (in Dutch, English, French and German)

Table 4. Methodology to diagnose the safety culture (quantitative and/or qualitative)

	Tool 1. MATURITY IN SAFETY	Tool 2. SAFETY CULTURE AUDIT	Tool 3. SAFETY CULTURE R-ACT	Tool 4. SIRK SEKUUR IN COMPANY	Tool 5. SMART-SAFETY METHOD	Tool 6. THE 4D SAFETY BRAIN CONCEPT	Tool 7. TOTAL IMPROVEMENT PROJECT OF SAFETY CULTURE	Tool 8. WELL-BEING INDICATOR
Quantitative								
Questionnaires	✓		✓		✓		✓	✓
Qualitative	✓	✓	✓	✓	✓	✓	✓	✓
Observations	✓	✓		✓	✓		✓	✓
Interviews	✓	✓	✓	✓	✓		✓	
Focus groups						✓	✓	
Working groups			✓				✓	

Table 5. Methodology to diagnose the safety culture

	Tool 1. MATURITY IN SAFETY	Tool 2. SAFETY CULTURE AUDIT	Tool 3. SAFETY CULTURE R-ACT	Tool 4. SIRK SEKUUR IN COMPANY
a) Questionnaire info				
Type of questionnaire	Self-administered	N/A	Self-administered	N/A
Format of questionnaire	Paper-based	N/A	Paper-based	N/A
Number of items	60	N/A	60	N/A
Type of answers	Six point Likert-scale	N/A	Five point Likert-scale	N/A
b) Target population	<ul style="list-style-type: none"> - Questionnaire for the CEO, prevention advisor, HR-manager and 3 supervisors (this number can increase as the company size and/or the number of departments increases) - Informal conversations are done with the employees during the observation - Interviews with the respondents of the questionnaires 	<ul style="list-style-type: none"> - Interviews: approximately one third of the organisation, all layers of the organisation. The respondents are chosen together with the person responsible for safety - Observations: the entire organisation 	<p>The entire organisation (numbers of respondents are based on the needs of the company)</p>	<ul style="list-style-type: none"> - Observation: the entire organisation - Interviews with the prevention advisor and the higher management
c) Time	3 days, spread within 1 month	3 to 5 days	<ul style="list-style-type: none"> - Questionnaire: 2 to 3 days to fill out and analyse all questionnaires - The duration of the interviews and working groups depends on the needs of the company 	Four sessions of half a day for the observation and interviews

Table 5 (continued). Methodology to diagnose the safety culture

	Tool 5. SMART-SAFETY METHOD	Tool 6. THE 4D SAFETY BRAIN CONCEPT	Tool 7. TOTAL IMPROVEMENT PROJECT OF SAFETY CULTURE	Tool 8. WELL-BEING INDICATOR
a) Questionnaire info				
Type of questionnaire	Self-administered	N/A	Self-administered	Self-administered
Format of questionnaire	Paper-based and web-based	N/A	Paper-based	Web-based
Number of items	50 - 60 items	N/A	Approximately 20 items	Between 85 and 103 items (depending on the answers)
Type of answers	Likert-scale	N/A	Yes/no questions (e.g. I know the most important safety rules of my working station; you can ask them to me later) and open-ended questions (e.g. give an achievement that you are proud of)	Varies per the question
b) Target population	<ul style="list-style-type: none"> - Questionnaire: the goal is to reach one third of the company, the company itself decides who participates - Observations: number is dependent on the size of the company (approximately 1 observation per 25 employees) - Interviews: participants are chosen in consultation with the supervisors, number is dependent on the size of the company (the square root of the total company population) 	<ul style="list-style-type: none"> - Focus groups: 20 - 25 people per focus group, people with different functions and from different departments are included per focus group, the company decides who participates, the goal is that a representative number of people participates 	<ul style="list-style-type: none"> - Workshop: with the management - Focus groups: with one third of the organisation, max. 12 persons per focus group, the groups are vertically and horizontally mixed, participants are chosen by the company - Interviews: with key figures - Questionnaire: respondents are the participants of the focus groups - Observation: the entire organisation 	Questionnaire and observations: the entire organisation
c) Time	<ul style="list-style-type: none"> - 15 - 30 minutes per respondent to complete the questionnaire - Half day per observation - 8 interviews per day 	One day per focus group	Dependent on the needs of the company	Questionnaire: 12 minutes per respondent to complete the questionnaire

Table 6. Goal of the tool and how this goal is achieved

	Tool 1. MATURITY IN SAFETY	Tool 2. SAFETY CULTURE AUDIT
a) Goal of the tool	Increasing the safety maturity in the organisation	Qualitative assessment and improvement of the Safety Culture as part of the Organizational Culture
b) Achievement of the goal		
(i) Diagnosis of the safety culture	<ol style="list-style-type: none"> 1. Questionnaires to determine the location of the safety maturity on a scale (high mature, moderate mature, low mature, not mature). Six dimensions are questioned (strategy, organisation, systems, human resources, cultures, values, beliefs) 2. Observation of the work place: informal conversations with employees and absorb the atmosphere about the safety policies 3. Interviews with the respondents of the questionnaires: elaboration of the answers of the questionnaires 	<ol style="list-style-type: none"> 1. An interview with the top-manager to identify the ideal situation for the particular organisation 2. A declaration of intent is formulated by the higher management to put in motion a process of change to a better safety culture 3. Interviews (using the crucial dialogue model) of relevant people of all levels of the organisation to gain insight in the organisational culture in general, and the safety culture in particular 4. Observations on how people behave in the organisation
(ii) Formulation of recommendations	<ol style="list-style-type: none"> 4. Group reporting of the results and formulation of concrete recommendations to increase the level of safety maturity 	<ol style="list-style-type: none"> 5. Audit report part I: actual (safety) culture of the organisation 6. Audit report part II: action plan (activities, strategy and transformation process from the current to the desired safety culture) – support during transformation 7. The report is presented to the entire management during a workshop of one day 8. The report is presented to the employees (by the higher management alone, or by the higher management and the assessor together)
(iii) Implementation of improvement strategies	<ol style="list-style-type: none"> 5. Assistance with the implementation of the recommended actions by suggesting the right safety, organisational and/or behavioural specialists 	<ol style="list-style-type: none"> 9. For the transformation process can, if needed, other consultants being deployed

Table 6 (continued). Goal of the tool and how this goal is achieved

	Tool 3. SAFETY CULTURE R-ACT	Tool 4. SIRK SEKUUR IN COMPANY
a) Goal of the tool	Detecting strong and weak points of the actual safety culture, implementing behaviour-based safety processes, supervisor driven observations and feedback process, and safety culture guidance	Coaching to safety culture with a focus on safe behaviour
b) Achievement of the goal		
(i) Diagnosis of the safety culture	<ol style="list-style-type: none"> 1. Quantitative measurement by means of self-administered questionnaires to detect in which cultural stadium the organisation is 2. Interviews to detect strong and weak points of the actual safety culture 3. Commitment meeting with the higher management 	<ol style="list-style-type: none"> 1. Preparation: observation of the workplace and interviews with the prevention advisor and the higher management to discuss the organisational culture. Results from the observations and interviews are used together with safety indicators such as the frequency rate and the accident severity rate, the number of incidents and accidents, and the establishment of a dynamic risk management system (policy, goals, etc.) to determine the safety level of the organisation
(ii) Formulation of recommendations	Incorporated in (i)	Incorporated in (i)
(iii) Implementation of improvement strategies	<ol style="list-style-type: none"> 4. Information sessions for employees: information on the goal of the assessment and call for members for the steering committee and observers (1 à 2 hour(s) per session, number of sessions based on the needs of the company) 5. Steering committee meetings: practical and concrete elaboration of the customised assessment (the meetings take place during and after the roll out of the assessment, at least once a month, dependent on the needs of the company and the stadium of the implementation process) 6. Video recording of safety behaviour to train and brief the observers and employees (2 days filming and 2 days editing) 7. Classical training of the observers (2 days) 8. Training of the observers on the floor (2 hours per duo & follow-up) 9. Observation process by the observers (continuous, analysis of the data each 3 à 4 months) 10. Analyses of the observation process by means of a software system (additional, technical and organisational inhibiting factors are detected) 11. Feedback meetings for employees: results of the observations are communicated to the employees 12. Awareness actions based on the results of the observations 13. Keeping contact with the observers: once every three months to share experiences and discuss improvement possibilities 14. Continuous monitoring in function of the needs of the company & keeping alive the process 	<ol style="list-style-type: none"> 2. Training session 1: interactive group training on prioritizing safety behaviour that can be improved, learning to see risks, reflect on the own behaviour and the aspects that can influence this behaviour, and learning the principles of Last Minute Risk Analysis through several practical situations 3. Training session 2: interactive training on learning to observe and to give and receive feedback 4. Aftercare: consultation on how to maintain safe behaviour as a point of attention

Table 6 (continued). Goal of the tool and how this goal is achieved

	Tool 5. SMART-SAFETY METHOD	Tool 6. THE 4D SAFETY BRAIN CONCEPT
a) Goal of the tool	Describe and understand the safety culture in the organisation with the focus on observed behaviour. Improvement strategies to have a positive impact on the anticipation, prevention and safety culture in the company.	Development of the global safety culture in an organisation
b) Achievement of the goal		
(i) Diagnosis of the safety culture	<ol style="list-style-type: none"> 1. Communication in the company (per letter and mail) to explain why the SMART-safety method is being used 2. Safety culture diagnosis: first, a questionnaire and interviews are done. Secondly, observations are done to verify what has been assessed based on the questionnaire and interviews. The company will be divided in a category from 1 (poor safety culture) to 5 (excellent safety culture) 	<ol style="list-style-type: none"> 1. Communication about the assessment is done by the company itself, by the assessor of the tool, or together 2. Measurement of the safety culture to determine a position. Based on focus groups, SWOT analyses are done in four domains of the safety brain concept: technical analysis, vision and policy, safe behaviour and human perception, organisational systems
(ii) Formulation of recommendations	<ol style="list-style-type: none"> 3. An improvement strategy regarding safety-related behaviours will be concretised. The report with recommendations will be presented at a meeting with the managers 	<ol style="list-style-type: none"> 3. Actions are defined in the four domains, with priority settings. 4. Workshops are done to validate the results. The participant will determine themselves the order of implementation of the defined actions based on their impact and their feasibility.
(iii) Implementation of improvement strategies	<ol style="list-style-type: none"> 4. The improvement strategy (SMART-safety method) is based on two pillars: (1) SMART-training and (2) SMART-tools. The SMART-trainings are focussed on communication and involvement of managers, supervisors and employees. The SMART-tools focus on collective awareness (visual campaign with another theme every month, interactive toolbox meetings) and individual awareness (safety cards). SMART-trainings: 3 trainings of one day per year, SMART-tools: available in the company for one or more years 	<ol style="list-style-type: none"> 5. Implementation of the actions

Table 6 (continued). Goal of the tool and how this goal is achieved

	Tool 7. TOTAL IMPROVEMENT PROJECT OF SAFETY CULTURE	Tool 8. WELL-BEING INDICATOR
a) Goal of the tool	Assisting companies in a comprehensive approach of the improvement of safety culture with tangible effects as a result. Self-sufficiency is the ultimate goal.	Increase the well-being in the workplace to obtain sustainable employability
b) Achievement of the goal		
(i) Diagnosis of the safety culture	<ol style="list-style-type: none"> 1. Communication about the tool is being done by the organisation itself. The input, however, can come from the external assessor 2. Based on workshops, focus groups, interviews, questionnaires and observations, the safety culture is diagnosed and divided in one of five maturity stages (pathological, reactive, calculative, proactive, generative) 	<ol style="list-style-type: none"> 1. Screening based on a self-administered questionnaire to identify the perception of the employees of well-being and the well-being policy in the workplace to identify the issues affecting the organisation 2. Observation: identification of the causes of the issues affecting the organisation
(ii) Formulation of recommendations	<ol style="list-style-type: none"> 3. A report is being compiled and the results are being discussed with the higher management 4. Based on the report and the discussion with the management, trainings (in group) and coaching (individual) are being aligned 	<ol style="list-style-type: none"> 3. Analysis: together with an internal working group, the external assessor proposes practical steps towards improvement 4. Expertise: together with the external assessor, the management of the organisation determines which actions are required most urgently and what their KPIs (key performance indicators) are 5. All the results are translated into a 'well-being plan'. Amongst others, the well-being plan contains practical steps towards improvement, how to implement these practical steps and guidance for permanent monitoring and evaluation
(iii) Implementation of improvement strategies	<ol style="list-style-type: none"> 5. The trainings and coaching can be given by the external assessor or by other partners. Examples from these coaching and trainings are: giving feedback, how to coach your employees to safe behaviour,... 	<ol style="list-style-type: none"> 6. Implementation of the actions

4. Discussion

4.1. Assessors of the tools

All eight tools use external assessors. In one way, an external assessor has the advantage that (s)he has no prejudices about the company. A disadvantage of an external assessor is that it takes a lot of time and effort for an outsider to understand an organisation. Some of the providers of the tools offer the concept of 'train the trainer' to make it possible that people from inside the company can also perform the tool. A disadvantage of an internal assessor is that many aspects of the company are self-evident. An advantage of an internal assessor is that it creates a degree of ownership of the tool by people within the organisation, which can increase the commitment and participation, and therefore can increase the success-ratio of the tool. The use of internal assessors also causes a degree of continuity and permanent attention for safety culture. As for example stated in Tool 7, the ultimate goal of the tool is self-sufficiency of the organisation regarding safety culture.

4.2. Benchmarking of safety culture

None of the included tools employ a database with comparative data to allow benchmarking. According to Lee and Harrison (Lee & Harrison, 2000), the capacity to benchmark against similar organisations is a desirable quality for a good safety culture tool. A question that might arise, is whether companies can be compared just like that, even if they have similar characteristics such as sector and company size. Benchmarking can give an organisation also a false feeling of doing well, for example when the average of all organisations is very bad and the particular organisation scores better than the average.

4.3. The importance of commitment of the entire organisation

All eight tools take into account several levels of the organisation to diagnose the safety culture in the organisations. However, as it comes to validation of the results of the safety culture diagnosis, and setting priorities of the formulated recommendations, only one tool includes other hierarchic levels besides the higher management. When addressing the safety culture, both in diagnosing as in improving, the involvement of the entire organisation is important. People from all hierarchic levels (higher management, middle management, supervisors and workers) should participate and be committed during the process. That way, a sense of ownership is created, which means that the employees are far more likely to cooperate (Davies et al., 2001; EU-OSHA, 2011).

Involvement of the higher management in diagnosing the safety culture is explicitly stated in most of the tools. A real and visible management commitment is a fundamental pre-requisite, both in diagnosing the culture as doing something with the results. Without this commitment, applying the tool can result in negative outcomes, as the workforce sees yet another tool being carried out without any related improvements to their working environment (Davies et al., 2001).

4.4. The importance of multi-method design and tailored approaches in safety culture research

In order to explore and understand safety culture, many authors put emphasis on the fact that not one single research method is suitable, but that a multi-method approach should be used (EU-OSHA, 2011). For instance, Glendon and Stanton (2000) and Choudhry et al. (2007) demonstrate that a triangulated methodology is appropriate for safety culture measurements. Almost all of the included tools (except for one) use more than one research method to diagnose the safety culture in an organisation.

In the literature it is also stressed that, considering the contextual differences between (and within) organisations, it is not feasible to adopt a standard, 'one size fits all' strategy to measure and improve safety culture (EU-OSHA, 2011). In conclusion, an ideal safety culture tool has to have the possibility to be tailored at the context and the needs of the organisation. The importance of this tailored approach is acknowledged in the included tools, as it was not always straightforward for the providers to give a standard methodology of their tool. As already mentioned, many of the providers adapt their offer (methods used, sample size, sample composition, duration, questions,...) to the needs of the company.

4.5. Practice not put into theory & theory not put into practice

As shown in this article, the development of the Belgian tools is based on experience with a focus on direct practical application. One drawback of this, is that none of the tools are validated through scientific evidence (e.g. by publication in peer-reviewed articles). However, it should be noted that some of the tools have found their inspiration with international tools that are based on scientifically validated frameworks. For example, the diagnosis of the safety culture in the Belgian tools is often based on the safety culture maturity ladder as used in the Hearts and Minds method (i.e. a division of the safety culture in different maturity levels) (Hudson, 2007). Tool 7 uses the same subdivisions as used in the Hearts and Minds toolkit. Others (e.g. Tool 1 and 5) have given an own interpretation to the safety culture maturity ladder.

The development of the identified tools is based on experience with little attention (or none at all) for academic, scientific validation. This lies in the fact that the tools are mostly developed by consultants. Consultants reason from an instinctive gut feeling – prevention is often a matter of common sense – and less from academic-based scientific input. Still, as stated by Lee and Harrison (2000), one of the characteristics of an ideal safety culture measurement tool is that its factors are valid, are shown to have internal reliability and that their relative importance to accident rates are known. Not only the quantitative methods such as questionnaires, but also the qualitative methods should be scientifically validated in order to guarantee an optimal quality of safety culture research.

To be clear, the authors of this article do not advocate that every tool should be based on a validated theoretical framework. Each theory is limited and therefore narrows the perspective of the researcher, which can lead to the overlooking of certain aspects. However, it might be good that every tool is scientifically validated in at least one way. As such, more explanatory investigations can result in important findings in safety culture research (Geller, 2005). The identified tools in this overview can be

seen as explanatory investigations and could lead – if enough of these explanatory investigations are done and certain patterns can be identified – to the development of a research-based theory. This means cooperation of the providers of tools for measuring and improving occupational safety culture with scientific research institutions.

The previous paragraphs are about practice not based on academic research or not put into a theoretical model or framework that is generally usable. By extension is this an appropriate place to draw the attention at the many theoretical frameworks that are not translated to have a practical implication in organisations, i.e. the theory that is not put into practice. As pointed out by Choudhry et al. (2007), many safety culture models are schematic and lack the means to objectively assess safety culture. As it comes to safety culture research, the usability in practice has – with rare exceptions – been largely ignored by researchers (Bentley & Tappin, 2010).

4.6. The need for a comprehensive approach of safety culture

In many of the included tools, great interest is given to safety behaviour. It is generally acknowledged that safety behaviour is an important aspect of the safety culture in an organisation (e.g. Flin et al., 2000; Lee & Harrison, 2000; Zhang & Fang, 2013; Choudhry, 2014). Furthermore, behavioural modification programmes are shown to be effective to improve an organisation's existing safety culture (e.g. Duff et al., 1994; Cox et al., 2004; Choudhry, 2014).

However, safety culture entails more than just focusing on behaviour. As stated by Reiman and Rollenhagen (2014) safety culture models mostly focus on human and organisational factors, and not on technology (or safety) itself. They argue that concepts of safety culture research never have really become integrated with classical engineering principles and concepts. Safety culture represents a holistic, comprehensive term that comprises a totality technological, organisational, human and external aspects (the latter, however, cannot be influenced by a single organisation, but needs to be taken into account when addressing safety culture) (Reiman & Rollenhagen, 2014). Safety behaviour (situated in the human aspects of safety culture) has to be included when safety culture is addressed, but there is more. The organisational and technological aspects should also be taken into account when carrying out safety culture research.

Subsequently, the question can be raised if the included tools in this article actually address the concept 'safety culture', or if they address only a subset of the concept. For instance, it can be argued that the Hearts and Minds toolkit (Hudson, 2007) does not tackle the concept of safety culture, but rather the concept of safety climate. Safety culture and safety climate are two concepts that have been intermingled for a long period. Nowadays, the two concepts are associated with different definitions and research methods (Neal & Griffin, 2002; Reiman & Rollenhagen, 2014). Safety climate was introduced by Zohar in 1980 and is often described as shared perceptions of safety related states of affairs (Zohar, 1980; Reiman & Rollenhagen, 2014). A uniform, clear definition of the concept safety culture can contribute to the development of tools to measure and improve safety culture that are based on a comprehensive interpretation, i.e. safety culture as a combination of interacting technological, organisational, human and external aspects.

4.7. The importance of diagnosing the safety culture, intervention strategies and longitudinal use

Diagnosing the safety culture of an organisation is a prerequisite to formulate recommendations and to select appropriate intervention strategies for improving the safety culture. After all, you cannot manage what you do not measure. Therefore, this was an inclusion criterion in the selection of the tools. However, as indicated by some of the providers of the tools, their offered method is not always completely carried out. For example, the providers of Tool 5 indicate that only (approximately) one out of ten completes the entire trajectory as described in Table 6. Most of their clients only appeal on the implementation of trainings or coaching, and skip the steps of diagnosing their safety culture and formulating recommendations based on this diagnosis. This can be disadvantageous, as the possibility exists that intervention strategies for improving the safety culture are implemented while the company in question is not yet ready for these specific interventions. In these cases, the company can go backwards instead of going forward.

Similarly, the providers of the tools cannot always assure that their recommendations are actually implemented, as they not always implement these interventions themselves. This can also be disadvantageous, as a measurement without a subsequent action is worse than no measurement at all (EU-OSHA, 2011).

As indicated by the providers of the included tools, it rarely happens that a follow-up measurement is performed in the same organisation. However, the overall success of a safety culture program is dependent on the follow-up. After all, the use of a tool is not an end in itself (Davies et al., 2001). The tools should be repeated after a suitable period to obtain tangible evidence of how successful initiatives have been (see Figure 3). Even if the results are generally positive, it should be recognised that a safety culture can change over time and that a good result today may not guarantee such good results in the future. Of course, this follow-up lies beyond the control of the providers of the tools. The intention for longitudinal use is present with the providers of the included tools, but this is a decision of the organisations that have to pay for it. Organisations should be made aware by the tool-developers of the importance of a long lasting commitment regarding safety culture optimisation.

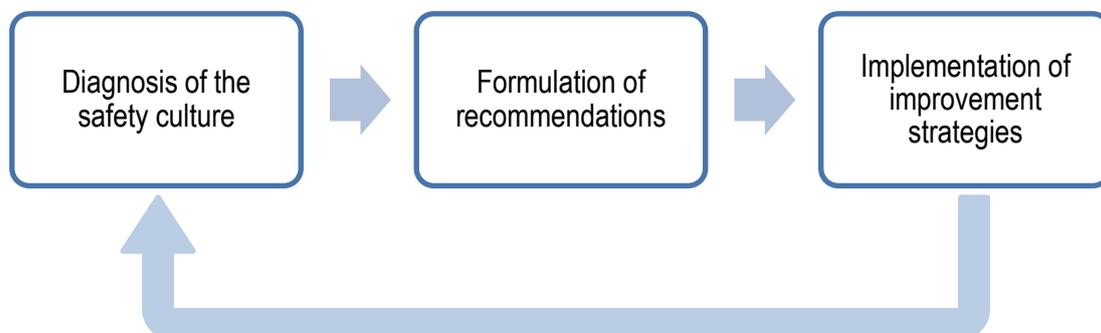


Figure 3. The importance of longitudinal use of safety culture tools

5. Conclusions and recommendations

In this paper, it is examined which practical tools to measure and improve safety culture are provided on the Belgian market. In total, fifteen Belgian tools were identified, of which eight agreed to cooperate. Amongst the included tools, there is a lot of variation regarding the methods to diagnose the safety culture and the overall procedure to improve the safety culture in the organisations.

The importance of the possibility to adapt the tool to the specific needs and context of the organisations is acknowledged in most of the included tools, as well as the importance to use a multi-method approach to measure the safety culture. Also, it is recognised that people from all hierarchic levels should participate and be committed during the process of diagnosing the safety culture to increase the success-ratio of the tool. However, this overall participation is not only important during the diagnosis of the safety culture, but also when it comes to the validation of the results of the diagnosis, and to setting priorities of the formulated recommendations. This latter is a point of attention for the included tools. Mostly, this validation and priority setting is only done by the higher management.

The development of the Belgian tools to measure and improve safety culture is based on experience with a focus on direct practical application, which leads to the fact that none of the tools are validated through scientific evidence. To increase this scientific validation, cooperation with and between the providers of practical tools to measure and improve safety culture, and the academics active in this field of interest, should be stimulated.

Another recommendation is that organisations should be made aware of the importance of a long lasting commitment regarding safety culture optimisation. Too little attention is paid at the continuity of safety culture research. Three important steps should be continuously repeated to obtain and maintain optimal safety culture results. Firstly, the safety culture of an organisation should be diagnosed. Secondly, appropriate recommendations to improve the safety culture should be formulated based on this diagnosis. And thirdly, the formulated intervention strategies should be actually being implemented in the organisation. These steps should be repeated after a suitable period of time. Permanent attention is key to the overall success of a safety culture program.

And finally, the question can be raised if the included tools in this article actually address the concept 'safety culture', or if they address only a subset of the concept. When safety culture is addressed, a comprehensive, holistic approach should be used. The totality of technological, organisational, human and external aspects should be taken into account as interacting and interrelating elements. A uniform, clear definition of the concept safety culture can contribute to the development of tools to measure and improve safety culture that are based on this comprehensive interpretation.

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- i Ariadne Consult – Consultancy bureau
 - ii Loss Control Centre Belgium (LCCB) (Ir. Johan Roels) – Consultancy bureau
 - iii R-ACT bvba – Consultancy bureau
 - iv VIGeZ – Institute for Health Promotion and Disease Prevention
 - v IDEWE – External Service for Prevention and Protection at Work
 - vi Next to Sirk Sekuur in Company, there also exists Sirk Sekuur for construction companies, Sirk Sekuur @ School, Sirk Sekuur Offices, Sirk Sekuur Health care,... Sirk Sekuur for construction companies is tailored for construction companies and is assessed in cooperation with the National Action Committee for Occupational Safety and Health in Construction.
 - vii Fullmark – Consultancy bureau
 - viii Samurai @ Work – Consultancy bureau
 - ix Amelior – Consultancy bureau
 - x Securex – External Service for Prevention and Protection at Work