The impact of communication on safety behavior of employees

Master thesis, Communication Studies

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Dutch summary

Industriële organisaties besteden tegenwoordig veel aandacht aan veiligheid op de werkvloer. Desondanks gebeuren er nog steeds tal van ongelukken. Daarom wordt er door industriële organisaties geïnvesteerd in veiligheid. Zo ook in communicatieplannen en –middelen. Die investering wordt gerechtvaardigd door recent onderzoek, want dat heeft uitgewezen dat: communicatie een positieve invloed kan hebben op veiligheidsgedrag, en daarmee op de veiligheidsprestaties. Dit veiligheidsgedrag is onder te verdelen in veiligheidsparticipatie en veiligheidsnaleving.

Eerder onderzoek heeft zich vooral gericht op het onderzoeken van het veiligheidsklimaat en de invloed hiervan op veiligheidsgedrag van werknemers. Daarin was communicatie één van de variabelen van veiligheidsklimaat die een positieve invloed had op veiligheidsgedrag. Echter, er is nog niet specifiek onderzocht welk aspect van communicatie nu zorgt voor die positieve invloed. Met andere woorden: welk(e) aspect(en) van de communicatie beïnvloedt(en) veiligheidsgedrag van werknemers?

In dit onderzoek is onderzocht welke aspecten van communicatie invloed hebben op veiligheidsparticipatie en/of veiligheidsnaleving. Communicatie wordt onderverdeeld in zes aspecten: communicatieklimaat, organisatorische integratie en perspectief, persoonlijke feedback, mediakwaliteit, horizontale- en veiligheidscommunicatie en de relatie met leidinggevenden. Samen met de veiligheidshouding van de werknemer wordt onderzocht welk(e) aspect(en) van communicatie een positieve invloed hebben op veiligheidsgedrag en dus ook op de prestatie van de werknemer.

Werknemers van een grote industriële organisatie (*N* = 213) zijn met behulp van een vragenlijst ondervraagd om te bepalen welke van de veiligheidshoudingsitems en welke van de zes communicatieaspecten positief gerelateerd zijn aan veiligheidsgedrag in termen van veiligheidsparticipatie en -naleving. Hiernaast werden demografische gegevens verzameld en vijf open vragen gesteld om de diepere betekenis achter het veiligheidsgedrag te ontdekken. De effecten van de veiligheidshouding items en communicatieaspecten op veiligheidsgedrag werden getest door middel van hypotheses.

Het onderzoek laat zien dat organisatorische integratie en perspectief een significante voorspeller is van veiligheidsparticipatie. Dat media kwaliteit een significante voorspeller is voor veiligheidsnaleving en dat horizontale veiligheidsinformatie zowel veiligheidsparticipatie als –naleving beïnvloedt. Ook hadden de communicatie aspecten een positieve invloed op de veiligheidshouding items die ook deels veiligheidsgedrag beïnvloeden. Door de open vragen werd duidelijk dat ongelukken vooral werden veroorzaakt door valincidenten of beknellingen, vaak met handletsel als gevolg. De respondenten gaven aan dat vooral de media kwaliteit en de relatie met leidinggevenden worden gezien als belangrijke aspecten van veiligheidscommunicatie. Daarnaast werd er gekeken of verschillende groepen verschillende antwoorden gaven. Dit was niet het geval.

Implicaties van het onderzoek voor het verhogen van het veiligheidsgedrag worden besproken, evenals de bijdrage van dit onderzoek aan de praktijk en de wetenschap. Echter, een aantal beperkingen van het huidige onderzoek moet worden overwogen bij het aannemen van de resultaten. Zo is, bijvoorbeeld, het onderzoek gedaan

bij één bedrijf, in één veiligheidsklimaat en in één land en bestond de steekproef voornamelijk uit mannen. Toekomstig onderzoek is nodig om nog meer te weten te komen over de invloed van communicatie op veiligheidsgedrag en om de externe validiteit van de resultaten te verbeteren.

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Summery

Workplace safety is an important focus for a lot of organizations, but despite this focus there are still many industrial accidents. Therefore organizations invest in safety and subsequently in communication plans and resources. That investment is justified by previous research which states that communication is an important factor that influences safety behavior of employees and therefore safety performance. This safety behavior can be divided into safety participation and safety compliance.

Previous research on safety behavior was mainly focused on the investigation of safety climate and its influence on safety behavior of employees. With this communication was one of the safety climate variables that had a positive effect on safety behavior. However, it has not been indicated what specific aspect(s) of communication affect(s) safety behavior. Therefore the following research question was stated: which aspect(s) of communication affect(s) safety behavior of employees?

This study contributes to the research field by distinguishing communication in six aspects: communication climate, organizational integration and perspective, personal feedback, media quality, horizontal and safety communication and relationship to superiors. Along with the attitude of the employee was examined which aspect(s) of communication have an effect on safety behavior and consequently safety performance.

Employees of a large industrial organization (N=213) were surveyed to determine which of the six aspects of communication and the safety attitude items were related to safety behavior in terms of safety participation and safety compliance. Included in the survey were demographic questions and five open ended questions to discover a deeper meaning behind the safety behavior of the employees. The effects of the communication aspects, safety attitude items and safety behavior were tested via a series of hypothesis.

The research shows that organizational integration and perspective emerge as significant predictor of safety participation. Media quality as significant predictor for safety compliance and horizontal safety information influenced both safety participation and safety compliance. Also, the communication aspects have a positive effect on the safety attitude items which partly effect safety behavior. The open ended questions revealed that employees hands were often injured, and falling or crushing were the main courses of accidents. Respondents indicated that especially the communication aspects, media quality and relationship to their superior were seen as important aspects for a positive safety communication. It was also examined whether different groups gave different answers, this was not the case.

Implications of the research to increase safety behavior were discussed as well as the contribution of this

research to practice and science. However, some limitations of the present study should be considered by the interpretation of the results. For example, this study was conducted by only one company in one safety environment and in one country and the sample primarily consisted of men. Future research is needed to investigate more about the impact of communication on safety behavior and to improve the external validity of the results.

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1. Introduction

Each year more than 3.000 people in the Netherlands die because of work related accidents (FNV, 2010). Although safety in the workplace increases, there still is much to be improved with regards to safety in organizations (Arboportaal, 2012a). Besides this human aspect, safety is also a major concern for many organizations because effects direct and indirect cost (Neal and Griffin, 2006). For example, the Ministry of Social Affairs and Employment of the Netherlands estimate that one industrial accident costs an organization an average of € 5000,00 (e.g. loss of production and medical care), and the total society approximately another € 6000,00 (Arboportaal, 2012b).

Most organizations focus on safety regulations, policies and procedures to obtain a safe working environment. This, to keep their employees safe and minimize the costs associated with accidents and injuries. This is achieved by communication plans and resources to influence employees safety behavior. However, many organizations do not know which aspects of communication they have to focus on to reach safety behavior.

A literature review reveals that recently there has been a focus, both academic and practical, on the improvement of safety behavior in the workplace. Researchers focused mainly on general safety climate (Cox and Cheyne, 2000; Fernández-Muñiz et al., 2012; Glendon and Litherland, 2001; Lu and Yang, 2011; Mearns et al., 2003; Thompson et al., 2011; Vredenburgh, 2002; Wu et al., 2008). These studies show positive relations between various dimensions of safety climate with safety behavior and safety performance. A positive safety climate can predict safety behavior of employees, which can be divided in safety participation and safety compliance (Griffin and Neal 2000, Neal et al., 2000).

Communication is seen as one of the dimensions of safety climate which positively relate to safety behavior (Griffin and Neal, 2000; Mearns et all, 2003). Though, the dimension communication is not specifically researched, defined and disaggregated. Therefore this study will research which aspect(s) of communication affect(s) safety behavior. Having good and effective communication about safety regulations and procedures is very important for all organizations to gain safety behavior.

Researchers found that safety attitude plays a central role in safety climate and effect safety behavior. For example, McGovern et al. (2000) found that attitudes towards risk predicted safety compliance behavior. Safety climate depends on the environment but employees attitudes are determined by the environment as well as individual differences. Similarly, Cox and Cheyne (2000) stated that employees differ in their attitude towards safety communication. Considerably less is known about the effect of communication on safety attitude and thus safety behavior.

While previous research has provided evidence for positive associations of communication (Cigularov et al., 2010; Fernández-Muñiz, et al., 2012; Lu and Yang, 2011) and safety attitude (Cox and Cheyne, 2000) with safety behavior, these two factors have not been examined together as predictors of occupational safety. The aim of the present study is to determine which aspects of communication affect safety attitude items and safety behavior in terms of safety participation and safety compliance.

2. Literature review

This chapter firstly reviews the literature on safety climate which has an effect on safety behavior. It then reviews two constructs consisting safety behavior, safety participation and safety compliance.

The dimension communication is defined and distinguished in, communication climate, organizational integration and perspective, personal feedback, media quality, horizontal and safety communication and relationship to superiors. Next to communication, safety attitude is reviewed and they are both connected to safety behavior. Finally safety performance is reviewed.

2.1. Safety climate

Zohar (1980) suggested that the perception of an employee to safety in the workplace is important. Therefore the term safety climate is introduced as a 'summary of molar perceptions that employees share about their work environments' which may affect their behavior (Zohar, 1980, p. 96). Dedobbeleer and Beland (1991, p. 97) defined it later as 'molar perceptions people have of their work settings'. This especially refers to the interest and actions of management in the fields of safety and to employees' own participation in preventing risk in their workplace. In this study we combine these to definitions, so when talking about safety climate it refers to the perceptions of management and to the employees themselves. Besides this definition safety climate is often seen a 'snapshot of the current state of safety' (Mearns and Flin, 1999 p. 5). This snapshot is important if one wants to ensure and regulate the safety in a large industrial organization.

Research from Neal, Griffin and Hart (2000) concludes that the perception of safety climate is influenced by the overall organizational climate. This perception of safety climate influences the safety performances and safety behavior of individual employees through their effect on knowledge, motivation, compliance and participation. It would therefore appear that the two safety behavior components: compliance and participation are results of the safety climate. Safety climate may so affect an individual's safety behavior in the workplace and by that reduce incidents and accidents (Hofmann and Stetzer, 1998; Lu and Yang, 2011; Neal et al., 2000; Niskanen, 1994; Oliver et al., 2002; Zohar, 1980).

The dimensions of safety climate are often discussed because there are so many different dimensions (Mueller et al., 1999 as cited in Kath et al., 2010). Many researchers have examined a variety of safety climate dimensions. The most common dimensions that are important for a positive safety climate include management commitment (Cheyne et al., 1998; Poolman, 2008) and values, management and organizational practices (training/rewards/hiring), communication and employee involvement in workplace health and safety (Fernández-Muiz et al., 2012; Neal et al., 2000; Vredenburgh, 2002). From all these factors communication is a frequently mentioned dimension. In the present study this factor will be researched extensively because it has always been incorporated in the broad scope of being one of the many dimensions of safety climate that influences safety behavior.

2.2. Safety behavior

Safety behavior can be seen as closed and open actions that are adopted by the individual to prevent feared outcomes and maintain a sense of safety. According to Seo (2005) perceived safety climate is the best predictor of unsafe work behavior. Communication is one of the dimensions of safety climate and therefore also a predictor of safety behavior. Especially safety communication is seen by Cigularov et al. (2010) as a factor that has a significant main effect on safety behavior and pain. Safety behavior consist of two types of behavior according to Griffin and Neal (2000) and Neal and Griffin (2006) namely Safety participation and safety compliance.

2.2.1. Safety participation

According to Vroom and Jago (1988) participation refers to "taking part". Such participation can take multiple forms: direct or indirect; formal or informal; performed alone or shared. In the current research safety participation refers to all activities that do not directly influence an individual's personal safety but do contribute to an environment that supports safety. These can be activities like joining voluntary safety activities, helping coworkers with safety-related issues and attending safety meetings (Neal and Griffin, 2006). Safety participation has a great voluntary element that goes beyond the actual 'work role' that an individual has within an organization (Clarke and Ward, 2006). Neal and Griffin (2006) concluded that if employees participate in safety activities this can lead to an increase of safety motivation.

2.2.2. Safety compliance

Compliance can occur when an individual accepts external influence because he or she hopes to achieve a favorable reaction from the other person or group. It is apart from identification and internalization one of the basics of which psychological involvement with an organization can be achieved (Kelman, 1985). The term safety compliance refers to, according to Neal and Griffin (2006, p. 947), 'the core activities that individuals need to carry out to maintain workplace safety'. Examples of these behaviors are complying with standard work procedures and wearing personal safety equipment. The attitude towards compliance with regulations is an ethical issue for most organizations (Lundgren and McMackin, 2009), since for most organizations it is an issue to balance the needs of the organization with those of the employees. Hayes et al. (1998) found that people who perceived their job as safe, complied with safety behaviors at work more frequently than people who perceived their job as less safe. This indicates that safety compliance is important for organizations.

The behavior of employees often differs from the intention, if it comes to safety related issues. It often is not the safety behavior of the worker itself, but the noncompliance of safety procedures and refusal to participate in activities that could improve safety of others. Therefore the noncompliance of safety behavior cannot directly affect the worker but also the surroundings and colleagues (Neal and Griffin, 2006).

2.3. Communication on safety issues

The term communication is seen by several authors as a factor of safety climate that influences safety behavior (Fernández-Muñiz, et al., 2012; Lu and Yang, 2011). In the research of Lu and Yang (2011) the concept of communication is not defined or clearly explained, even though it is considered the most important factor of safety climate influencing safety behavior. Therefore this will be a significant part of this research.

General communication is a way for individuals to enact meaning and change in their environment. This process is forced by the context in which people function (Germonprez and Zigurs, 2009). The focus of this research is the context of work environment. Communication within and outside an organization is called corporate communication. Corporate communication is defined by Cornelissen (2011, p. 5) as 'a management function that offers a framework for the effective coordination of all internal and external communication it has the overall purpose of establishing and maintaining favorable reputations with stakeholder groups upon which the organization is dependent'. Internal communication to employees is therefore an important characteristic of corporate communication.

In the current research about communication we will focus on the satisfaction of communication. Overall, organizational communication received a strong support as a predictor of job satisfaction (Pettit et al., 1997). Crino and White (1981) made a conceptualization of communication satisfaction. They argued that organizational communication satisfaction involves both individual's satisfaction and various aspects of communication that occur in an organization. Therefore in this research we use six variables that are used to measure communication satisfaction (Downs and Hazen, 1977; Rubin et al. 2004) namely: communication climate, organizational integration and perspective, personal feedback, media quality, horizontal and safety information and relationship to superiors.

2.3.1. Communication climate

Communication climate 'includes only communicative phenomena, e.g. judgments concerning such things as the receptivity of management to employees' or the accuracy of information being disseminated in the organization' (Dillard et al., 1986, p.87). Later Guzley (1992) found that communication climate influences the employees' level of commitment to the organization. Furthermore Bartels et al. (2007) found that communication climate has a strong link with employee identification in sub-identities of an organization. Therefore it can be stated that a fit communication climate will influence and encourage the commitment to the organization (especially in sub-identities) and thus safety behavior of employees in a positive way. Accordingly the hypotheses for communication climate are as follows:

H1a   Employees perception of communication climate will be positively related to employees' self-reported safety participation.

H1b   Employees perception of communication climate will be positively related to employees' self-reported safety compliance.

2.3.2. Organizational integration and perspective

The concept of organizational integration and perspective is diversely understood but in this research it is seen as the extent to which various and interdependent components of an organization form a whole (Barki and Pinsonneault, 2005). The term components refers to the different hierarchies and departments and includes business processes and people. This is related to in what extend the organization has its organizational communication in order.

Organizational communication includes information that employees receive about their job and related items (e.g. policies) named organizational integration (Rubin et al., 2004). It also can include information about corporate goals and policies, government actions that affect the employees' organization, changes in the organization and financial status of the organization in other words called, organizational perspective (Downs and Hazen, 1977). This gives employees an idea of the future of the organization.

Downs and Adrian (1997) stated that trust and commitment are used as performance indicators of organizational communication. This is demonstrated by De Ridder (2004) who has identified two goals of organizational communication: the first goal should be to inform the employees about their tasks and about the policy and other issues of the organization and the second goal is to get communication with the aim to create a community spirit within the organization. For employees it is important to make them feel integrated by providing information about organizational integration and perspective to gain a community spirit like safety behavior. Thus:

H2a   Organizational integration and perspective will be positively related to employees' self-reported safety participation.

H2b   Organizational integration and perspective will be positively related to employees' self-reported safety compliance.

2.3.3. Personal feedback

It is important for employees to receive feedback on their performance because conducts resulting in industrial accidents often are no new incidents (Vredenburgh, 2002). Roughton (1993) stated that employees must be recognized for their contribution, this can be done by giving feedback through verbal discussions and charts of behavioral data in safety meetings. When an organization wants to promote a safety climate and safety behavior where employees are aware of risks, they should have an appreciation of the employees' tendency to conceal and distort significant and available information (Pidgeon, 1991). In order to influence this feedback must be provided to the employees. The hypotheses are as follows:

H3a   Personal feedback will be positively related to employees' self-reported safety participation.

H3b   Personal feedback will be positively related to employees' self-reported safety compliance.

2.3.4. Media quality

In an organization internal communication is used to inform employees about safety and thereby influences their safety behavior. This is conducted by several channels for example by rules, regulations, procedures, signs, trainings, meetings, verbal, non- verbal and didactic communications. Putti et al. (1990) found that organizational members' communication satisfaction is associated with the amount of information available to them. So the quantity of information about safety is important for the quality of the media and these effects on the safety behavior of employees. Thus the following hypotheses are proposed:

H4a   Media quality will be positively related to employees' self-reported safety participation.

H4b   Media quality will be positively related to employees' self-reported safety compliance.

2.3.5. Horizontal and safety communication

Besides general corporate communication there is also safety communication. This includes industrial risk communication. This communication involves informing workers about potential safety and health risk in the workplace (Lundgren and McMackin, 2009). According to Laughery (2006), warnings are safety communications They are intended to communicate information about safety issues or problems. In this previous mentioned research there are four perspectives to show the purpose of warnings namely: safer world, provide information, influence behavior, and reminder. Traditionally communication moves vertically in organizations, Simpson (1959) found that horizontal communication (communication between employees) is depending on the degree of mechanization. In the industrial organization of this current research mechanization is an important factor of safety. The hypotheses are as follows:

H5a   Horizontal and safety communication will be positively related to employees' self-reported safety participation.

H5b   Horizontal and safety communication will be positively related to employees' self-reported safety compliance.

2.3.6. Relationship to superiors

According to Vredenburgh (2002), consistent and forthright communication is an essential feature for any strong organization. Good communication leads to trust, which is a fundamental element of strength. It is also essential for understanding the different learning styles and needs of employees (Harris and Marceli, 2010). This strength can be seen as a positive safety climate as this is a result of management showing a committed and non-punitive approach to safety (Edmondson, 1996). These climates should promote a more-open, free flowing exchange about safety related issues. Leaders should be able to communicate expectations and give employees direction to achieve organizational goals (Scott, 2009). This is in line with previous work of Edmonson (2004) who stated that sharing

information is important for reducing failures and starts with the leaders. Thus, rather than using rules and procedures and monitoring these to increase the compliance of the employees, high commitment management can create conditions that encourage employees to identify themselfs with organizational goals and creates an urge to achieve these goals (Whitener, 2001). Upward safety communication is the freedom employees feel in discussing safety issues with their direct supervisors (Kath et al, 2010). This has been linked to improved safety commitment and decreased injuries (Hofmann and Stetzer, 1998). Communication in relationship to superiors is thus important for the safety at work, because it plays an important part in reducing workplace injuries. It is therefore hypothesized that:

H6a   Relationship to superiors will be positively related to employees' self-reported safety participation.

H6b   Relationship to superiors will be positively related to employees' self-reported safety compliance.

2.4. Safety attitude

Employee attitudes with respect to risk and safety, play a central role in relation to safety climate (Cheyne et al, 1998). Mearn and Flin (1999 p. 5) also state that 'safety climate describes perceptions, attitudes and beliefs of the employees and management with respect to risk and safety'. Attitude is defined as 'mental sets which direct an individual response to a stimulus' (Udell, 1965, p. 46). Safety attitude are all the beliefs (thinking, feelings) of an individual against safety. It refers to beliefs about hazards and the importance of safety together with the motivation to act on those beliefs (Pidgion, 1991). Hannaford (1976 as cited in Diaz and Caberera, 1997, p. 644) defines these beliefs as 'a readiness to respond effectively and safely, particularly in tension-producing situations'.

Safety climate refers to the environment of an organization, while safety attitude reflects on both the environment and individual differences. Furthermore is stated that the safety attitude of an employee differ towards safety communication (Cox and Cheyne, 2000). Thus, it is suitable to see whether an employees' safety attitude (individual) influences safety communication (environment).

Many conditions have been developed in which attitudes are essential behavior predictors (e.g. making a safety rule and observing this) (Glendon et al., 2006; McGovern et al., 2000). In this respect is it relevant for this research to explore whether there is a relationship between safety attitudes and safety behavior. Attitudes and behavior have been connected in a variety of theories (Ajzen, 1991; Fishbein and Ajzen, 1975). Safety attitude and safety behavior can be seen in the same context. However these theories are not often applied to the safety context. Diaz and Cabrera (1997) used safety attitude in relation to safety climate and Landeweerd et al. (1990) used it in a research as a 'risk taking tendency' that influences safety behavior.

The safety attitudes of an organization also affect its safety performance. This is shown in actions, policies and procedures (Ostrom et al., 1993). This view is reinforced by Donald and Canter (1994) who found a clear and strong relationship between safety attitude climate and accident performance. Thus it is important for employees to have a positive safety attitude to gain a positive safety behavior. Therefore it is stated that:

H7a   Employees' safety attitude will predict employees' self-reported safety participation.

H7b   Employees' safety attitude will predict employees' self-reported safety compliance.

2.5. Safety performance

When talking about safety in an organization the actual safety performance is interesting because this is how organizations measure their results regarding safety. Safety performance is affected by many dimensions like the organization's beliefs and attitudes, manifested in actions, policies, and procedures (Ostrom et al., 1993). In recent literature, safety performance is measured by Zacharantos et al. (2005) as personal-safety orientation: safety knowledge, safety motivation, safety compliance, and safety initiative and safety incidents: injuries requiring first aid and near misses.

This dimension of safety performance is not measured in this current research, but there are implications that safety behavior has a relation to safety performance (Clarke and Ward, 2006). For instance, there are data showing that rewarding people owing to their safety performance is effective in reducing occupational injuries (Haynes et al. 1982). So we can assume that if safety attitude and communication have a significant relation to safety behavior this also influences the safety performance.

3. Method

To measure the influence of the attitude items and communication aspects on safety behavior (including safety participation and safety compliance) a survey was conducted. In the next chapter the sample, procedure, measurement scales and data analysis are explained.

3.1. Sample

Participants who were approached for this research are employed in the technical department of a large industrial organization that produces steel. They have to deal with safety in a safety climate which includes a safety program with regulations, procedures and communication. Of the 425 approached participants 221 assisted with the research. The overall response rate for the survey was 52%. One participants' data were excluded because the data were not completed enough seriously. Due to incomplete data another seven surveys were excluded; a total of 213 surveys remained. Among the 213 respondents 98% were male (n = 208) and 2% were female (n = 5). The average age was M = 45 years (SD = 12.28) and the average tenure was M = 22 (SD = 14.77) years. The majority of the participants (29%) had a secondary school level 4 education, which is vocationally oriented. Table 1 displays characteristics of work satisfaction and number of safety trainings.

Table 1

Characteristics of work satisfaction and number of safety trainings (*N* = 213).

Characteristics		Frequency	%
Work satisfaction	3-5	10	4,8
grade	6-7,5	95	44,6
	8-10	103	48.3
	Unknown	5	2.3
Number of safety trainings	None	1	0,5
	1-10	129	60,6
	10-20	48	22,5
	20-30	15	7,0
	30 or more	16	7,5
	Unknown	4	1,9

Most participants (73%) are operational employees, 17% are team leaders, 4% are product manager, 4% are product group manager, 1% of the professions is unknown, 0,5% is safety expert and 0,5% is project manager. They work in a variety of product groups including: central workplace (26%), lifting and transport equipment (17%), furnace construction service (17%), hydraulic-, gas and lubricating systems (9%), mounting (9%), electronic service (7%), logistics and distribution systems (7%), multidisciplinary coordination and service (4%), unknown (1%), product support (0,5%), electrical engineering (0,5%) and exchange parts maintenance (0,5%). As visible in Table 2 there are three types of services including: shiftwork: team of 5 employees and team of 2 employees which are divided in different sub groups, dayshift en office shift.

Table 2

Characteristics of type of service (*N* = 213).

Characteristics	Sub –group	Frequency	%
Team of 5	Red	12	
	Green	11	
	Blue	12	
	Yellow	10	
	White	13	
	Total	57	26,8
Team of 2	Team 1	6	
	Team 2	4	
	Unknown	2	
	Total	13	6,1
Dayshift		90	42,3
Office	Normal	34	
	4 x 9 shift	19	
	Total	53	24.9

Table 3 displays characteristics about the respondents regarding accidents mentioned in the first two open ended questions. Accordingly Table 4 gives a summary of all the different descriptions respondents gave about their own accidents (i.e., Did you ever have an industrial accident? If yes, please describe) or witnessed accidents (i.e., Have you ever been a witness of an industrial accident? If yes, please describe).

Most respondents (37%) answered 'always' to the question, when do you comply with the safety rules/procedures? Furthermore 48% gave a description and 15% was unknown. Descriptions consisted for example of 'mostly', 'if possible' or '99% of the time'. To the opposite question: when do you not comply with the safety rules/procedures?, 22% of the respondents answered 'never', 21% had no opinion, 7% answered 'not applicable'

and 50% had a different explanation. These explanations varied from 'at home' to 'when they are clearly nonsense'.

Table 3

Characteristics of accidents (*N*=213).

Characteristic		Frequency	%
Ever had an industrial accident			
	Yes	59	28
	No	154	72
Ever been a witness of an industrial accident			
	Yes	52	24
	No	161	76
Ever had or been a witness of an industrial accident			
	Yes	85	40
	No	128	60

Table 4

Descriptions about accidents.

Had an accidents (*n* = 57)				Witness of an accident (*n* = 48)			
Type of limp affected by an accident	Frequency	Type of accident	Frequency	Type of limp affected by an	Frequency	Type of accident	Frequency
Finger	16	Fallen	5	Finger	12	Crushing	11
Hand	6	Crushing	5	Hand	6	Fallen	5
Head	6	Car	2	Leg	6	Deadly	5
Eye	5	Burnt	2	Foot	5	Car	3
Foot	5	Grind	1	Arm	3	Under voltage	2
Arm	4	Gas inhalation	1	Chest	2	Burnt	1
Legg	3	Fractures	1	Hip	1	Grind	1
Wrist	2	Bruises	1			Cuts	1
Shoulder	2						
Knee	1						

3.2. Procedure

Participants were asked to complete a paper-and-pencil survey. All participants were informed about the research by the general manager and participated during working hours. All participants were assured confidentiality. One hundred and eleven surveys were personally conducted by the researcher. One hundred and ten surveys were handed out by the researcher to the direct superior of the participants. Afterwards they were collected by the researcher. To ensure confidentiality the participants could place the surveys in an envelope.

3.3. Instrument

The survey consisted of statements that measured nine different variables (seven independent and two dependent) and demographic variables. The participants used a 5-point Likert scale to report whether or not they agreed to the statements ranging from '1= strongly disagree to 5 strongly agree'. All of the items used in the scales are formed to the first person.

A jury of experts (*N* = 3) reviewed the preliminary instrument to maximize the content validity (DeVellis, 2012). Included were two faculty members and one safety communication expert. Besides this a pre-test was done by employees (*N* = 3) of a similar industrial organization. Several items were further refined for clarity and conciseness. All measurement items were randomly ordered in the survey and are provided in Appendix A.

Independent variables:

3.3.1. Communication

Communication was measured using six constructs that are drawn from the Communication Satisfaction Questionnaire (CSQ) created by Downs and Hazen (1977). Also four items of Zwijze-Koning and de Jong (2007) and four self-created items were added. The six constructs are:

1. Communication climate: Measures safety communication at both organizational and individual level with four items. These items assess whether or not the company's communication is stimulating or motivating, whether it encourages employee identification and the extent to which the information flow assist the working process (e.g. I receive communication about safety on time). After analyzing the reliability, the scale was reduced to three items. The Coefficient alpha for this construct was estimated at 0.70 which is acceptable. A higher score indicates a more positive communication climate.

2. Organizational integration and perspective: This construct consists of two combined constructs from the CSQ and is measured by two items. They refer to the information given by the organization concerning the organizational and departmental policies and goals (e.g. I am fully informed about the future plans of my department). The results showed that the two-item scale demonstrated good internal consistency (α = .85).

3. Personal feedback: The six items in this construct consist of questions about the supervisors' understanding and knowledge of problems regarding to safety (e.g. My team leader is aware of the safety problems we may have). They also examine if the criteria by which the employees are judged are correctly understood. The results show that the six -item scale demonstrated questionable internal consistency (α = .66) (George and Mallery, 2003).

4. Media quality: Measured by eight items to show how safety information is dealt with through several channels (e.g. safety meetings and signs). Participants were asked about the quantity, usefulness and clarity of this information (e.g. Safety rules and procedures are clear and consistent). One of the items has been removed to get a better internal consistency, the seven -item scale still demonstrated a questionable internal consistency (α = .65).

4. Horizontal and safety communication: Contains ten items about the seriousness of employees regarding safety and the amount of activity and accuracy of safety communication between employees (e.g. We often talk about safety). Following reliability analysis, the scale is reduced to nine items. The nine items show a Coefficient alpha of 0.74 which is acceptable.

5. Relationship to superiors: This construct measures the upward and downward communication. Subjects of the seven items are trust, assisting, attention, openness and ability to listen to the superior's employees (e.g. My supervisor gives me enough attention). The results show that the seven -item scale demonstrated acceptable internal consistency (α = .74).

The construct 'relationship with subordinates' from the CSQ is removed because in this research the participants are subordinates (production workers). The items are adapted to the circumstances of the research design, which means that they are simplified and converted to safety.

3.3.2. Safety attitude

Safety attitude was measured with six individual items. These include four self-created items about feelings and thoughts about safety (e.g. I have a positive feeling about safety) and two items originating from Diaz and Caberera (1997) (e.g. Working with a form of risk is exiting). Mixtures of positively and negatively voiced items were presented as recommended in the measurement literature (Pedhazur and Schmelkin, 1991).

Dependent variables.

3.3.3. Safety participation

Safety participation was measured using a three items scale which was drawn from Lu and Yang, 2011 study (e.g. I actively participate in setting safety goals.) To optimize the scale three items of Neal and Griffin (2006) were added. The results show that this six-items scale demonstrated good internal consistency ($\alpha = 0.78$).

3.3.4. Safety compliance

Safety compliance was measured using a four items scale which was drawn from Lu and Yang, 2011 study (e.g. I maintain safety awareness at work.) One of these items is divided in two items. Also two items originating from Neal and Griffin's (2006) study (e.g. I use all the necessary safety equipment to do my job) are added. Reliability analysis show that this seven-item scale demonstrated good internal consistency ($\alpha = 0.78$).

3.3.5. Demographic factors

To collect personal information about the respondents the following 10 items are included: gender, year of birth, tenure, number of safety trainings, work satisfaction, product group, team , service, level of education and five open ended items. The open items are about experiences with accidents, compliance with the rules and procedures and giving suggestions. All the data are analyzed by categorizing the answers in yes, unknown and no. Whereby it was assumed that unknown, was no. At the questions answered with yes, some gave descriptions. Using a qualitative method of content analysis, text segments of these descriptions referencing distinct type or themes of accidents were tagged by code names. These codes were not preconceived, but empirical: each new code marked a separate type not a previously raised type or theme. Codes similar in nature were grouped together to define themes. This data were analyzed by a second coder to ensure reliability.

3.4. Data analysis

The data are coded and analyzed by Statistical Package for Social Science (SPSS 20). Descriptive statistics and correlations are given. Means between groups are compared by a one-way between subjects ANOVA and an independent samples t test. To test the hypothesis multiple linear regression analysis is used. The coefficients of the linear equation are estimated, involving seven independent variables that best predict the value of the dependent variables safety participation and safety compliance (safety behavior).

4. Results

4.1. Descriptive statistics and comparison between means.

A correlation analysis is preformed to examine the relationships between the various variables. The results are shown in Table 5. In general, there were significant correlations among nearly all variables. Remarkably the only significant correlation between safety attitude item five and all the other safety attitude items was between A5 and A6 (r =.25; p <.001) and at the communication scales between A5 and OIP (r =.18; p <.001).

A one-way between subjects ANOVA was conducted to compare the effect of the type of service the respondents work in with safety participation in dayshift (n = 90), office (n = 53) and team (n = 70) conditions. With p set at <.05, the results failed to reveal a statistically difference of the type of service regarding safety participation for the three conditions (F(2,210) = .18, p = .84). This was also done for the effect of the type of service the respondents work in on safety compliance. There also was no significant effect of the type of service found for safety compliance at the p<.05 level for the three service conditions (F(2,210) = .15, p = .86). This implies that the type of service the respondents work in has no effect on both safety participation and safety compliance.

To compare whether respondents who had an accident and/or had witnessed an accident (n = 85) responded differently from respondents who neither had an accident or had not been a witness to an accident (n =128) an independent samples t-test was conducted. There was no significant difference in the scores for having had an accident and/or had been witness to an accident (M = 3.59, SD = .59) or not (M = 3.63, SD = .51) conditions; t(211) = -.51, p = .61 regarding safety participation. There also was no significant difference in the scores for having had an accident and/or having witnessed an accident (M = 3.75, SD = .50) or not (M = 3.82, SD = .49) conditions; t(211) = -.98, p = .33 regarding safety compliance. These results suggest that having an accident and/or being a witness to an accident or not, has no effect on either safety participation or safety compliance. However if the means are compared separately for all variables, differences are found (see Table 6), but they are not significant differences.

Table 5

Correlations of all variables (*N* = 213).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SP	-												
2. SC	.561**	-											
3. A1	.328**	.255**	-										
4. A2	.328**	.405**	.263**	-									
5. A3	.199**	.357**	.149**	.252**	-								
6. A4	.485**	.450**	.253**	.372**	.196**	-							
7. A5	.225**	.335**	-.031	.107	.320**	.121	-						
8. A6	.253**	.259**	.140*	.168*	.220**	.187**	.247**	-					
9. CC	.357**	.438**	.388**	.201**	.230**	.343**	.134	.171*	-				
10. OIP	.387**	.340**	.191**	.171*	.107	.283**	.184**	.100	.330**	-			
11. PF	.256**	.276**	.333**	.143*	.107	.226**	.093	.189**	.276**	.423**	-		
12. MQ	.249**	.414**	.287**	.126	.199**	.092	.086	.079	.469**	.248**	.410**	-	
13. HS	.409**	.424**	.371**	.394**	.182**	.325**	.105	.233**	.312**	.282**	.368**	.279**	-
14. RS	.224**	.300**	.292**	.152*	.059	.183**	.101	.210**	.354**	.290**	.682**	.315**	.367**

Note: SP = Safety Participation, SC = Safety Compliance, A = safety Attitude (following the number of the question), CC = Communication Climate, OIP = Organization Integration and Perspective, PF = Personal Feedback, MQ = Media Quality, HS = Horizontal and Safety communication, RS = Relationship to Superiors.

* *p* < .05, two-tailed.

** *p* <.01, two-tailed.

Table 6

Descriptive statistics and independent samples *t*-test results comparing having had an accident and/or had been witness to an accident, or not.

Variable	Yes accident and/or witness		No accident and no witness		t	Sig. (P)	Total	
	(*N* = 85)		(*N* = 128)				(*N* = 213)	
	M	SD	M	SD			M	SD
SP	3.59	0.59	3.63	0.51	-0.51	0.61	3.62	0.54
SC	3.75	0.50	3.82	0.49	-0.98	0.33	3.79	0.49
A1	3.83	0.65	3.87	0.59			3.86	0.61
A2	4.28	0.55	4.23	0.49			4.25	0.51
A3	3.92	0.95	3.82	0.97			3.86	0.97
A4	3.82	0.76	3.89	0.65			3.86	0.70
A5	3.10	1.14	3.29	1.13			3.22	1.14
A6	3.93	0.95	3.87	0.99			3.89	0.97
CC	3.55	0.63	3.59	0.54			3.58	0.57
OIP	2.64	0.76	2.69	0.94			2.67	0.87
PF	3.72	0.44	3.78	0.42			3.76	0.43
MQ	3.57	0.40	3.60	0.42			3.59	0.41
HS	3.78	0.34	3.84	0.38			3.82	0.37
RS	3.75	0.44	3.86	0.41			3.82	0.43

Note: SP = Safety Participation, SC = Safety Compliance, A = safety Attitude (following the number of the question), CC = Communication Climate, OIP = Organization Integration and Perspective, PF = Personal Feedback, MQ = Media Quality, HS = Horizontal and Safety communication, RS = Relationship to Superiors.

* *p* < .05, two-tailed.

** *p* <.01, two-tailed.

4.2. Predicting safety participation

Multiple regression analysis were conducted to examine the proportion of variance explained by each of the communication scales (*n* = 6) and safety attitude items (*n* = 6) to determine which may be the most useful aspect in predicting safety behavior in terms of safety participation. The analysis was conducted in two stages. In the first stage the individual safety attitude items were entered in the first block into the regression on safety participation and safety compliance. Secondly all individual safety attitude items and all communication scales (communication climate, organizational integration and perspective, personal feedback, media quality, horizontal and safety information and relationships to superiors) were entered into the second block into the regression on safety participation. Table 7 summarizes the results.

The results of the first block regression indicated that the six safety attitude items explained 31% of the variance of safety participation. Safety attitude item 1 (β = .20, *p* = .001), safety attitude item 4 (β = .36, *p* = .000) and safety attitude item 5 (β = .15, *p* = .016) significantly predicted safety participation.

In the second regression block the communication scales were added to the regression of the attitude items. The results indicate that the independent variables explain approximately 37% of the variance of safety participation. Of all safety attitude items only item 4 (β = .23, *p* = .000) significantly contributed to safety

participation and it supports Hypothesis 7a partly. Organizational integration and perspective (β = 0.19, p = .003) and horizontal and safety communication (β = 0.15, p = .027) were the communication scales that significantly predicted safety participation which supports Hypotheses 2a and 5a. Contrary to expectations, Hypotheses 1a, 3a, 4a and 6a are not supported.

Table 7

Multiple regression analysis predicting safety participation with safety attitude items and communication scales (*N*=213).

Variable	B	SE(B)	β	T	Sig. (P)	Variable	B	SE(B)	β	t	Sig. (P)
Block 1						**Block 2**					
A1	0.175	0.053	0.199	3.288	0.001*	**A1**	0.107	0.057	0122	1.892	0.060
A2	0.114	0.067	0.109	1.712	0.088	**A2**	0.065	0.066	0.062	0.986	0.326
A3	0.001	0.035	0.002	0.024	0.981	**A3**	-0.009	0.034	-0.015	-2.252	0.801
A4	0.276	0.049	0.357	5.673	0.000*	**A4**	0.228	0.050	0.295	4.587	0.000*
A5	0.071	0.029	0.150	2.441	0.016*	**A5**	0.053	0.029	0.111	1.850	0.066
A6	0.057	0.034	0.103	1.705	0.090	**A6**	0.052	0.033	0.093	1.579	0.116
						CC	0.037	0.067	0.039	0.549	0.584
						OIP	0.121	0.040	0.195	3.050	0.003*
						PF	-0.073	0.106	-0.058	-0.694	0.489
						MQ	0.112	0.088	0.086	1.274	0.204
						HS	0.219	0.098	0.149	2.225	0.027*
						RS	-0.022	0.100	-0.017	-0.217	0.828
Adjusted R²	0.31						0.37				
R²	0.33						0.40				
F	17.25**						11.21**				
ΔR²							0.68				
ΔF							3.78				

Note: A = Safety attitude (following the number of the question), CC = Communication Climate, OIP = Organization Integration and Perspective,

PF = Personal Feedback, MQ = Media Quality, HS = Horizontal and safety communication, RS = Relationship to Superiors.

* *p* < .05

** *p* < .0001

4.3. Predicting safety compliance

Multiple regression analyses were also conducted to examine the proportion of variance explained by each of the communication scales (n = 6) and safety attitude items (n = 6) to determine which may be most useful in predicting safety behavior in terms of safety compliance. This regression was conducted in two stages. In the first stage the individual safety attitude items were entered in the first block into the regression on safety compliance. In the second stage all individual safety attitude items and all communication scales (communication climate, organizational integration and perspective, personal feedback, media quality, horizontal and safety information and relationships to superiors) were entered into the second block into the regression on safety compliance. The results regarding the effect of individual safety attitude items and communication scales on safety compliance appear in Table 8.

The results of the first block regression indicated that the six safety attitude items explained 36% of the variance in safety compliance. The second (β = 0.20, p = .001), third (β = 0.15, p = .013), fourth (β = 0.28, p = .000) and fifth (β = 0.22, p = .000) safety attitude items have a significant effect on safety compliance. So, four of the six safety attitude items were significant. However two of the safety attitude items were not significant. Therefore Hypothesis 7b is partly supported.

Approximately 47% of the variation in safety compliance can be explained by all the independent variables. The same safety attitude items as in block 1 predict safety behavior in terms of safety compliance. Namely safety attitude item two (β = 0.15, p = 0.008), safety attitude item three (β = 0.11, p = .050), safety attitude item four (β = 0.23, p = .000) and safety attitude item five (β = 0.18, p = .001). The communication scales media quality (β = 0.22, p = .000) and horizontal and safety communication (β = 0.12, p = .042) are positively related to safety compliance, which supports Hypothesis 4b and 5b. In addition Hypothesis 1b, 2b, 3b and 6b are not supported.

Table 8

Multiple regression analysis predicting safety compliance with safety attitude items and communication scales (*N*=213).
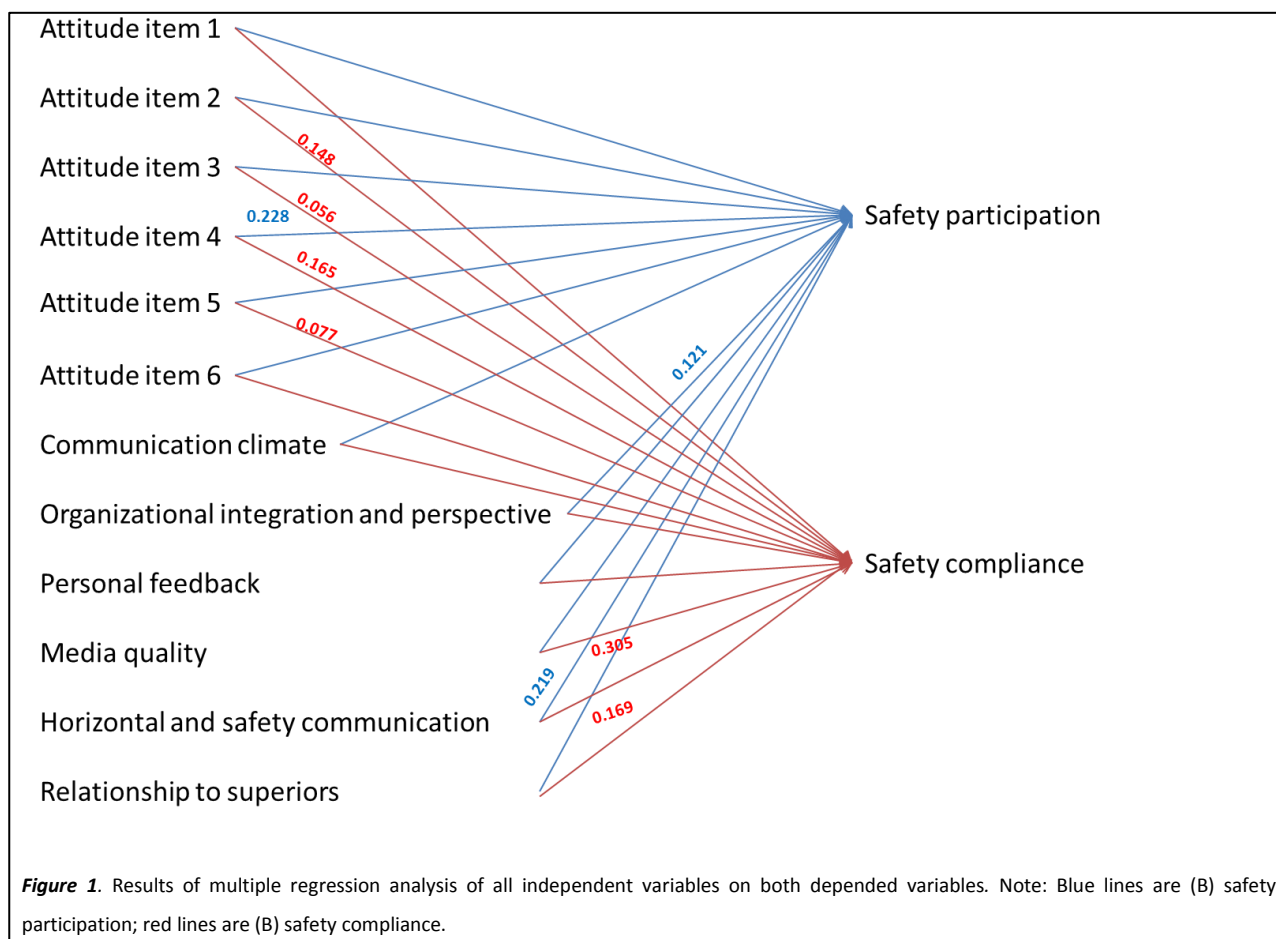
Variable	B	SE(B)	β	T	Sig. (P)	Variable	B	SE(B)	β	T
Block 1						**Block 2**				
A1	0.085	0.047	0.106	1.804	0.073	**A1**	-0.021	0.047	-0.026	-0.449	0.654
A2	0.190	0.059	0.199	3.243	0.001*	**A2**	0.148	0.055	0.155	2.678	0.008*
A3	0.077	0.031	0.151	2.496	0.013*	**A3**	0.056	0.029	0.110	1.968	0.050*
A4	0.198	0.043	0.280	4.614	0.000*	**A4**	0.165	0.042	0.233	3.967	0.000*
A5	0.094	0.026	0.217	3.651	0.000*	**A5**	0.077	0.024	0.178	3.243	0.001*
A6	0.036	0.030	0.072	1.230	0.220	**A6**	0.026	0.027	0.052	0.961	0.338
						CC	0.074	0.056	0.085	1.311	0.191
						OIP	0.053	0.033	0.094	1.606	0.110
						PF	-0.123	0.088	-0.107	-1.392	0.165
						MQ	0.305	0.074	0.225	4.147	0.000*
						HS	0.169	0.082	0.126	2.051	0.042*
						RS	0.110	0.083	0.095	1.327	0.186
Adjusted R²	0.36						0.47			
R²	0.38						0.50			
F	20.95**						16.72**			
ΔR²							0.12			
F²							8.14			

Note: A = Safety attitude (following the number of the question), CC = Communication Climate, OIP = Organization Integration and Perspective, PF = Personal Feedback, MQ = Media Quality, HS = Horizontal and safety communication, RS = Relationship to Superiors.

* $p < .05$

** $p < .0001$

Figure 1 shows the model of this research, showing a regression equation (B) of all the significant relations between the independent variables and both dependent variables.

Figure 1. Results of multiple regression analysis of all independent variables on both depended variables. Note: Blue lines are (B) safety participation; red lines are (B) safety compliance.

4.4. Open ended question

The final open ended question asking the respondents to give general suggestions on safety communication was analyzed by coding the answers into categories and frequency. Firstly, the most cited answer was 'too much' (mentioned ten times). This refers to the communication aspect media quality regarding quantity of media. Secondly, 'more communication between employees and higher management' was mentioned nine times, this refers to the communication aspect relationship to superiors. Finally, respondents replied with: 'keep it simple' (mentioned five times) and 'give a mature approach to safety' (mentioned four times).

Most notable were remarks like: 'make pictures to give an image of unsafe situations. They say more than words', 'give feedback of reported unsafe situations', 'encourage employees to actively participate in making new rules'. These were remarkable because the respondents gave extensive explanations to the data collector. Respondents also wrote down (extensive) their reasons extensively .

5. Discussion

In the current study is examined which aspect(s) of communication (communication climate, organizational integration and perspective, personal feedback, media quality, horizontal and safety communication and relationship to superiors) and safety attitude items affect(s) safety behavior in terms of safety participation and safety compliance. In addition, explored is whether the communication aspects have an influence on safety attitude. Based on literature, hypotheses were tested to see whether there is a positive relationship between the safety attitude items and communication aspects regarding safety participation and safety compliance.

The research shows that safety participation is positively related to organizational integration and perspective. In other words, this means that employees need information about organizational goals and policies in order to contribute to an environment that supports safety. It is not surprising that organizational integration and perspective is not positively related to safety compliance because of the 'community spirit' (De Ridder, 2004) that needs to arise in an organization, instead by an activity of an individual that needs to be performed (Neal and Griffin, 2006) to achieve safety behavior.

In addition, the communication aspect media quality is positively related to employees' self-reported safety behavior in terms of safety compliance. Thus, if the media quality is high, employees will be provided with more individual activities to support workplace safety. This will have a positive effect on the whole organization and can lead to a better safety performance. However, there is no significant relation found between media quality and safety participation. This indicates that media quality is more important for the individual safety behavior (safety compliance) than for group safety behavior (safety participation).

Horizontal and safety communication is the only communication aspect that has a positive influence on both safety participation and safety compliance. This is consistent with the conclusions of Edmonson (1999) who found that learning behavior mediates between team psychological safety and team performance. Which is suggesting that it is important for employees to create structures and beliefs within a team to gain a positive safety behavior. These results could also indicate that interpersonal communication is important. Because safety communication include messages that initiates, define or maintain a relationship between two or more employees where content and quality is important by gaining safety behavior (Dainton and Zelley, 2005).

Contrary to the hypothesis, the communication aspect relationship to superiors is not positively related to safety behavior. This result fails to replicate findings of several researchers (Cigularov et al., 2010, Thompson, 1998) who did find such an effect. One of the reasons for the different results could be that different variables are used to measure relationship to superiors. This could also be the case for the communication aspects: communication climate and personal feedback.

Both hypotheses about safety attitude were partly supported, suggesting that safety attitude is positively related to safety participation and safety compliance. In fact, multiple regression analyses indicated that the aspects of communication have a positive influence on the safety attitude items by explaining safety participation and safety compliance with an R^2 increase and ΔR^2. This could be an indication that individual differences (like

safety attitude) can be influenced by communication.

From the correlation analysis between all variables is notable that the highest correlation found between all the constructs is between safety participation and safety compliance. This indicates that safety participation is associated with safety compliance. However, the sequence of these variables has not been considered. It could be that safety compliance is a condition for safety participation or the other way around.

Unexpectedly, the results of the comparison between groups indicate that there are no differences between groups. Mearns et al. (2003) stated that communication is related to accident proportion, suggesting that having and/or witnessing an accident will affect the results. However, in the current study it appears that neither the type of services employees work in, nor the fact whether they experienced an accident and/or witnessed an accident, or not, has an effect on the results.

Furthermore with regards to the open ended questions, most of the respondents gave equal answers. These could be expected answers. Regarding the final question 'could you give general suggestions on the communication of safety?' respondents often referred to the communication aspects: media quality and relationship to superiors. This shows that the quantity and quality of the media should be adjusted and a more open and free relationship between workplace and leaders is needed.

Overall, this study has several strengths. One of the strengths of this study is that the survey is held in a large industrial organization and had a good response rate which led to a relatively large sample size. The data was collected in a way that enhanced the response rate. First of all, participants were offered to complete the survey during working hours, which meant they were paid to fill in the survey. Secondly the participants were ensured anonymity. Because the data collector was not employed by the organization and female (in a 'male organization') this could have a positive effect on the quality and quantity of the response. This study provides a unique insight into a large industrial organizations safety climate, including safety attitude, communication and safety behavior. The design of this study provides a unique opportunity to predict relationships between communication aspects and safety behavior.

5.1. Practical implications

The key findings of this study suggest several practical implications. The study provides evidence that the communication aspect horizontal and safety information are the most useful aspects in predicting safety behavior. Therefore, organizations are encouraged to invest in their communication on horizontal and safety information; this includes encouraging employees to talk about safety mutually and to communicate informally. For employees it is important to share their opinions about safety in order to create a positive safety climate also called 'communication openness' as stated in Thompson et al. (2011). In medical research the importance of communication and openness has earlier been documented (Nieva and Sorra, 2003). Using this type of communication can create a safe atmosphere, where employees feel they can speak freely if they have any safety concerns or issues at work.

In addition, organizations should be conscious to communicate about their organizational integration and perspective, through providing the employees efficient information about the organizational and departmental policies and goals regarding the future. This could lead to better safety participation. Also, organizations need to ensure that media quality is monitored and guaranteed. They should pay attention to the quantity and clarity of safety information that travels through several channels. This needs to be a high priority to gain safety compliance among the employees. As stated in Luria and Yagil (2010), safety messages should be adapted to the specific group or categorization of employees in the organization. For example, safety trainings can be associated with the organization; alerting employees on safety measures may be on group level; and giving safety warnings can be on individual level.

For this specific organization (Tata Steel Ijmuiden) it can be suggested to pay extra attention to people who experienced an accident, with specific focus on aftercare. The results of the open ended questions indicated that those respondents who experienced or witnessed an accident gave an extra extensive description; this can suggest that if employees experience an accident they want to share their story. Reporting near accidents is also important to decrease accidents. The focus of safety measures should be on hands, falling and crushing accidents because they are the most frequently mentioned type of accidents in this specific organization.

5.2. Limitations of the study and directions for future research

There are several limitations that need to be considered when interpreting the results. This also gives a number of areas which are open to further investigation. First, this study was executed in one organization with one safety climate in one country, which may limit the generalizability of the results found. Henning et al. (2009) demonstrated that either safety attitudes, communication or safety behavior can be influenced by environment and individual differences. Although the differences between groups are examined, and no differences were found, these environmental and individual differences are important to keep in mind.

Second, the current research focused on the use of the communication satisfaction questionnaire (Downs and Hazen, 1977) for identifying six aspects of communication. Although three of the communication aspects are found to significantly influence safety behavior, communication is a diverse construct. Future studies are needed to investigate more aspects of communication that could affect safety behavior. These could be aspects such as communication and support (Glendon and Litherland, 2001) or new communication media (Zwijze-Koning and de Jong, 2007). Accordingly, the positive relation of horizontal and safety communication with both safety participation and safety compliance could suggest that it would be relevant to see if there are connections between interpersonal communication and safety behavior. This could be researched in terms of system perspective, politeness theory, social exchange theory or dialectical perspective (Daiton and Zelley, 2005).

Third, the safety attitude items of the current study could not be integrated into one variable (safety attitude), because there was no internal consistency found between these items. Therefore it is recommended that the items on safety attitude are further investigated and refined.

Fourth, with respect to the sample, the sample used in this study included 97% males. However, females can have different attitudes and opinions about work (Martin and Kirkaldy, 1998) and this could lead to different results. Furthermore the sample also included product managers who were highly motivated and experienced, these are factors that may have influenced the findings. In addition, the collected data include self-reported safety behavior and perceptions of safety attitudes. These may have been subjected to bias in terms of giving the expected answers.

Fifth, results of the open ended questions gave directions to the communication aspects media quality and relationship to superiors. Such findings suggest that future studies should therefore be more of a qualitative nature. This could help to identify communication aspects that are important for a positive safety behavior.

Sixth, as stated in the theoretical review of safety performance, there are implications that safety behavior has a relation to safety performance (Haynes et al. 1982). Therefore it is recommend to perform a research between communication aspects, safety behavior and safety performance.

Finally the findings of this study are reflecting the situation of attitude, communication and safety behavior at a specific moment in time, therefore causal relationships cannot be investigated. It is recommended to use a longitudinal research to investigate the differences between several moments and short- term and long term effects of communication and safety attitude on safety behavior in industrial organizations.

6. Conclusion

Workplace accidents have direct and indirect costs for many organizations. Although workplace safety can be improved by creating a positive safety climate. Communication is seen as one of the dimensions that influences a safety climate. This research indicates that specific aspects of communication are useful in predicting safety behavior in terms of safety participation and safety compliance. More specifically, the communication aspect organizational integration and perspective emerge as significant predictor of safety participation. Media quality is seen as a significant predictor for safety compliance. Horizontal safety communication influences both, safety participation and safety compliance. Additionally, an employee's individuals safety attitude, partly predicts safety behavior and is influenced by communication.

Furthermore, the overall findings suggest that investing in organizational integration and perspective, media quality and especially horizontal and safety information communication will lead to better safety behavior and safety performance which means a reduction of accidents and injuries in the workplace. The findings of this research should stimulate additional research to investigate the relation between communication and safety behavior more extensively.

Appendix A: Measures used in research

Communication climate.

Original questions

Question 1: Extent to which the organization communication motivates and stimulates an enthusiasm for meeting its goals. (Downs and Hazen, 1977)

Question 2: Extent to which the organization's communication makes me identify with it or feel a vital part of it. (Downs and Hazen, 1977)

Question 3: Extent to which I receive in time the information needed to do my job. (Downs and Hazen, 1977)

Question 4: Extent to which the organization's communications are interesting and helpful. (Downs and Hazen, 1977)

Adjusted questions.

Question 1: Due to the way Tata Steel communicates about safety, I feel at home.

Question 2: I feel identified with the safety communications of the organization.

Question 3: I receive communication about safety on time.

Question 4: The safety communications of the organization are interesting and helpful.

Translation (Dutch).

Question 1: Door de manier waarop Tata Steel over veiligheid communiceert voel ik me thuis.

Question 2: Ik vind de veiligheidscommunicatie van Tata Steel interessant.

Question 3: Ik krijg de veiligheidscommunicatie op tijd.

Question 4: Ik vind de veiligheidscommunicatie van Tata Steel nuttig.

Organizational integration and perspective.

Original questions

Question 1: Information about organizational policies and goals. (Downs and Hazen, 1977)

Question 2: Information about departmental policies and goals. (Downs and Hazen, 1977)

Adjusted questions

Question 1: I am fully informed about the future plans of Tata Steel.

Question 2: I am fully informed about the future plans of my department.

Translation (Dutch)

Question 1: Ik ben volledig op de hoogte van de toekomstplannen van Tata Steel.

Question 2: Ik ben volledig op de hoogte van de toekomstplannen van de HTD.

Personal feedback

Original questions

Question 1: Extent to which my superiors know and understand the problems faced by subordinates. (Downs and Hazen, 1977)

Question 2: Information about how I'm being judged. (Downs and Hazen, 1977)

Question 3: Recognition of my efforts. (Downs and Hazen, 1977)

Question 4: Reports on how problems in my job are being handled. (Downs and Hazen, 1977)

Question 5: Extent to which my superiors know and understand the problems faced by subordinates. (Downs and Hazen, 1977)

Question 6: Extent to which my superiors know and understand the problems faced by subordinates. (Downs and Hazen, 1977)

Adjusted questions.

Question 1: My team leader is aware of the safety problems we may have.

Question 2: It is clear how I am judged.

Question 3: I get enough appreciation on my work.

Question 4: I know how Tata Steel handles security issues.

Question 5: If we report a safety problem the team leader understands this problem well.

Question 6: My team leader does not understand the safety problems. (negative)

Translation (Dutch).

Question 1: Mijn teamleider is op de hoogte van de mogelijke veiligheidsissues die wij hebben.

Question 2: Het is duidelijk hoe ik word beoordeeld.

Question 3: Ik krijg genoeg waardering op mijn werk.

Question 4: Ik weet hoe Tata Steel omgaat met veiligheidsissues.

Question 5: Als wij een veiligheidsissue melden begrijpt de teamleider dit probleem goed.

Question 6: Mijn teamleider begrijpt de veiligheidsproblemen niet. (negatief)

Horizontal and safety communication.

Original questions

Question 1: Extent to which informal communication is active and accurate. (Downs and Hazen, 1977)

Question 2: Extent to which horizontal communication with other organizational members is accurate and free flowing. (Downs and Hazen, 1977)

Question 3: Extent to which my work group is compatible. (Downs and Hazen, 1977)

Question 4:There is a good atmosphere between colleagues in my unit. (Zwijze-Koning and de Jong, 2007)

Question 5: My colleagues offers me support. (Zwijze-Koning and de Jong, 2007)

Question 6: Extent to which horizontal communication with other organizational members is accurate and free flowing. (Downs and Hazen, 1977)

Question 7: Extent to which horizontal communication with other organizational members is accurate and free flowing. (Downs and Hazen, 1977)

Question 8: self-created

Question 9: self-created

Question 10: self-created

Adjusted questions.

Question 1: I can discuss safety issues with my colleagues.

Question 2: We often talk about safety.

Question 3: My group works well together towards safety.

Question 4: There is a good atmosphere between the colleagues in my group.

Question 5: My colleagues support me.

Question 6: The information that colleagues share about safety is accurate.

Question 7: It is easy to talk about safety.

Question 8: We think the talk about safety is excessive. (negative)

Question 9: Safety is a serious subject for us.

Question 10: A joke about safety should be fine.

Translation (Dutch).

Question 1: Ik kan veiligheidszaken bespreken met mijn collega's

Question 2: We praten vaak over veiligheid.

Question 3: Mijn groep werkt goed samen ten opzichte van veiligheid.

Question 4: Er is een goede sfeer tussen de collega's in mijn groep.

Question 5: Mijn collega's steunen mij.

Question 6: De informatie die collega's delen over veiligheid is nauwkeurig.

Question 7: Het is gemakkelijk om over veiligheid te praten.

Question 8: Wij vinden het gepraat over veiligheid overdreven. (negatief)

Question 9: Veiligheid is een serieus onderwerp voor ons.

Question 10: Een grap over veiligheid moet kunnen.

Media quality.

Original questions

Question 1: Extent to which the amount of communication in the organization is about right.

(Downs and Hazen, 1977).

Question 2: Extent to which the amount of communication in the organization is about right.

(Downs and Hazen, 1977).

Question 3: Extent to which conflicts are handled appropriately through proper communication channels.

(Downs and Hazen, 1977)

Question 4: Extent to which our meetings are well organized. (Downs and Hazen, 1977)

Question 5: Extent to which written directives and reports are clear and concise. (Downs and Hazen, 1977)

Question 6: Communication by means of email works well within this organization.

(Zwijze-Koning and de Jong, 2007)

Question 7: Extent to which communication practices are adaptable to emergencies. (Downs and Hazen, 1977)

Question 8: self-created.

Adjusted questions.

Question 1: We get an overload of communication about safety.

Question:2: There is too limited communication about safety. (negative)

Question 3: The communication about safety travels through the appropriate channels of communication.

Question 4: Safety meetings are well organized.

Question 5: Safety rules and protocols are clear and consistent.

Question 6: Safety communication by means of signs works well within this organization

Question 7: The safety rules and protocols are useful in emergencies.

Question 8: I get the safety communication in the right way.

Translation (Dutch).

Question 1: Er word overdreven veel gecommuniceerd over veiligheid.

Question 2: Er word te weinig gecommuniceerd over veiligheid. (negatief)

Question 3: De communicatie over veiligheid gaat via de juiste communicatiekanalen.

Question 4: Veiligheidsbijeenkomsten zijn goed georganiseerd.

Question 5: Veiligheidsregels en veiligheidsprotocollen zijn duidelijk en consistent.

Question 6: Binnen de veiligheidscommunicatie, werken waarschuwingsborden goed.

Question 7: De veiligheidsregels en protocollen zijn bruikbaar in noodgevallen.

Question 8: Ik krijg de veiligheidscommunicatie op de goede manier.

Relationship to superiors.

Original questions

Question 1: Extent to which my supervisor offers guidance for solving job related problems.
(Downs and Hazen, 1977)

Question 2: Extent to which my supervisor trusts me. (Downs and Hazen, 1977)

Question 3: Extent to which my superior listens an pays attention to me. (Downs and Hazen, 1977)

Question 4: Extent to which my superior listens an pays attention to me. (Downs and Hazen, 1977)

Question 5: Extent to which my superior is open to ideas. (Downs and Hazen, 1977)

Question 6: When I need to ask my supervisor something, I can always reach him/her. (Zwijze-Koning and de Jong, 2007)

Question 7: self-created.

Adjusted questions.

Question 1: My supervisor offers me help when I have a problem. (Zwijze-Koning and de Jong, 2007)

Question 2: My supervisor trusts me.

Question 3: My supervisor listens to me.

Question 4: My supervisor gives me enough attention.

Question 5: My supervisor is open to ideas.

Question 6: When I need to ask my supervisor something, I can always reach him/her

Question 7: The top management within Tata Steel has little sense regarding the safety issues at the workplace. (negative)

Translation (Dutch).

Question 1: Mijn teamleider helpt mij, wanneer ik een probleem heb.

Question 2: Mijn teamleider vertrouwt mij.

Question 3: Mijn teamleider luistert naar mij.

Question 4: Mijn teamleider geeft mij genoeg aandacht.

Question 5: Mijn teamleider staat open voor ideeën.

Question 6: Wanneer ik mijn teamleider iets wil vragen, kan ik hem/haar altijd bereiken.

Question 7: De hogere leiding binnen Tata Steel heeft weinig gevoel voor de veiligheidsissues op de werkvloer. (negatief)

Safety attitude.

Original questions

Question 1: self-created.   (positive)

Question 2: self-created.

Question 3: self-created.   (negative)

Question 4: self-created.

Question 5: Working with a certain amount of risk is exciting. (Diaz and Cabrera, 1997)

Question 6: When the job requires it, the most important thing is to finish on time. (negative) (Diaz and Cabrera, 1997)

Adjusted questions.

Question 1: I have a positive feeling about safety.

Question 2: Safety in the workplace is important to me.

Question 3: I like to take risks. (negative)

Question 4: I often think of safety.

Question 5: Working with a form of risk is exciting. (negative)

Question 6: Production is more important than working safely. (negative)

Translation (Dutch).

Question 1: Ik heb een positief gevoel bij veiligheid.

Question 2: Veiligheid op de werkvloer vind ik belangrijk

Question 3: Ik neem graag risico's. (negatief)

Question 4: Ik denk vaak aan veiligheid.

Question 5: Werken met een vorm van risico is spannend. (negatief)

Question 6: Productie draaien is belangrijker dan veilig werken. (negatief)

Safety participation.

Original questions

Question 1: I actively participate in setting safety goals. (Lu and Yang, 2011)

Question 2: I actively provide safety improvement suggestions. (Lu and Yang, 2011)

Question 3: I actively participate in safety meetings. (Lu and Yang, 2011)

Question 4: I put in extra effort to improve the safety of the workplace. (Neal and Griffin, 2006)

Question 5: I promote the safety program within the organization. (Neal and Griffin, 2006)

Question 6: I voluntarily carry out tasks or activities that help to improve workplace safety. (Neal and Griffin, 2006)

Adjusted questions.

Question 1: I actively participate in setting safety goals.

Question 2: I try to improve safety.

Question 3: I actively participate in safety meetings.

Question 4: I put in extra effort to improve the safety of the workplace.

Question 5: I promote the safety program within Tata Steel.

Question 6: I preformed voluntary activities that contribute to the improvement of safety in the workplace.

Translation (Dutch).

Question 1: Ik neem actief deel aan het vaststellen van veiligheidsdoelstellingen.

Question 2: Ik probeer de veiligheid te verbeteren.

Question 3: Ik neem actief deel in veiligheidsbijeenkomsten (o.a. toolboxen).

Question 4: Ik lever extra inspanning om de veiligheid op de werkvloer te verbeteren.

Question 5: Ik promoot het veiligheidsprogramma binnen Tata Steel.

Question 6: Ik verricht vrijwillig activiteiten die bijdragen aan de verbetering van de veiligheid op de werkvloer.

Safety compliance.

Original questions

Question 1: I maintain safety awareness at work. (Lu and Yang, 2011)

Question 2: I comply with safety rules and standard operational procedures. (Lu and Yang, 2011)

Question 3: Same as question 2. (Lu and Yang, 2011)

Question 4: I do not neglect safety, even when in a rush. (Lu and Yang, 2011)

Question 5: I use all the necessary safety equipment to do my job. (Neal and Griffin, 2006)

Question 6: I use the correct safety procedures for carrying out my job. (Neal and Griffin, 2006)

Question 7: I comply with safety rules and standard operational procedures. (Lu and Yang, 2011)

Adjusted questions.

Question 1: At work I am aware of safety.

Question 2: I always comply with safety rules.

Question 3: I always comply with standard operational procedures.

Question 4: I always pay attention to safety.

Question 5: I use all the necessary safety equipment (e.g.: glasses, ear protection, helmet and clothing) to do my job.

Question 6: I use the correct safety procedures for carrying out my job.

Question 7: I sometimes violate the safety rules. (negative)

Translation (Dutch).

Question 1: Tijdens het werk ben ik me bewust van veiligheid.

Question 2: Ik houd me altijd aan de veiligheidsregels.

Question 3: Ik houd me altijd aan standaard procedures.

Question 4: Ik let altijd op veiligheid.

Question 5: Ik gebruik alle nodige PBM's (b.v.: bril, oor bescherming, helm en kleding) om mijn werk te doen.

Question 6: Ik gebruik de juiste veiligheidsprocedures om mijn baan uit te voeren.

Question 7: Ik overtreed weleens de veiligheidsregels. (negatief)

Additional questions:

Original questions:

Question 1: self-created.   (demographics)

Question 2: self-created.   (demographics)

Question 3: self-created.   (demographics)

Question 4: self-created.   (demographics)

Question 5: self-created.   (demographics)

Question 6: self-created.   (demographics)

Question 7: How satisfied are you with your job? (CSQ)

Question 8: self-created.   (demographics)

Question 9: self-created.   (demographics)

Question 10: self-created. (demographics)

Question 11: self-created. (demographics)

Question 12: self-created. (demographics)

Question 13: self-created. (demographics)

Question 14: self-created. (demographics)

Question 15: If the communication associated with your job could be changed in

no matter which way to make you feel more satisfied, please indicate how: (CSQ)

Adjusted questions.

Question 1: In which team do you work?

Question 2: In which service do you work?

Question 3: What is your gender?

Question 4: What is your date of birth?

Question 5: How many years have you been employed at Tata Steel?

Question 6: Which department of Tata Steel do you work in:

Question 7: Please Indicate how satisfied you are with your job (1 = not satisfied to 10 = very satisfied):

Question 8: Number of safety trainings (without toolbox, only about safety) obtained during your work:

Question 9: Highest level of education (completed):

Question 10: Are you: Executive assistant / Team Leader / Group Product Manager / Product Manager.

Question 11: Did you ever have an industrial accident at Tata Steel? If yes, please describe:

Question 12: Have you ever been a witness of an industrial accident at Tata Steel? If yes, please describe:

Question 13: When do you comply with the safety rules/procedures?

Question 14: When do you not comply with the safety rules/procedures?

Question 15: Could you give general suggestions on the communication of safety?

Translation (Dutch).

Question 1: In welke ploeg bent u werkzaam?

Question 2: In welke dienst bent u werkzaam?

Question 3: Wat is uw geslacht?

Question 4: Wat is uw geboortejaar?

Question 5: Hoeveel jaar bent u in dienst bij Tata Steel?

Question 6: Welke afdeling van Tata Steel werkt u in:

Question 7: Geef aan hoe tevreden u bent over uw werk (1 = niet tevreden tot 10 = erg tevreden):

Question 8: Aantal veiligheidstrainingen(zonder tool box, alleen over veiligheid) tijdens uw werk:

Question 9: Hoogst genoten (afgeronde) opleiding:

Question 10: Bent u : Uitvoerend medewerker/Teamleider/Product groep manager/Product manager.

Question 11: Heeft u zelf weleens een bedrijfsongeval gehad bij Tata Steel? Zo ja, kunt u dit beschrijven:

Question 12: Bent u weleens getuige geweest van een bedrijfsongeval bij Tata Steel? Zo ja, kunt u dit beschrijven:

Question 13: Wanneer houdt u zich wel aan de veiligheidsregels/procedures?

Question 14: Wanneer houdt u zich niet aan de veiligheidsregels/procedures?

Question 15: Heeft u nog algemene tips over de communicatie van veiligheid?

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