

Summary:

Survey of safety culture in three Norwegian haulier companies

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The report presents the results of a survey of safety culture in three Norwegian haulier companies, which are selected based on an assumption that they have good safety culture. The study supports the assertion that the companies have good safety cultures. This especially applies to Company A, which has the highest safety culture score of the three companies, and which also have a higher safety culture score than we have found in other transport sectors. This is probably due to the fact that Company A transports dangerous goods, which is a line of transport which has particular framework conditions favoring safety. The accident involvement of the drivers were in accordance with the companies' score on the safety culture index. Analyzing the data on the three companies' work on safety, we have identified the following common characteristics of good safety work in haulier companies: 1) Follow up of drivers' speed, seat belt use and driving style, 2) Managers' and employees' safety commitment, 3) Predictability, 4) Organization of transport assignments, 5) Pay system, 6) Control of drivers' compliance with regulations related to drive and rest, 7) Safety training/education, 8) Arenas for communication about safety, 9) Reporting culture and –systems, and 10) Safety management system: a) risk analyses, b) procedures, c) training.

Background and method

The present report presents results from a survey of safety culture among drivers in three Norwegian haulage companies (N=224). The three haulier companies were selected based on an assumption that they had good safety cultures. The first aim of the study was to identify common characteristics describing how haulier companies with good safety cultures work on safety. The second aim was to test a scale for measuring safety culture in haulier companies.

Safety culture is studied quantitatively by means of a questionnaire which previously has been used to study safety culture in aviation, helicopter, bus and rail (GAIN-index for safety culture).¹ The questionnaire was distributed to all drivers in the companies by means of e-mails or letters. The benefit of using this questionnaire is that it can be used to establish a measurement of the safety culture level of each company. Consequentially, the safety culture results of haulier companies can be compared to previous results from bus, rail and aviation. The questionnaire also included questions on demographic background variables, working environment, accident involvement, near miss involvement, sick leave, private safety behavior and work related factors that may influence traffic safety in haulier companies.

¹ GAIN is an acronym for Global Aviation Information Network.

We have supplemented the quantitative measures of safety culture with seven interviews with managers and trade union representatives in the three companies to acquire information on the companies' efforts on safety and safety culture.

The haulier companies in the study

Company A transports dangerous goods in Norway and neighboring countries, for well-established customers under long term contracts. The company has about 450-500 employees and 200 vehicles. The company has a HSE and quality manager and a safety advisor, both employed in full time positions. Company A has four departments in Norway, transporting different types of dangerous goods

Company B employs about 85 drivers, and transports goods in Norway for well-established customers under long term contracts. The company was part of a motor coach company until it was established a separate company in 2003. The company has three departments, and the department managers have the daily contact with the drivers in addition to the customers' goods delivery managers.

Company C employs 190 drivers and transports goods in Norway for well-established customers under long term contracts. The company has 250 employees and about 190 drivers, and was part of a motor coach company until it was established a separate company. Eighteen traffic managers organize the goods delivery and have the daily contact with the drivers. During long distance transport the drivers also communicate with the customers by means of telephone. Company C hires a safety advisor.

Table S1 Submitted e-mails and letters with questionnaires, response rate.

Companies	Submitted questionnaires	Number of answers	Response rate
Company A	212	122	57,5
Company B	72	26	36,1
Company C	190	76	40

Results –safety culture index

The study supports the assumption that the three companies have positive safety cultures. The upper and lower limits of positive safety culture range from 120 points to 88 points on the safety culture index. Company A and C score within the positive safety culture limits with 94,9 points and 90,8 points respectively, while company B scores just below, with 85,4 points. However, Company B scores in the upper scale of the zone for moderate safety culture (Min: 47, Max: 87). It is important to note that although the response rate in Company B is 36 %, only 26 respondents answered the questionnaire in this company. This indicates both that the sample may be biased compared with the population of drivers in the company, and that small changes in the numbers may generate substantial percentages (1 driver make up 3,8 % of the drivers in the Company B sample).

The differences between the three companies are statistically significant ($P=0,028$). The GAIN-questionnaire on safety culture is universal, in the sense that the questions are not sector- or industry specific. As a consequence, we may compare our results from the three haulage companies with previous results from studies of safety culture among helicopter and airline pilots, bus and tram drivers (Bjørnskau & Longva 2009). Interestingly, these comparisons reveal that Company A scores somewhat higher than aviation (91 points) on the safety culture index. This is probably due to the fact that Company A transports dangerous goods, which is a line of transport with particular framework conditions favoring safety. Figure S1 shows average scores on the safety culture index in the three companies, and scores of different transport sectors studied by Bjørnskau and Longva (2009).

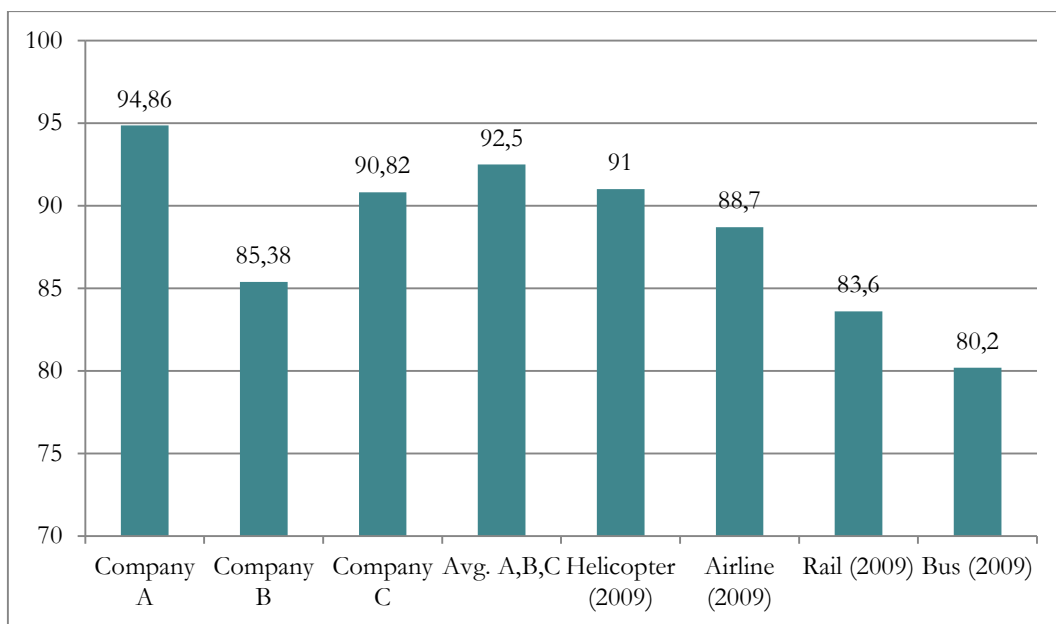


Figure S1. Average scores on the safety culture index in the three companies, and scores of different transport sectors studied by Bjørnskau and Longva (2009). Twenty four questions with five answer alternatives (Min: 24, Max 120).

When we compare safety culture scores between sectors, it must be mentioned that respondents from the different sectors probably take both the safety level and the most common safety measures of their sector for given, and use this as a baseline when they answer the questions that make up the GAIN-index. We know however that the objective safety levels and the collection of safety measures vary among transport sectors (Bjørnskau & Longva 2009). Thus, we cannot necessarily use the results from figure S1 to claim that the safety level is better in haulier companies than it is in the aviation sector.

We have conducted linear regression analyses to examine whether other variables than company may explain variation in safety culture among the respondents. In these analyses, we used independent variables like age, private safety behavior and dichotomized company variables. Only the company variables significantly predicted safety culture.

We added 12 questions to the questionnaire based on main results and suggestion for further research in a study of organizational causes of traffic accidents triggered by drivers at work (Nævestad & Phillips 2013). These questions concerned seat belt use, speed, stress and pressure and drive- and rest rules.

The GAIN-index for safety culture worked well, together with the twelve questions that we developed based on the study of Nævestad & Phillips (2013). We therefore recommend that these twelve questions should be included in future studies of safety culture in haulier companies. Moreover, several respondents used the free text field to report that they found the questionnaire relevant and meaningful.

Results- accident and near misses

There were fewer drivers reporting traffic accident involvement in their work in Company A (7,4 %), than in the other two companies, although the drivers in Company A on average drove 20 000 more km in the reporting period. Twenty three percent of the drivers in Company B had been involved in traffic accidents in their work, while 15,7 % of the drivers in Company C had been involved in traffic accidents in the reporting period.

It is important to note that we did not define traffic accidents in the questionnaire, or ask whether the drivers were blamed for the accidents by police or insurance companies. Thus, in the survey, traffic accidents may refer to both serious accidents like collisions or single accidents, and smaller incidents involving minor material damage. Moreover, it is also important to note that the drivers in the study did not necessarily trigger the accidents that they report. The differences in accident involvement were in accordance with the different safety cultures scores of the companies.

Estimates of the accident risks of the three companies indicate that they have lower accident risks than the general material damage accident risk for lorries. This finding supports the conclusion that the three companies have good safety cultures and work well on safety. The differences in accident risk reflect the differences between the companies' safety culture scores.

Company B had the largest share of drivers to report of near miss involvement (Jan. 2012-October 2013), defined as situations involving sudden braking or hard turns to avoid collisions. Twenty six of the respondents from all companies reported traffic accident involvement in the reporting period, while 146 reported of near miss involvement.

We also conducted logistic regression analyses to study independent variables (e.g. age, exposure, private safety behavior, safety culture) predicting the respondents' accident and near miss involvement. We use the following independent variables: age exposure (number of 1000 km driven), private safety behavior, safety culture, company. Age and exposure significantly predicted accident/near miss involvement, as we assumed in advance. The age variable contributed negatively, meaning that the older respondents become, the less likely it is for them to be involved in an accident. The exposure variable contributed positively, meaning that the more respondents drive, the more likely it is for them to be involved in an accident. The model explained 10 % of the accident/near miss involvement among the respondents.

Results – common characteristics of good safety work in the three companies

Our analysis identified common characteristics of positive safety work, safety culture efforts and organizational factors that are positive to safety in the three haulier companies. The analysis is primarily based on similarities and differences in the safety

work of Company A, B and C, and secondarily on main results from a previous study of fatal accidents triggered by drivers at work (Nævestad & Phillips 2013) and safety culture research (e.g. Reason 1997; Schein 2004). Company A had a higher safety culture score and a more comprehensive set of safety measures, compared with the other companies. As a consequence, we first present six common characteristics of the three companies, and then four characteristics that are well developed in Company A, but which also are highlighted as positive in the research literature. The six first features are:

1) *Follow up of drivers' speed, driving style and seat belt use.* All companies have technically limited the speed of their vehicles at a lower speed than the legally prescribed 90 km/h limit, and they have policies regulating the speed, seat belt use and driving style of their drivers. Company A has the most comprehensive measures regulating these factors, and this was reflected in the questionnaire answers. Company A had more drivers agreeing in the five statements on speed and seat belt use. Moreover, there was a correspondence between the managers' focus and drivers' answers, when it comes to speed and seat belt use. The companies follow up these issues through automatic records of drivers' speed, safety talks with the drivers and declarations that must be signed by the drivers. Risky driving is sanctioned. The companies also require drivers to use seat belt. Company A has implemented most measures to regulate seat belt use, and this is reflected in the questionnaire results. Managements' follow up of drivers' speed, driving style and seat belt use is a measure that can be transferred to other companies. These are relatively simple measures with considerable potential for preventing accidents. Interviewees reported of good experiences with technical speed limiters in the vehicles.

2) *Managers' and employees' safety commitment.* Management commitment for safety is the most crucial aspect of safety culture. This tends to influence all other safety related aspects of organizations. The interviews and the questionnaire results indicate that the studied companies have managers and union representatives who are committed to safety and safety culture. The companies' average scores on the index for management commitment to and focus on safety was 28,97 points (Min: 8, Max: 40). Company A had the highest score on these eight statements, but the differences between the three companies were not statistically significant.

3) *Predictability.* The three companies have long term contracts with big and well established customers. Their activities are characterized by predictability and long term focus, and they are not in hard competition with other companies. Thus, they are not forced to lowering prices, or meeting tight deadlines. Research indicate that this could induce stress on the drivers and potentially increase their speed. In addition, the companies emphasize predictability with respect to the routes and vehicles that the drivers use.

4) *Organization of transport assignments.* Interviewees stated that their customers respect their decision if, or when they delay or stop assignments based on safety concerns. The drivers in Company B however, experiences somewhat more pressure from their customers than the drivers in the two other companies. The difference was significant when it comes to the statement "In my job, I experience that customers press/stress drivers". In Company A, 73,7 % of the respondents disagreed, while 26,9 % in Company B and 45,3 % in Company C disagreed. The low share in Company B probably reflects differences in the customer relationship and different organization of transport assignments. While Company A and C have region managers or transport managers organizing the transport, almost all of the transport

assignments are given directly from customers to the drivers in company B, and the customers have nearly daily contact with the drivers in this company. It seems that the organization of transport in Company A and C puts less pressure on the drivers.

5) *Pay systems.* The drivers in the three companies mainly have fixed salaries. This is probably positive for traffic safety (Nævestad & Phillips 2013). Company B has a collective bonus arrangement which rewards one month of driving without vehicle damage. Teams of 3-5 drivers earn bonuses together, and loose bonuses together if any of them are involved in an accident resulting in insurance damage of more than 20 000 NOK each month. Interviewees stated that the bonus arrangement makes the small team look after each other and sanction unsafe driving. The questionnaire data may indicate that the arrangement work according to its purpose. Bonus for accident free driving may lead drivers to focus more on the safety of themselves and their colleagues, probably with a possible economic benefit for both the company and the drivers. However, more research is needed on this issue.

6) *Control of drivers compliance with regulations relating to driving time and rest.* The companies oversee drivers' compliance with regulations relating to driving time and rest on a monthly or quarterly basis. Drivers must sign the output from their tachographs. Few of the drivers reported that they often violate regulations relating to driving time and rest. This could indicate that the companies' control of drivers' compliance with the rules is a purposeful way of controlling driving patterns and preventing violations. Company A had the largest share of respondents disagreeing with the statement "The drivers in this company sometimes violate the regulations relating to driving time and rest", but the differences between the companies were not big. The most common reported cause of drivers violating driving time and rest rules was "Lack of rest areas", followed by "Other factors", "To get home earlier", and "To compensate for unforeseen delays"

Company A had a more comprehensive set of safety measures related to the following four characteristics, which also are highlighted as positive in the research literature.

7) *Safety training/education.* The differences between the companies were substantial with respect to safety training and education, and Company A had a considerably higher score. The differences between the three companies were statistically significant ($P=0,00$). The companies' average score was 15,3 (Min: 4, Max: 20). Company A has a comprehensive training program with an internal tutor arrangement, internal practical exam, internal driving instructor who gives individually adjusted training to each driver according to their needs. The companies have tutor arrangements, and courses in safe and defensive driving. Implementing a training program like the one that Company A has, probably requires considerable resources. However, companies could have internal tutor arrangements like Company B and C, and require a certain competence for drivers to be employed. Safe driving courses for drivers also appear to be a positive safety measure.

8) *Arenas for safety communication.* Managers' safety commitment may be expressed both in daily work activities and in designated safety forums, where managers and employees discuss safety. The three companies, and especially Company A have a high score on questions relating to: i) all personnel are informed on changes that may influence on safety, ii) all personnel get feedback on the safety level of the company, iii) all personnel have the opportunity to present safety suggestions. One of the common characteristics of the three companies is that they regularly hold driver

meetings with information on important changes that may influence safety, and the safety level of the company. The drivers may also present safety suggestions and raise different safety issues in these meetings. The latter may also be done by means of reporting systems. Safety relevant issues are also shared on information boards and websites. This can be transferred to other haulier companies. It is of course vital that managers and employees are dedicated to safety in their daily work, and not just in these formal arenas.

9) Reporting culture and reporting systems. Reporting is an essential aspect of safety culture. Company A has the best reporting culture and clear routines for reporting of unwanted incidents and safety issues. Electronic schemes for reporting can be found on the company's website, and all reported issues are discussed in weekly manager meetings. Implementing such a reporting culture requires considerable resources, but the reporting schemes could perhaps be standardized and used for statistical purposes, simplifying their interpretation and enabling overviews of safety problems in the company.

10) Safety management system: 1) risk analyses, 2) procedures, 3) training. Safety management system means that a company regularly carries out risk analyses of relevant vulnerabilities and hazards, and then develop procedures and training programs based on these. The qualitative data indicates that especially Company A has a comprehensive safety management system. This company has good training programs, conduct risk and vulnerability analyses according to several ISO-standards, and has a comprehensive set of procedures regulating safety. Company B and C do not regularly conduct risk analyses of potentially dangerous transport assignments and activities, like Company A. This could be explained in light of the different demands raised by the employers of the companies. The differences are reflected in the questionnaire results. Implementing safety management systems probably requires considerable resources.

When it comes to procedures, it is important to note that the three companies have driver manuals that regularly are updated. These manuals include information that the drivers must use in their work. Company A has a 150 page driver manual that includes procedures and necessary information that drivers under training must sign that they are familiar with. The other companies have similar, but less comprehensive manuals. Procedures are an important element of safety management, and such manuals may therefore be an important measure. They should include quite detailed instructions.