The influence of leadership on the prevention of safety incidents: on risk reduction, leadership, safety principles and practices

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We would have to wait too long to accumulate empirical evidence to prove whether a failure probability was really one in 100.000 years or actually one in 10.000.

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8 Prospective survey results

8.1 Introduction

We conducted an online prospective survey as part of our exploration into the principal research query: "Can leaders of organisations help to prevent safety incidents?" During factor analyses (EFA/CFA) of the survey data, we discovered two contradictions. Due to that discovery, we reconsidered the validity of the survey reference, the Safety Leadership Model. This resulted in an upgrade of the model to Version III (Figure 26) as presented in Section 7.5. The initial set of three leadership orientations (Task, Relation and Self-) was changed to a set of four leadership orientations (Relation, Process, Production and Dominance). This required a review of the analyses of the survey results. The Safety Leadership Model Version III served as the reference framework in this review. The results of these analyses delivered the proof required to resolve the principal research query. In this chapter we explain how we have obtained this proof.

First, in Section 8.2, 'General mean outcomes', we show the mean scores of the respondents' perceptions in relation to the three nodes of the Safety Leadership Model. In Section 8.3 we present the mean scores for five additional moderator variables (gender, hierarchy, age, vocational experience and incident history). In order to establish the value of this research for safety improvements, we asked the senior leaders of surveyed organisations to reflect on the research results. This reflection process and a summary of the feedback by senior leaders was presented in Section 6.7. The effects of the four different leadership orientations on risk reduction, as well as on safety, was established through Structural Equation Modelling (SEM). The outcomes of this SEM path analysis are shown in Section 8.4.

8.2 General mean outcomes

In these sections we present the responses of the general employees in terms of the general results and the results for each business sector regarding the safety leadership orientations of their direct leaders, their organisations' risk reduction capacities and their average perceptions of safety. We also report the outcomes related to the additional mod-

erator variables: gender of supervisors, hierarchical positions, vocational experience, age and major incident experience. Our presentation follows the structure of the Safety Leadership Model; first we present the outcomes with respect to the leadership orientations, then we show the outcomes regarding Risk Reduction Capacity, and in conclusion we present the outcomes regarding safety. We present the underpinning statistics and related graphs in Appendix 15.6.

8.2.1 *Safety Leadership orientations*

8.2.1.1 Safety Leadership: General mean scores

The mean scores of the general employees concerning the Safety Leadership orientations show that these respondents, on average, *somewhat agree* that their direct supervisors show Process- and Relation-oriented behaviours, where Process orientation slightly prevails over Relation orientation (respectively M=1.34, SD=1.07 and M=1.33, SD=1.20). The members of this population, on average, *somewhat disagree* that their direct supervisors show Dominance-oriented behaviours (M=-0.81 SD=1.13). These results are graphically presented in Section 15.6.1.1.

8.2.1.2 Safety Leadership: Mean scores per business sector

The employees of 33 organisations, operating in six different specific business sectors responded to the online prospective survey questionnaire. The distribution of the respondents over the business sectors is not identical due to the differences in staffing at the participating organisations. The contribution of general employees from the rail infrastructure sector (1010) and the hospital sector (767) is relatively large, and fewer employees from the process industry (128) and the tank storage sector (185) participated. The response from the oil and gas industry (414) and the general infrastructure sector (454) is located between the other categories. The category 'other' represents respondents who participated as attendees in symposia, courses and workshops, and whose business sectors are not known.

The distribution of respondents over the six specific business sectors and one general sector 'Other' is presented in Table 12 below.

	Frequency	Percent
Tank storage	185	5.6
Hospitals	767	23.0
Process industry	128	3.8
Oil & gas	414	12.4
Infra general	454	13.6
Rail infra	1010	30.3
Other	374	11.2
Total	3332	100.0

TABLE 12 Distribution of respondents over business sectors

In the acquired data we found that the Process leadership orientation was perceived as the preferred orientation of the respondents' leaders in all sectors, except rail infrastructure. Leaders working in the oil and gas industry scored the Relation leadership orientation the lowest of all sectors (*M*=1.06 *SD*=1.05), whereas the rail infrastructure sector leaders were at the other end of the spectrum; they are perceived as preferably Relation-oriented, scoring highest of all sectors (*M*=1.59 *SD*=1.06). It is not surprising that the employees in this sector score lowest on the Dominance leadership orientation (*M*=-1.09 *SD*=1.02). Employees in the tank storage sector show the opposite perception of Dominance as a leadership orientation; although still somewhat below 'neutral', in relation to the other business sectors the tank storage sector reports the highest presence of dominant leadership (*M*=tank -0.48 *SD*=1.36). The highest score for Production leadership orientation was returned by the general infrastructure sector (*M*=1.35 *SD*=1.06) and the respondents in the oil and gas industry report the lowest score (*M*=0.80 *SD*=1.12). These data are graphically presented in Section 15.6.1.2.

8.2.2 *Risk Reduction Capacity*

8.2.2.1 Risk Reduction Capacity: General mean scores

On average, employees perceive the different levels of the five risk reduction phases, and *close to agree* that people on the work floor recognise safety risks in their working environment (*M*=1.65 *SD*=1.29). The scores by respondents regarding the Ability of people on the work floor to intervene when risks were recognised were somewhat less (*M*=1.40 *SD*=1.28). Their scores for Motivation to intervene were between these two risk reduction phases (*M*=1.58 *SD*=1.31). Scores for Courage to intervene were somewhat lower than for Motivation (*M*=1.36, *SD*=1.41). Timely Action to solve safety risks scored lowest, but the respondents scored *somewhat agree* slightly higher for this risk reduction phase (*M*=1.31, *SD*=1.45). The Recognition and Motivation risk reduction phase scores are thus relatively high, and Action scores relatively low. These data are graphically presented in Section 15.6.2.1.

8.2.2.2 Risk Reduction Capacity: Mean scores per business sector

This survey question was answered by all 3332 respondents. Due to the different natures of the various business sectors in this research, there are also differences between the mean scores for the risk reduction profiles in these sectors but there are also similarities.

Our first observation is that the respondents in all sectors, except general infrastructure, score the Recognition and Motivation risk reduction phases most highly in their respective sectors. The respondents working in the general infrastructure sector ranked the Recognition risk reduction phase first, and Ability second. The respondents working in the process industry, oil and gas sector, and general infrastructure all ranked the Action risk reduction phase third. The other sectors, tank storage, hospitals, rail infrastructure and other, ranked Action lowest of all risk reduction phases. Respondents in the tank storage sector judged Courage (*M*=1.61 *SD*=1.43) as relatively high, where the general infrastructure sector ranked it lowest (*M*=1.03 *SD*=1.49).

The relatively overall high scores from the respondents in the oil and gas industry are of interest, with Recognition (*M*=1.86, *SD*=1.21) as the top scoring risk reduction phase of all sectors. The respondents working in the oil and gas industry also gave a relatively high score for Action (*M*=1.46, *SD*=1.35). The oil and gas sector thus seems to recognise *and* remedy risks more effectively than other sectors. This might be explained by the fact that most of the respondents in that sector work *and* live 24 hours per day on isolated offshore platforms, surrounded by open sea, where the risk of a safety incident is the main safety threat, and the workers themselves are the potential victims of these safety incidents when risks are not recognised and remain unremedied. These data are graphically presented in Section 15.6.2.2.

8.2.3 ***Safety***

8.2.3.1 Safety: General mean scores

In the survey general employees were asked to respond to statements indicating their perceptions about the organisation's recent Event History (statement used: "In the area of safety, a great deal went wrong within my organisation in the past year."), about their present Sense of Safety (statement used: "I feel safe in my organisation.") and about their view on the future (statement: "The risk of an accident is real within my organisation.").

The research data shows that with respect to Event History the respondents, on average, *somewhat disagree* with the statement that 'a great deal went wrong in the area of safety' (*M*=-1.14 *SD*=1.51). The respondents indicate that, on average, that they feel safe in the present (*M*=1.91, *SD*=1.25). On average, scoring between *neutral* and *somewhat agree* (*M*=0.74 *SD*=1.76), they not perceive potential safety risks as a real threat. These data are graphically presented in Section 15.6.3.1.

NOTE: The safety of organisations was not investigated during the early phase of this online prospective survey, because it was necessary to add the 'safety' node to the Safety Leadership Model following the pilot survey analysis. This meant that only 2006 re-

spondents were offered the improved survey questionnaire which included statements with respect to 'safety.'

8.2.3.2 Safety: Mean scores per business sector

This survey question was by answered by 2005 respondents. We observed some interesting scores with respect to Safety. At first both the hospital and the oil and gas sectors showed relatively high scores, close to *neutral,* for the 'Event History' variable (respectively *M*=-0.38, *SD*=1.57 and *M*=-0.29, *SD*=1.58), indicating that the respondents in these sectors considered that, safety-wise, a great deal went wrong in their organisation over the past year. This meant these sectors scored well above the mean for this variable (*M*=-1.14, corresponding with: *somewhat disagree*). Remarkably the tank storage and rail infrastructure sectors showed the opposite; both sectors scored lower than *somewhat disagree* (respectively *M*=-1.29, *SD*=1.51 and *M*=-1.50, *SD*=1.31).

The way in which respondents experienced their present individual Sense of Safety was closely connected to their scores for Event History; in sectors where less went wrong last year (i.e., tank storage, the process industry, and both general and rail infrastructure), the respondents scored relatively highly for their Sense of Safety; above *agree*. In the sectors with relatively high scores for Event History (i.e., hospitals and oil and gas), the respondents indicated feeling less safe; around *somewhat agree* (respectively *M*=0.92, *SD*=1.52 and *M*=1.26, *SD*=1.35). With respect to perceptions of the potential risk of accidents, all sectors except the 'other' group (*M*=1.35, *SD*=1.50) indicated scores lower than *somewhat agree* (*M*=1.00), resulting in a mean score of 0.74 (*SD*=1.76). The estimate by the rail infrastructure sector, which was close to *neutral*, was exceptionally low (*M*=0.42, *SD*=1.89). These data are graphically presented in Section 15.6.3.2.

8.2.4 *Summary*

In this section we summarise the mean scores as presented in the previous sections.

Safety Leadership orientations

As general outcomes concerning Safety Leadership orientations, we noted that the entire group of respondents indicated that they 'somewhat agree' that their leaders show that, in order of scores, they are Process-, Relation- and Production-oriented, and they 'somewhat disagree' that their leaders show Dominance-oriented behaviours. We see a similar pattern in all business sectors with respect to the outcomes concerning Safety Leadership orientations distinguished by business sectors: 'somewhat agreeing' with Process-, Relation- and Production orientation, and 'somewhat disagreeing' with Dominance. The rail infrastructure stands out, with the highest score for Relation orientation and lowest score for Dominance orientation. The process industry stands out with the highest score for Process orientation.

Risk Reduction Capacity

The entire group of respondents scored the Recognition of risks as the highest risk reduction phase, followed closely by Motivation. Action was the lowest scoring risk reduction phase. In the individual business sectors the oil and gas sector stands out with the highest scores for Recognition and Action. In the tank storage sector Motivation and Courage scored highest, and Action was seen as a relatively weak risk reduction phase. This was also true for the process industry, which, unexpectedly, gave relatively low scores for all risk reduction phases. The rail infrastructure sector gave the highest score for Ability.

Safety

In general, the respondents indicated that they 'somewhat disagree' with the statement that 'a great deal went wrong in the past year.' The entire group returned a positive 'agree' score for Sense of Safety. They were less sure about the Risk Potential in their organisation; they scored this between 'neutral' and 'somewhat agree.' The outcomes for each business sector were very interesting. There was an understandably clear relationship between the occurrence of incidents (indicated by scores for 'a great deal went wrong in the past year') and the Sense of Safety. Respondents working in the hospital and oil and gas sectors indicated a relatively high level of 'things going wrong' (read: incidents) and simultaneously a relatively low Sense of Safety. All other sectors reported much lower levels of incidents and much higher senses of safety.

In this section we presented the responses as acquired from general employees in terms of the general mean scores of the Safety Leadership orientations of their direct leaders, their organisation's risk reduction capacities and their individual perceptions about safety. We showed these parameters per business sector, for Safety Leadership orientations, Risk Reduction Capacity and Safety. In addition to the analyses of these data, we also organisation the mean scores related to some additional moderator variables (hierarchical positions, working for certain supervisors, vocational experience, age and major incident experience). The results of these analyses are presented below.

8.3 Outcomes by additional moderator variables

8.3.1 *Summary*

In the previous section we presented the general mean scores and the mean scores per business sector, for Safety Leadership orientations, Risk Reduction Capacity and Safety. In this section we summarise the results for five additional moderator variables: gender of supervisors, hierarchical position, age, vocational experience and incident history.

Safety Leadership

The analysis of moderator variables revealed that in general leaders are Relation- and Process-oriented, followed by Production-oriented leaders. The respondents clearly encountered Dominance-oriented leaders less often. The same picture was seen concerning the gender of supervisors, hierarchical position and vocational experience. Differen-

tiation by age results in a different order; respondents under 31 years old consider their leaders predominantly Production-oriented, followed by Process-, Relation- and (clearly less) Dominance-oriented leaders.

Where safety incident history is concerned, there was a difference between people who had been victims of an incident, or had witnessed a major incident, and respondents who had experienced neither. Victims report that their leaders primarily show Relation-oriented behaviours, followed by Process-, Production- and (clearly less) Dominance-oriented leaders. Witnesses report that their leaders primarily demonstrated Process-oriented behaviours, followed by Relation-, Production- and (clearly less) Dominance-oriented leaders. Respondents who had experienced neither reported equal scores for Relation- and Process-oriented leaders, followed by Relation-, Production- and (clearly less) Dominance-oriented leaders.

Risk Reduction Capacity

Risk reduction phases differentiated by the gender of supervisors show that people working for women gave a lower score for Recognition of risks and remedial Action, but better scores than the followers of male leaders for Ability to intervene, Motivation and Courage to intervene. There were interesting differences in the perceptions of respondents in different hierarchical positions. Directors were clearly the most positive group, followed by senior staff (senior staff members without hierarchical authority). Both groups perceived risks as relatively well recognised at the shop floor level, and that remedial Action is relatively well taken, however the directors scored Courage to intervene as the lowest risk reduction phase. Management returned a similar pattern, but stands out for their relatively low scores for Courage to intervene. Supervisors and support staff followed a similar pattern. Operational staff showed that they were not content about the execution of remedial Actions by giving the lowest scores of all.

Evaluation of Risk Reduction Capacity differentiated by age offered one clear indication: the older the respondents, the better they perceived Risk Reduction Capacity. There was a similar pattern in the evaluations differentiated by vocational experience, although the juniors were somewhat more positive in the first five years where Recognition of risks, Ability to intervene and remedial Action taken were concerned. After five years these perceptions had fallen.

There were some interesting differences where the survey output data was differentiated according to safety incident history. Compared with the other response groups, the victims of incidents considered there to be a relatively high Recognition of risks, Motivation and Courage to intervene, but were not convinced about the Action to intervene risk reduction phase. This also applied for the group with no safety incident experience (neither victim nor witness). Interesting enough, this group scored lowest of all.

Safety

Respondents of both genders scored Event History almost identically where the output data was differentiated by gender. The scores on Sense of Safety indicated that people

working for male supervisors feel safer than their colleagues working for female supervisors. People working for female supervisors saw fewer future potential risks than their colleagues working for men.

Evaluations differentiated by hierarchical positions demonstrate clear differences; directors, supervisors, support staff and senior staff (senior employees without hierarchical authority) report the lowest Event History, indicating that they consider the incident rate relatively low. Management and operational staff are slightly less positive about incidents records. Directors are most confident that their organisation is safe where their Sense of Safety is concerned, closely followed by their managers and senior staff. Supervisors and support staff also feel relatively safe, but people in operations are less content with the level of safety.

The survey responses show that older people perceived less impact from incidents. The older respondents also felt safer than the younger respondents. Future risk judgement differed according to age category; the group between 31 and 40 years of age saw more potential risk than the others, and the oldest group (51–67 years) saw the lowest potential risk in their organisation.

When differentiated by vocational experience, the least and the most experienced groups perceived a relatively low number of safety incidents. The least experienced group (0–5 years of experience) felt safest, and scored Sense of Safety highest. The middle category, people with 11–30 years of experience, perceived future potential risks as highest; the group with 5–10 years of experience perceived potential risk as lowest.

When differentiated according to individual incident history, ex-victims and the witnesses of major incidents scored the safety characteristic in the same way. Respondents who reported no incident history at all scored Event History lowest, Sense of Safety highest, and expectation concerning Risk Potential lowest.

8.3.1.1 Mean scores by gender of supervisor

In the following sections we present the respondents' mean scores in relation to the Safety Leadership orientations of their direct leaders, Risk Reduction Capacity and Safety, according to the gender of their direct supervisors.

Of a total population of 3332, 3298 respondents completed a question designed to reveal the specific gender distribution of their direct supervisors. This survey question was answered by employees working for 2578 men and 720 women (77% men and 22% women). These numbers are presented in Table 13 below.

	Frequency	Percent
Male	2578	77.4
Female	720	21.6
Total	3298	99.0
Missing	34	1.0
Total	3332	100.0

TABLE 13 Gender of respondents' direct supervisors

Safety Leadership orientations by gender of direct supervisors

This part of the survey outcomes shows the scores for Safety Leadership, differentiated by respondents working for female and male direct supervisors. The data shows slight differences in the scores of people working for female supervisors and people working for male supervisors. People working for female supervisors scored Relation- and Production-oriented leadership behaviours more highly (respectively *M*=1.51, *SD*=1.17 and *M*=1.20, *SD*=1.22) than their colleagues working for male supervisors (respectively *M*=1.29, *SD*=1.19 and *M*=1.13, *SD*=1.22). People working for women perceived their supervisors as less dominant (*M*=-0.88, *SD*=1.04) than people working for men (*M*=-0.80, *SD*=1.16). The data generated by the general employees suggests that female supervisors show more Relation- and Production-oriented behaviours, and are considered less Dominance-oriented.

Risk Reduction Capacity by gender of supervisors

The scores for the five risk reduction phases as generated by respondents working for male and female direct supervisors were also split in order to identify possible differences in the mean scores. This survey question was answered by 2578 male and 719 female respondents.

The scores related to the individual risk reduction phases as reported by male and female respondents are very similar and follow the same order of precedence. The minor differences observed are that respondents working for male direct supervisors scored the Recognition and Action risk reduction phases (respectively *M*=1.68 *SD*=1.29 and *M*=1.35 *SD*=1.45) slightly higher than the respondents working for female supervisors; the scores for the latter were respectively *M*=1.58 *SD*=1.28 and *M*=1.24 *SD*=1.43. the opposite was true for the other three risk reduction phases, Ability, Motivation and Courage: the scores of people working for female supervisors (respectively *M*=1.41 *SD*=1.23, *M*=1.64 *SD*=1.25 and *M*=1.40 *SD*=1.35) slightly exceeded the scores by their colleagues working for male supervisors (respectively *M*=1.39 *SD*=1.30, *M*=1.57 *SD*=1.33 and *M*=1.35 *SD*=1.43).

The practical implications of the observed differences between the scores reported from male and female respondents are negligible.

Safety by gender of direct supervisors

The scores for the three safety characteristics as generated by respondents working for male and female direct supervisors were differentiated in order to identify possible differences in the mean scores. This survey question was answered by 1640 male and 364 female respondents. We observed that the scores related to individual safety by respondents working for male supervisors, and for female supervisors are very similar and follow the same approximate pattern for Event History, Sense of Safety and potential future risk. The only notable difference was that respondents working for male direct supervisors were slightly more positive concerning their Sense of Safety than people working for female supervisors (respectively M=1.96, SD=1.20 and M=1.70, SD=1.44).

These data are graphically presented in Section 15.7.1.

8.3.1.2 Mean scores by hierarchical position

We also considered the possible differences in individual perceptions by people holding different hierarchical positions. We therefore analyzed the scores given according to the positions of directors, managers, supervisors, support staff, operational staff and senior staff (the latter position refers to business sectors where people hold senior positions without hierarchical authority).

Hierarchical positions of respondents

The valid respondents held six different hierarchical position levels: directors/board members, managers, supervisors, support staff, senior staff and operational staff. Out of a total population of 3332, 3317 respondents completed this questionnaire question. Within the group of general employees, operational staff represented 46% of the respondents, supervisors 20%, support staff (predominantly members of quality and safety departments) 17%, category managers 10%, senior staff 5%, and directors/board members 1%.

The results of the data analyses regarding the perceptions of the respondents regarding the Safety Leadership Orientations of their direct leaders, Risk Reduction Capacity and Safety are presented below.

Safety Leadership by hierarchical positions

This survey question was answered by 3317 respondents. There were some interesting details in the position-specific survey data. First, the outcomes show that, compared to respondents in other positions, directors perceive the Relation-, Process and Production leadership orientations most positively; this group scores highest of all respondents (respectively M=1.69, SD=1.03, M=1.56, SD=1.13 and M=1.48, SD=1.02). Senior staff follows closely for these leadership orientations (respectively M=1.54, SD=0.99, M=1.55, SD=0.89 and M=1.48, SD=1.19). Managerial respondents reported Process as the primary leadership orientation (M=1.55, SD=1.01). The same was true for supervisors (M=1.42, SD=1.02). An obvious difference can be seen when comparing the scores by directors, and their managers and supervisors: there is a gap between the scores of directors (M=1.48, SD=1.02)

and those of managers (*M*=1.21, *SD*=1.19) and supervisors (*M*=1.09, *SD*=1.20). Apparently, directors perceive the behaviour of the people they report to (boards of directors, shareholders and the like) as primarily Relation- and Process-oriented. The scores by senior staff are similar to those by the directors. It is interesting to see that senior staff score the Dominance leadership orientation lowest of all positions (*M*=-0.96, *SD*=1.11).

Operational staff, as the group primarily exposed to operational safety hazards, score lowest of all positions for Relation-, Process- and Production-oriented leadership (respectively *M*=1.24, *SD*=1.30, *M*=1.21, *SD*=1.14 and *M*=1.05, *SD*=1.19), and score the Dominance leadership orientation highest (*M*=-0.78, *SD*=1.18); and their supervisors follow suit by (*M*=-0.79, *SD*=1.10).

Risk Reduction Capacity by hierarchical position

This survey question was answered by 3311 respondents. We observed that the respondents in all positions considered Recognition as the most controlled of the five risk reduction phases.

The very high degree of confidence (*M*=2.24, *SD*=0.92) shown by the directors, closely followed by senior staff, is notable (*M*=2.03, *SD*=1.01). Compared with the other four positions, the respondents in these two most senior positions perceive all risk reduction phases as the best controlled. Another interesting observation is that respondents in all positions indicate the Motivation risk reduction phase as second best controlled.

Management considered the Courage risk reduction phase (*M*=1.01, *SD*=1.45) as least controlled of all respondents, and demonstrated relatively high confidence in the Action phase (*M*=1.39, *SD*=1.32). A relatively high confidence in Action is supported by supervisors (*M*=1.50, *SD*=1.32) and support staff (*M*=1.27, *SD*=1.38). This was not true for operational staff, who considered Action (*M*=1.18, *SD*=1.56) the least controlled of all, and also the least controlled of all positions.

Safety by hierarchical positions

Safety represents the respondents' specific safety-related perceptions. This reflects the past through the respondents' experiences of *safety events*, the present through the respondents' *sense of the actual safety* for the primary process concerned, and the future through the respondents' impressions of the likelihood of operational disturbances, referred to as the *Risk Potential.* This survey question was answered by 2000 respondents. We observed that directors and senior staff experienced actual safety events as relatively infrequent (respectively *M*=-1.32, *SD*=1.45 and *M*=-1.55, *SD*=1.28). Respondents in these positions also reported that their Sense of Safety was relatively high; directors *M*=2.55, *SD*=0.51 and senior staff *M*=2.17, *SD*=1.11. Management also shows a relatively high level of confidence in Sense of Safety (*M*=2.28, *SD*=0.92), however this group had experienced a somewhat higher level of actual safety events than reported by the directors and senior staff (*M*=-1.02, *SD*=1.43).

Individual safety as reported by operational staff is of special interest. These respondents reported the highest level of actual safety events (*M*=-0.99, *SD*=1.60), and the lowest Sense of Safety (*M*=1.68, *SD*=1.38).

Directors reported a relatively high level of Risk Potential in their analyzed (*M*=1.30, *SD*=1.66), whereas senior staff perceived this characteristic as relatively low (*M*=-0.45, *SD*=1.89), and the respondents in other positions reported values between *M*=-0.71, *SD*=1.74 and *M*=-0.91, *SD*=1.58.

These data are graphically presented in Section 15.7.2.

8.3.1.3 Mean scores by age

The different moderator variables analyzed were chosen because we considered them possibly of influence with respect to the survey outcomes. In this research, age is considered a relevant variable where it concerns the safety-related perceptions of individuals. Of a total population of 3332, 3319 general employees informed us about their age. We divided these general employees into four age groups: age up to 30 (n=352), age between 31 and 40 (n=737), age between 41 and 50 (n=1001), and age between 51 and 67 (n=1229). The following sections show the results regarding their perceptions of the Safety Leadership orientations of their direct leaders, Risk Reduction Capacity and Safety, differentiated by the age of the respondents.

Safety Leadership by age

This survey question was answered by 3319 respondents. There were very similar perceptions regarding Relation (scores between *M*=1.29, *SD*=1.13 and *M*=1.36, *SD*=1.24) and Process leadership orientations (scores between *M*=1.31, *SD*=1.02 and *M*=1.38, *SD*=1.10), indicating that age does not make a difference to views on these two leadership orientations. The youngest group (<31 of age) recognised Production-oriented leaders more often (*M*=1.32, *SD*=1.11), than their older colleagues (respectively: age 31–40 *M*=1.13, *SD*=1.19, age 41–50 *M*=1.11, *SD*=1.22 and age 51–67 *M*=1.11, *SD*=1.26). The youngest group also distinguished itself in their perceptions of the Dominance leadership orientation. Respondents aged <31 report more Dominance (*M*=-0.62, *SD*=1.03) than their older colleagues, who experienced less Dominance as they grew older (respectively: age 31–40 *M*=-0.74, *SD*=1.06, age 41–50 *M*=-0.85, *SD*=1.11 and age 51–67 *M*=-0.88, *SD*=1.20).

Risk Reduction Capacity by age

We observed some interesting variations between the different age groups concerning their insights into Risk Reduction Capacity. The confidence in Recognition of safety risks increases with age. Respondents younger than 31 years of age scored this lowest (*M*=1.45, *SD*=1.34), and the other scores were as follows: 31–40 age group (*M*=1.53, *SD*=1.27), the 41–50 age group (*M*=1.68, *SD*=1.29) and the oldest age group, 51–67 (*M*=1.77, *SD*=1.25). The other four risk reduction phases showed a similar pattern, with one exception: respondents aged between 31 and 40 considered the Ability to intervene lowest of all groups (*M*=1.30, *SD*=1.28) (age group <31 (*M*=1.40, *SD*=1.25), age group 41–50 (*M*=1.41, *SD*=1.29) and the oldest age group, 51–67 (*M*=1.46, *SD*=1.27)).

Safety by age

The safety-related questions concerning the respondents' views on Event History returned interesting outcomes from the different age groups of respondents. The younger than 31 age group (*M*=-0.79, *SD*=1.56) were more concerned about the incident history of their analyzed than their older colleagues between ages 31–40 (*M*=-0.92, *SD*=1.50), the 41–50 age group (*M*=-1.16, *SD*=1.52) and the oldest age group, 51–67 (*M*=-1.36, *SD*=1.46). The youngest age group (<31) also returned the lowest score for their present Sense of Safety (*M*=1.72, *SD*=1.41). Their older colleagues judged the safety of the analyzed somewhat higher, and reported the following, relatively similar scores; the 31–40 age group (*M*=1.90, *SD*=1.22), the 41–50 age group (*M*=1.93, *SD*=1.21) and the oldest age group, 51–67 (*M*=1.96, *SD*=1.22). The oldest age group (51–67) returned the lowest score for future potential risks (*M*=0.66, *SD*=1.80). Their younger colleagues perceived this potential somewhat higher; they scored it as follows: the <31 age group (*M*=0.67, *SD*=1.69), the 31–40 age group (*M*=0.82, *SD*=1.69) and the 41–50 age group (*M*=0.79, *SD*=1.77).

These data are graphically presented in Section 15.7.3.

8.3.1.4 Mean scores by vocational experience

We considered the vocational competence of the people involved as influential in risk reduction, and explain 'competence' according to the combined results for vocational knowledge, skills and experience. We therefore included vocational experience in this online prospective survey questionnaire. Of a population of 3332, 3319 general employees informed us about their vocational experience. We divided these general employees into five time periods: <5 years of experience (n=546), 5–10 years of experience (n=668), 11–20 years of experience (n=883), 20–30 years of experience (n=674), and over 30 years of experience (n=548).

In the following sections we present the perceptions of respondents have regarding the leadership orientations of their direct leaders, Risk Reduction Capacity and Safety, according to their vocational experience (in terms of years of experience in the business sector in which they are actually working).

Safety Leadership by vocational experience

This survey question was completed by 3319 respondents. We observed that respondents with relatively little vocational experience (0–5 years) clearly considered their direct supervisors as mainly Relation-oriented leaders (*M*=1.47, *SD*=1.08). In order of perceptions, this group considered their leaders as Process- (*M*=1.39, *SD*=1.02), Production- (*M*=1.27, *SD*=1.15) and Dominance-oriented (*M*=-0.80, *SD*=1.0). The respondents with 5–10 years of experience showed a similar trend, starting with a score of *M*=1.36, *SD*=1.14 for Relation-oriented leaders, gradually decreasing to *M*=-0.85, *SD*=1.09 for Dominance-oriented leaders. After 10 years of experience the respondents' views changed in that respondents with 11–50 years of experience reported that most leaders were Process-oriented (*M*=1.31, *SD*=1.09). Relation-oriented leaders (*M*=1.25, *SD*=1.20) were placed second in order. As in the groups

with little vocational experience, Production- (M=1.11, SD=1.21) and Dominance-oriented (M=-0.79, SD=1.16) leaders were less often reported. Respondents with 31–50 years of experience perceived their leaders as equally Relation- (M=1.39, SD=1.24) and Process-oriented (M=1.39, SD=1.12). Compared with all these groups, the most senior respondents perceived Production (M=1.11, SD=1.21) and Dominance (M=1.11, SD=1.21) as least present.

Risk Reduction Capacity by vocational experience

This survey question was completed by 3311 respondents. With respect to Risk Reduction Capacity, we observed that the most experienced respondents considered risk reduction most effectively controlled. This group, with 31–50 years of vocational experience, returned the following scores: Recognition M=1.85, SD=1.27, Ability M=1.54, SD=1.25, Motivation M=1.84, SD=1.26, Courage M=1.66, SD=1.35 and Action M=1.49, SD=1.45. These scores mean that this senior group perceive Recognition and Motivation on the work floor well implemented. Except for the juniors (0–5 years of vocational experience) the other respondents with 5–30 years of experience also scored Recognition and Motivation as the highest scoring risk reduction phases. The juniors scored Ability (M=1.52, SD=1.31) second and Motivation (M=1.46, SD=1.33) third. We also observed the interesting phenomenon that all groups, except the respondents with less than 5 years of experience, indicated that they perceived the Action risk reduction phase as the least controlled of all five phases. Courage was reported as controlled least by respondents with less than 11 years of experience (M=1.26, SD=1.41 and M=1.26, SD=1.43). Respondents with 11- 50 years of experience perceived Courage as better controlled (M=1.32, SD=1.39; M=1.37, SD=1.44; and M=1.66, SD=1.35).

Safety by vocational experience

This survey question was completed by 1999 respondents. The survey outcomes concerning safety, as reported in the five specific categories of vocational experience, show some interesting differentiations between the groups. The most experienced group reported the lowest score of all groups for event History (M=-1.39, SD=1.51). The other four groups reported perceptions between M=1.04, SD=1.53 and M=1.13, SD=1.52. The least experienced (0–5 years) group showed the highest confidence in the level of safety of the analyzed via Sense of Safety (M=2.02, SD=1.23). This confidence decreases, however, when people reach the next level of vocational experience (5–10 years) (M=1.88, SD=1.22), which remains around that level during the following years. How the respondents judge the future is shown by their perceptions of Risk Potential. The group with 5–10 years of experience had the lowest expectations (M=0.62, SD=1.79), the next group (11–20 years) had the highest expectations (M=0.87, SD=1.69), and the other groups expect Risk Potential in levels in between these two extremes.

These data are graphically presented in Section 15.7.4.

8.3.1.5 Mean scores by safety incident history

Involvement in a safety incident, whether as a witness or, even more intensely, as a victim, is an emotional experience, which may affect an individual's perceptions of the context in which they work. We therefore considered 'incident history' a relevant moderator variable in this research. In the following sections we present the effects of safety incident history on the leadership orientations of the participants' direct leaders, Risk Reduction Capacity and Safety.

Safety Leadership by safety incident history

Having experienced an incident with serious consequences, or having been a witness to such incident may have an effect on the way people view the safety risks in their working environment. Our survey shows that 3298 respondents of the population of 3332 general employees replied to this question: 233 respondents reported having been the victim of a serious accident, 1293 respondents had witnessed a serious accident and 1772 respondents had never experienced nor witnessed a serious accident.

The survey outcomes show that respondents who have been the victims of a serious safety incident consider their leaders predominantly Relation-oriented (M=1.35, SD=1.33), then Process-oriented (M=1.25, SD=1.14) and then Production-oriented (M=1.12, SD=1.29). According to these victim-respondents Dominance-oriented direct leaders are rare (M=-0.78, SD=1.25). Respondents who had witnessed major incident(s) reported that their leaders show predominantly Process-oriented behaviours (M=1.34, SD=1.23). These respondents reported that the next group of direct leaders was Relation-oriented (M=1.29, SD=1.23). Witness respondents scored Production-oriented leaders (M=1.11, SD=1.28) and Dominance-oriented leaders (M=-0.75, SD=1.17) in the same order as the victim-oriented leaders. Respondents who had not been involved in safety incidents, as victim either or witness, described the leadership orientations of their direct leaders somewhat more istinctly than the other categories of respondents (Relation M=1.37, SD=1.14, Process M=1.37, SD=1.02, Production M=1.17, SD=1.17 and Dominance M=-0.87, SD=1.09).

Risk Reduction Capacity by safety incident history

Having experienced an incident with serious consequences, or having been a witness to such an event may have an effect on the way people view the safety risks in their working environment. Our survey shows that 3298 respondents of the population of 3332 general employees replied to this question: 232 respondents reported having been the victim of a serious accident, 1292 respondents had witnessed a serious accident, and 1767 respondents had never experienced or witnessed a serious accident. The analysis showed that respondents who have reported being victims of safety incidents have most confidence of all groups, with respect to four of the five risk reduction phases; only the Action phase scored as low as for the respondents who had not been involved (as either victim or witness) in safety incidents. We also observed that all three groups showed a similar trend where scores concerning the Risk Reduction Capacity were concerned.

Safety by safety incident history

Having experienced an accident with serious consequences, or having been a witness to such an event may have an effect on the way people view the state of safety in their working environment. Our survey shows that 2004 respondents of the population of 3332 general employees replied to this question. 140 respondents noted having been the victim of a serious accident, 821 respondents had witnessed a serious accident, and 1043 respondents had never experienced or witnessed a serious accident. This analysis shows that safety clearly differs between the three categories of respondents. Respondents who had been the victims of safety incidents gave a medium score for Event History (M=-1.12, SD=1.53), whereas witnesses perceived more safety incidents having occurred (M=1.0, SD=1.56) and respondents who had not been involved in safety incidents at all reported the least number of incidents (M=1.27, SD=1.46). A Sense of Safety was lowest for respondents who had been victims (M=1.73, SD=1.34). Witness respondents were slightly more positive about their sense of Safety (M=1.86, SD=1.27) and respondents who had not been involved in safety incidents at all were most positive about their Sense of Safety (M=1.97, SD=1.21). Risk Potential demonstrated the opposite trend with respect to perceptions of the future; victims scored the possibility of future risks highest (M=1.05, SD=1.71), witnesses scored this option at an intermediate level (M=0.96, SD=1.67) and people who had not been involved in safety incidents in any way scored Risk Potential lowest (M=0.52, SD=1.80).

These data are graphically presented in Section 15.7.5.

Having determined the mean scores as presented in the above sections, we reached the concluding analysis stage; testing the specific relationships (path analysis) between the three nodes of the Safety Leadership Model (Safety Leadership, Risk Reduction Capacity and Safety). We thus analyzed the acquired survey data via Structural Equation Modelling (SEM). The results of this process are presented in the following sections.

8.4 Structural Equation Modelling (SEM) path analysis

The Safety Leadership Model Version III (Figure 26), as presented in Section 7.5, served as the basic structure for this SEM path analysis. In this model Risk Reduction Capacity is considered the mediating factor between Safety Leadership and Safety. The Recognition, Ability, Motivation, Courage and Action risk reduction phases are considered mutually independent entities. Due to this independence and the different characteristics of the risk reduction phases, five separate SEM path analyses were performed; one analysis for each risk reduction phase. In these path analyses the four leadership orientations (Production, Process, Relation and Dominance) are considered as independent *predictors*, the risk reduction phases are considered *mediators* and the three safety characteristics (Event History, Sense of Safety and Risk Potential) are considered dependent *outcomes*.

Structure of presentation

The presentation of the SEM path analysis results follows the sequence of the five phases of the Risk Reduction Cycle (Recognition, Ability, Motivation, Courage and Action). Each section consists of two sub-sections: the analysis results (tables and figures) and the interpretation of results (text). In the 'Analysis results' sections the results of the subject path analysis are presented in a table, and in a figure showing the mapped analysis results.

Analysis results (tables)

On the third line of the tables, we show the explained variances between the applicable mediating risk reduction phase and the three safety characteristics (Event History, Sense of Safety and Risk Potential). The effects of two different path analyses, one showing the mediated, and one showing the non-mediated (or direct), effects of the four leadership orientations on the three safety characteristics, are displayed, working down from the sixth line to the bottom of the tables (line 13).

The powers of the displayed effects are expressed in standardised regression coefficients.[1] This means that a higher absolute value represents a stronger effect, and vice versa. Positive effects are shown as positive numbers, and negative effects are shown as negative numbers. Only the significant ($p < .05$) and the highly significant ($p < .01$) paths are considered in this analysis.

Classification of identified values

In order to evaluate the statistical power of the identified correlation levels, we refer to a hierarchical taxonomy of variables to produce empirical effect size benchmarks, as developed by Bosco et al.[2] Their Correlational Effect Size Benchmarks table (Appendix 15.4) refers to statistical power criteria as published by Cohen[3] in terms of uncorrected effect size (|r|). The criteria as published by Bosco et al. conclude that |r| values between .24 and .50 are classified as a 'medium' or 'moderate' effect size. We used this effect size classification as guidance during the interpretation of the correlations as described below.

Analysis results (figures)

The analysis results are graphically presented below the tables. These figures show the four leadership orientations at the top, the applicable risk reduction phase below, and the three safety characteristics at the bottom. Arrows show the directions and the specific effect sizes, as given in the tables. Each arrow is accompanied by a number indicating the applicable effect size.

1 The numbers indicating standardised regression coefficients represent the change rate in response, in terms of one standard deviation (SD) change in a predictor.

2 Bosco, Aguinis, Singh, Field and Pierce (2015), p. 433.

3 Cohen (2013)

Explanations

We explain the analysis results after each section, in a sub-section: 'Explanation of effects per leadership orientation.' We explain the specific effects of the applicable risk reduction phase under the same heading.

We give the results of these five SEM path analyses in the next sections.

8.4.1 *Recognition-related effects*

In this section we present the results of the SEM path analysis related to the Recognition risk reduction phase.

Analysis results

The SEM path analysis results for cases where Recognition acts as a mediator between the four leadership orientations and the three safety characteristics are shown in Table 14 below.

Risk reduction phase: RECOGNITION		**Event History**	**Sense of Safety**	**Risk Potential**
Explained variance		.198	.299	.018
Leadership orientation	**Effect**	**Standardised regression coefficient**		
Relation	**Direct**	.34	-	-
	Mediated	.04	-.004	-
Process	**Direct**	-.45	.37	-
	Mediated	-.12	.10	-
Production	**Direct**	.17	-	-
	Mediated	.03	-.03	-
Dominance	**Direct**	.37	-	.23
	Mediated	-	-	

TABLE 14 Leadership effects (mediator: Recognition)

A graphical representation of the standardised regression coefficients as included in the above analysis table is shown in Figure 27 below.

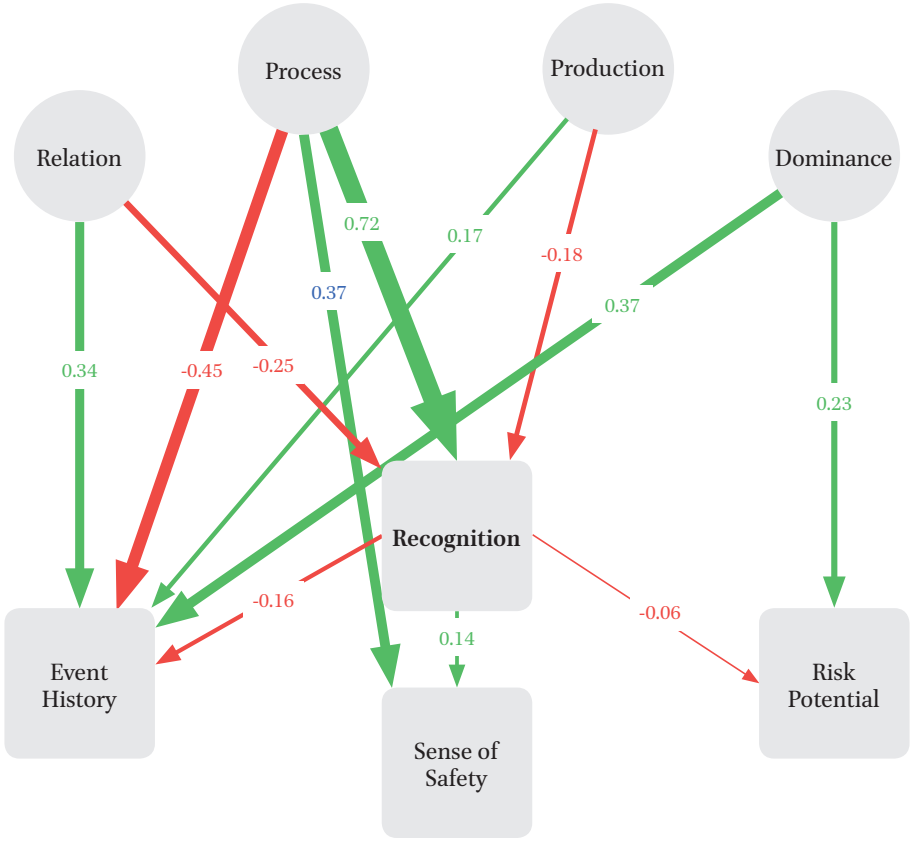

FIGURE 27 Significant effects (mediator: Recognition)

Explanation of effects per leadership orientation

Relation-oriented leaders

We observe that Relation-oriented leaders have a medium-strong positive effect (.34) on the occurrence of safety incidents (shown by the green arrow leading to Event History). A red arrow to Recognition shows us that Relation-oriented leaders have a medium strong reductive effect (-.25) on Recognition, so the more a leader behaves in a Relation-oriented way, the less risks are recognised.

Process-oriented leaders

We see a red arrow in the direction of Event History, concerning Process-oriented leaders, which means that they have a medium strong reducing effect (-.45) on the occurrence of safety incidents. We also note two green arrows, indicating that Process-oriented leaders have a strong positive effect on Recognition (.72), and a medium strong positive effect (.37) on the Sense of Safety of the respondents of this survey.

Production-oriented leaders

Production-oriented leaders have a weakly positive effect (.17) on the occurrence of incidents (shown by the green arrow leading to Event History), and also a weak negative effect (-.18) on Recognition. Leaders behaving in a Production-oriented way thus increase safety incidents and dampen the Recognition of risks.

Dominance-oriented leaders

The green arrow pointing at Event History shows that leaders in this group have a medium strong positive effect (.37) on the occurrence of safety incidents. We also see a green arrow in the direction of Risk Potential, showing a weak Relation (.23) with this safety element, and meaning that the more dominantly leaders behave, the more potential risks are expected.

Mediator's influence

In this analysis we note that the Recognition of risks has a weakly positive effect (.14) on the Sense of Safety (green arrow), a weak negative effect (-.16) on Event History, and a negligible effect (-.06) on Risk Potential (both red arrows).

8.4.2 *Ability-related effects*

In this section we present the results of the SEM path analysis related to the Ability risk reduction phase.

Analysis results

The SEM path analysis results for cases where Ability acts as a mediator between the four leadership orientations and the three safety characteristics are shown in Table 15 below.

Risk reduction phase: ABILITY		**Event History**	**Sense of Safety**	**Risk Potential**
Explained variance		.198	.299	.018
Leadership orientation	**Effect**	**Standardised regression coefficient**		
Relation	**Direct**	.36	-	-
	Mediated	-	-	-
Process	**Direct**	-.47	.39	-
	Mediated	-.09	.08	-
Production	**Direct**	.18	-	-
	Mediated	.03	-.02	-
Dominance	**Direct**	.37	-	.23
	Mediated	-	-	-

TABLE 15 Leadership effects (mediator: Ability)

A graphical representation of the standardised regression coefficients as included in the above analysis table is shown in Figure 28 below.

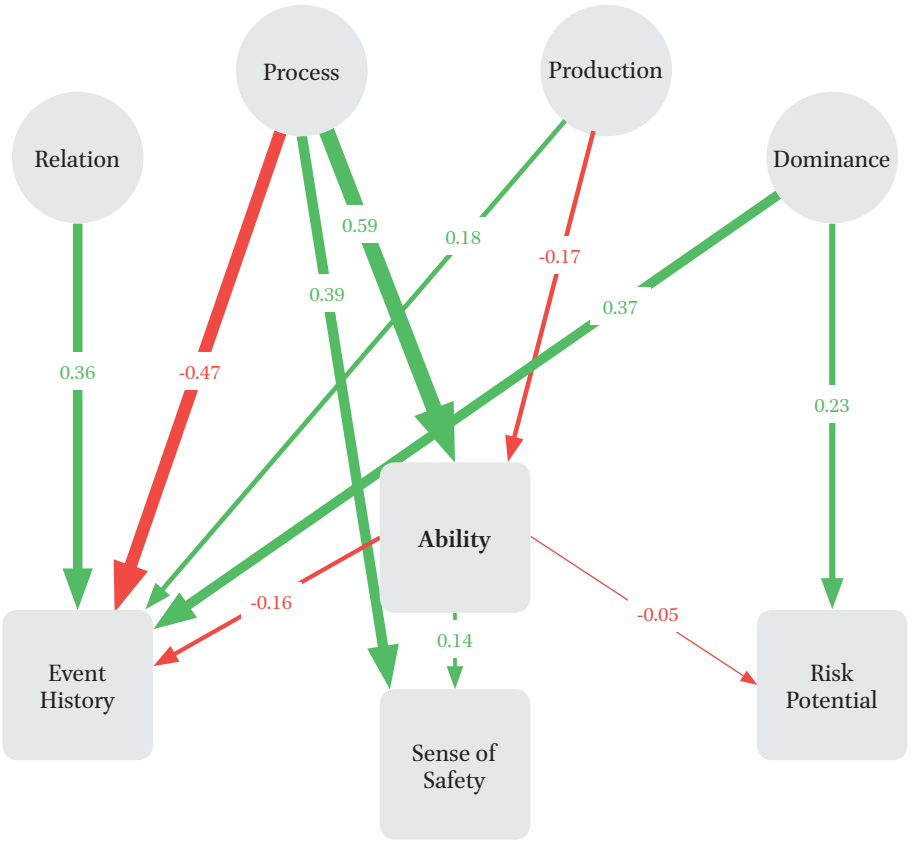

FIGURE 28 Significant effects (mediator: Ability)

Explanation of effects per leadership orientation

Relation-oriented leaders

The green arrow leading to Event History shows that Relation-oriented leaders have a medium-strong positive effect (.36) on the occurrence of safety incidents.

Process-oriented leaders

There is a red arrow in the direction of Event History for Process-oriented leaders, which means that they have a medium-strong effect (-.47) in reducing safety incidents. The two green arrows indicate that Process-oriented leaders have a strong positive effect (.59) on Ability and a medium-strong positive effect (.39) on the Sense of Safety, for the respondents of this survey.

Production-oriented leaders

Production-oriented leaders have a weakly positive effect (.18) on the occurrence of incidents (shown by the green arrow leading to Event History), and also a weakly negative effect (-.17) on Ability. Leaders behaving in a Production-oriented manner thus promote safety incidents and dampen the Ability to intervene.

Dominance-oriented leaders

The green arrow pointing at Event History shows that leaders in this group have medium-strong positive effects (.37) on the occurrence of safety incidents. We also see a green arrow in the direction of Risk Potential, showing a weak Relation (.23) with this safety element, and meaning that the more dominantly leaders behave, the more potential risks are expected.

Mediator's influence

Ability to intervene has a weakly positive effect (.14) on the Sense of Safety (green arrow), a weakly negative effect (-.16) on Event History and a negligible effect (-.05) on Risk Potential (both red arrows).

8.4.3 *Motivation-related effects*

In this section we present the results of the SEM path analysis related to the Motivation risk reduction phase.

Analysis results

The SEM path analysis results for cases where Motivation acts as a mediator between the four leadership orientations and the three safety characteristics are shown Table 16 below.

Risk reduction phase: MOTIVATION		**Event History**	**Sense of Safety**	**Risk Potential**
Explained variance		.189	.287	.018
Leadership orientation	**Effect**	**Standardised regression coefficient**		
Relation	**Direct**	.38	-	-
	Mediated	-	-	-
Process	**Direct**	-.52	.44	-
	Mediated	-.05	.03	-
Production	**Direct**	.19	-	-
	Mediated	-	-	-
Dominance	**Direct**	.37	-	.23
	Mediated	-	-	-

TABLE 16 Leadership effects (mediator: Motivation)

A graphical representation of the standardised regression coefficients as included in the above analysis table is shown in Figure 29 below.

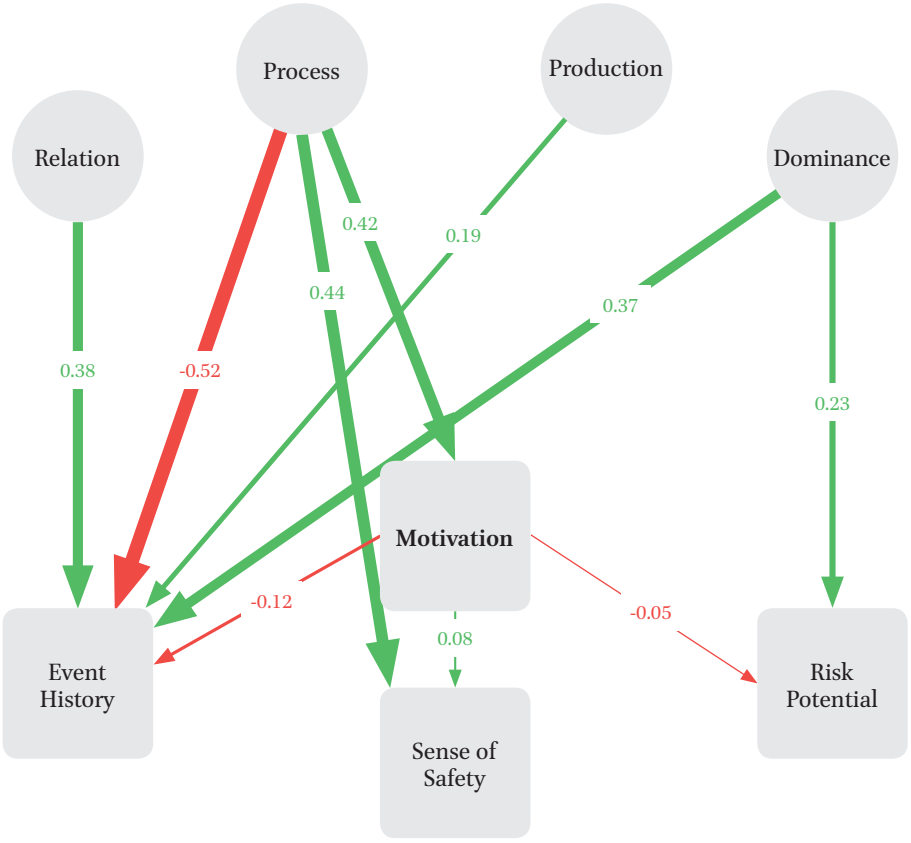

FIGURE 29 Significant effects (mediator: Motivation)

Explanation of effects per leadership orientation

Relation-oriented leaders

The green arrow leading to Event History shows that Relation-oriented leaders have a medium-strong positive effect (.38) on the occurrence of safety incidents.

Process-oriented leaders

Concerning Process-oriented leaders, we see a red arrow in the direction of Event History for Process-oriented leaders, which means that they have a strong reducing effect (-52) on the occurrence of safety incidents. We also observe two green arrows, indicating that Process-oriented leaders have a medium-strong positive effect (.42) on Motivation, and a medium-strong positive effect (.44) on the Sense of Safety of the respondents of in this survey.

Production-oriented leaders

Production-oriented leaders have a weakly positive effect (.19) on the occurrence of incidents (shown by the green arrow leading to Event History).

Dominance-oriented leaders

The green arrow pointing at Event History shows that leaders in this group have a medium-strong positive effect (.37) on the occurrence of safety incidents. We also see a green arrow in the direction of Risk Potential, showing a weak Relation (.23) with this safety element, and meaning that the more dominantly leaders behave, the more potential risks are expected.

Mediator's influence

In this analysis we note that Motivation to intervene has a negligible effect on the Sense of Safety (green arrow), a weak negative effect on Event History and a negligible effect on Risk Potential (both red arrows).

8.4.4 *Courage related effects*

In this section we present the results of the SEM path analysis related to the Courage risk reduction phase.

Analysis results

The SEM path analysis results for cases where Courage acts as a mediator between the four leadership orientations and the three safety characteristics are shown Table 17 below.

Risk reduction phase: COURAGE		**Event History**	**Sense of Safety**	**Risk Potential**
Explained variance		.196	.286	.02
Leadership orientation	**Effect**	**Standardised regression coefficient**		
Relation	**Direct**	.36	-	-
	Mediated	-	-	-
Process	**Direct**	-.47	.43	-
	Mediated	-.09	.04	.04
Production	**Direct**	.18	-	-
	Mediated	-	-	-
Dominance	**Direct**	.38	-	.24
	Mediated	-	-	-

TABLE 17 Leadership effects (mediator: Courage)

A graphical representation of the standardised regression coefficients as included in the

above analysis table is shown in Figure 30 below.

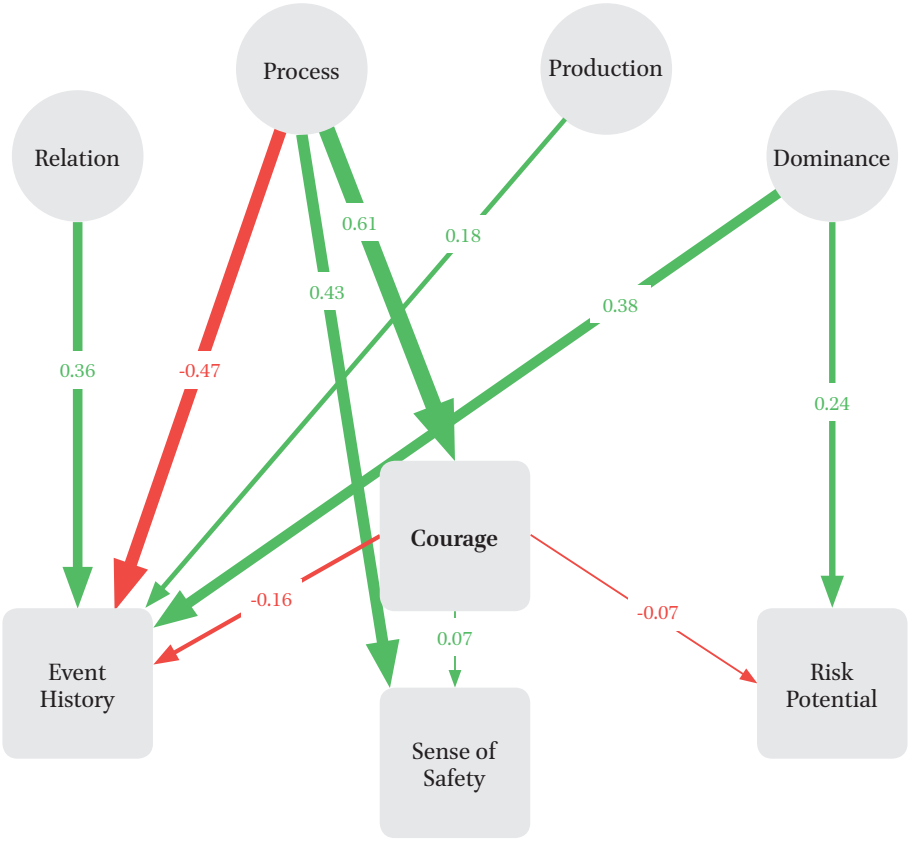

FIGURE 30 Significant effects (mediator: Courage)

Explanation of effects per leadership orientation

Relation-oriented leaders

The green arrow leading to Event History shows that Relation-oriented leaders have a medium-strong positive effect (.36) on the occurrence of safety incidents.

Process-oriented leaders

A red arrow points in the direction of Event History, which means that Process-oriented leaders have a medium-strong reducing effect (-.47) on the occurrence of safety incidents. We also observe two green arrows, indicating that Process-oriented leaders have a strong positive effect (.61) on Courage, and a medium-strong positive effect (.43) on the Sense of Safety for the respondents of this survey.

Production-oriented leaders

Production-oriented leaders have a weakly positive effect (.18) on the occurrence of incidents (shown by the green arrow leading to Event History). Leaders behaving in a Production-oriented manner thus cause safety incidents.

Dominance-oriented leaders

The green arrow pointing at Event History shows that leaders in this group have a medium-strong positive effect (.38) on the occurrence of safety incidents. We also see a green arrow in the direction of Risk Potential, showing a weak Relation (.24) with this safety element, and meaning that the more dominantly leaders behave, the more potential risks are expected.

Mediator's influence

In this analysis we note that Motivation to intervene has a negligible effect on the Sense of Safety (green arrow), a weak negative effect on Event History and a negligible effect on Risk Potential (both red arrows).

8.4.5 *Action related effects.*

In this section we present the results of the SEM path analysis related to the Action risk reduction phase.

Analysis results

The SEM path analysis results for cases in which Action acts as a mediator between the four leadership orientations and the three safety characteristics are shown Table 18 below.

Risk reduction phase: ACTION		**Event History**	**Sense of Safety**	**Risk Potential**
Explained variance		.201	.301	.023
Leadership orientation	**Effect**	**Standardised regression coefficient**		
Relation	**Direct**	.33	-	-
	Mediated	.05	-.04	-
Process	**Direct**	-.43	.35	-
	Mediated	-.14	.12	-.07
Production	**Direct**	.17	-	-
	Mediated	.03	-.03	-
Dominance	**Direct**	.37	-	.22
	Mediated	-	-	-

TABLE 18 Leadership effects (mediator: Action)

A graphical representation of the standardised regression coefficients as included in the

above analysis table is shown in Figure 31 below.

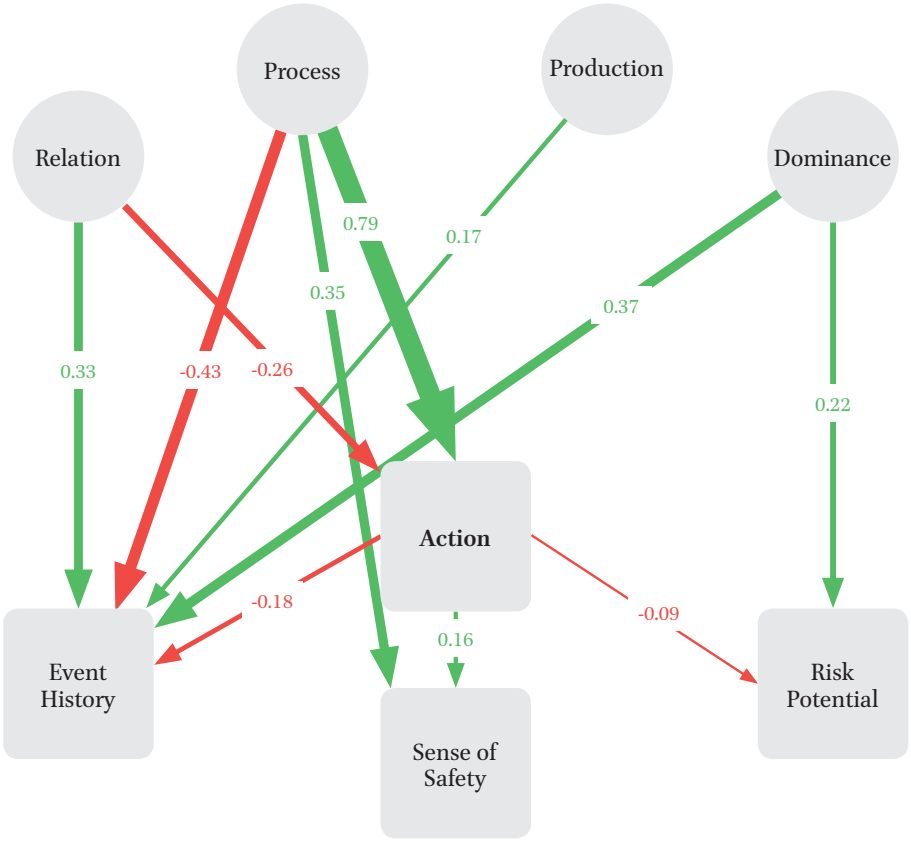

FIGURE 31 Significant effects (mediator: Action)

Explanation of effects per leadership orientation

Relation-oriented leaders

The green arrow leading to Event History shows that Relation-oriented leaders have a medium-strong positive effect (.33) on the occurrence of safety incidents. A red arrow in the direction of remedial Action, shows a weak negative effect (-.26) on this mediator.

Process-oriented leaders

We see a red arrow in the direction of Event History for Process-oriented leaders, which means that they have a medium-strong reducing effect (-.43) on the occurrence of safety incidents. We also observe two green arrows, indicating that Process-oriented leaders have a strong positive effect (.79) on remedial Action and a medium-strong positive effect (.35) on the Sense of Safety for the respondents of this survey.

Production-oriented leaders

Production-oriented leaders have a weakly positive effect (.17) on the occurrence of incidents (shown by the green arrow leading to Event History), and also a weak negative effect (-.19) on remedial Action. Leaders behaving in a Production-oriented manner thus prompt safety incidents and dampen the timely implementation of remedial Action.

Dominance-oriented leaders

The green arrow pointing at Event History shows that leaders in this group have medium-strong positive effects (.37) on the occurrence of safety incidents. We also see a green arrow in the direction of Risk Potential, showing a weak Relation (.22) with this safety element, and meaning that the more dominantly leaders behave, the more potential risks are expected.

Mediator's influence

In this analysis we note that the Action risk reduction phase has a weakly positive effect on the Sense of Safety (green arrow), a weakly negative effect on Event History, and a negligible effect on Risk Potential (both red arrows)

The next chapter presents the valorisation of our research. We present the answers to the research questions, and explain what these findings mean to us.