



**Universiteit Utrecht**

# ***Safety Performance in the Construction Sector***

*The Influence of Transformational Leadership  
and the Mediating Role of Safety Climate*

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## **Abstract**

The construction sector has clearly been marked as Holland's most dangerous work environment where accident occurrence is concerned. The aim of the present study is to shed light on the relationships between leadership, safety climate and safety performance, in order to help leaders to produce more effective safety outcomes. A total of 77 project participants, from three large construction firms in the Netherlands, filled in a questionnaire measuring transformational leadership, safety climate, safety participation and safety compliance. The results reveal a model wherein transformational leadership is positively related to safety participation, and this relationship is mediated by safety information flow; a safety climate subscale. The findings suggest that (the quality of) the leader's communication is of particular importance for the exertion of a positive influence on safety performance. Future research should pay attention to revealing various ways for leaders to influence safety performance, by focusing on climate strength, communication, different leadership behaviours, and by comparing the impact of these aspects in projects with their influence in organizations.

**Keywords:** *Construction Projects, Transformational Leadership, Safety Climate, Safety Compliance, Safety Participation, Safety Performance*

## 1. Introduction

In 2007, the Dutch Ministry of Social Affairs and Employment, in collaboration with the Dutch National Federation of Christian Trade Unions, published the outcomes of a five-year study on safety in the construction sector, performed by the Dutch Labour Inspection. The results indicated that approximately nine in every ten occurring accidents, are caused by unsafe behaviour of either the employer or the employee. Moreover, the researchers found that on a yearly basis, an average of twelve thousand construction workers (in a population of 480.000), had to receive first aid as a result of an accident at the construction site. These results reflect the hard truth of safety in the construction sector, clearly marking it as being Holland's most dangerous work environment where accident occurrence is concerned (Ministry of Social Affairs and Employment & National Federation of Christian Trade Unions, 2009).

Another notable characteristic of today's construction sector, is the fact that the work is mostly carried out in *projects*. A project can be seen as a temporary organization; it is started up in order to reach a certain outcome (for instance, the connection of two cities via a railway), and when that outcome is reached, the project is terminated (Turner & Müller, 2003). Currently, public as well as private organizations turn their attention more and more towards working by means of projects. For example, large scale infrastructure projects, also known as 'mega-projects', are becoming increasingly popular with national governments (van Marrewijk, 2007). Moreover, some authors even argue that if an organization wants to remain competitive in providing its customers with continually improved products and services, it has no choice but to use project management concepts and processes (Cleland, 1994).

The fact that the work in the construction sector is mostly carried out in project-based environments, sets it apart from other sectors. Present day contractors and sub-contractors often assign their employees to participate in (several) projects, and after a given project is terminated, the employees are assigned to another. Subsequently, this leads to the fact that employees participate in different project teams with different co-workers. In other words, the employees have to shift between different teams and work environments. These differences in environments and team compositions, are likely to result in different organizational cultures and climates, with which the employees are confronted. These cultural implications will now be discussed.

Many authors stress the vital importance of maintaining a healthy organizational culture within an organization (e.g., Cameron & Quinn, 1999; Hofstede, 1991; Schein, 1992). Considering the fact that projects are often described as being temporary organizations (Cleland & Kerzner, 1985; Turner & Müller, 2003), it is not strange that several researchers have tried to transfer the concept of organizational culture to project based environments, thus creating the concept of *project (management) culture* (Cleland, 1982; 1994; Du Plessis & Hoole, 2006a; 2006b; Kerzner, 2000; van Marrewijk, 2007; Newcombe, 1997; Turner & Simister, 2000; Zuo & Zillante, 2005). Also, ever since the 1980's, more attention has been drawn to the examination of cultural factors where antecedents to accidents are concerned (Seo, Torabi, Blair & Ellis, 2004). Especially the nuclear disaster of Chernobyl in 1986 seems to have triggered a fusion between the concepts of safety and organizational culture, thus giving birth to *safety culture* (Cooper, 2000; Pidgeon & O'Leary, 2000). The underlying mechanism which has set this fusion in motion, was the fact that the disaster was partly attributed to a poor 'safety culture' within the Chernobyl plant, as well as in the Soviet nuclear industry in general (IAEA, 1988). In the years that followed, there has been confusion in terminology, as to whether one should refer to *safety climate* or to *safety culture* (Glendon & Stanton, 2000; Hale, 2000). When the evolution of both culture and climate was reviewed by Reichers and Schneider (1990), they concluded that culture exists at a higher level of abstraction than does climate. Furthermore, they stated that climate is a manifestation of culture. A distinction that received much support by other researchers (Cox & Flin, 1998; Glendon & Stanton, 2000; Guldenmund, 2000; Schein, 1992; Seo et al., 2004). It is also congruent with the review presented by Denison (1996), who concludes that climate and culture research traditions are characterized by differences in perspective, rather than differences in phenomenon. The logical question that arises from this distinction between culture and climate, is: which of these constructs is the preferred metric in modern research? In their extensive literary review on safety culture, Cox and Flin (1998) argued that not safety culture, but safety climate deserves our preference. Reason behind this statement, is the fact that safety climate studies provide a limited set of variables that can be operationalized and measured. Other authors advocated their support for this statement, posing that quantitative measures are inadequate to measure all aspects of organizational culture (Glendon & Stanton, 2000). More specifically, some researchers argue that measuring safety culture is extremely difficult, if not impossible (Hale, 2000; Guldenmund, 2000). Accordingly, in the present study, the focus lies on safety climate and not on safety culture.

In addition to the arguments mentioned above, climate is the better fitting construct in the present study for two other reasons. Firstly, the study is carried out in a project based environment. As noted earlier, projects can be seen as temporary organizations (Turner & Müller, 2003). Therefore, the employees that participate in a project have much less shared history, than do those who work in a regular organization. Since culture is rooted in history (Denison, 1996), it is hard to determine whether a culture is even present at a given time in a project. Employees might bring some aspects of the organizational culture aspects of their contractor into the project, but it is highly unlikely that the (strength of the) culture in the project is identical to that of the organization. Furthermore, to the knowledge of the present author, literature gives us no indication whatsoever as to when a culture actually starts to manifest; be it in a project, team, department or organization. From this it follows, that measurement of project culture –especially where short-term projects are concerned– might be a fruitless endeavour, since it cannot be stated with certainty that a culture actually exists in the project. In conclusion, it can be said that although the concept of project culture might have considerable conceptual appeal, the practical value of the concept is highly doubtful. Climate, on the other hand, is a snapshot of a *situation* at a given point in time and is *not* considered to be rooted in history (Denison, 1996). Thus, it eliminates the drawbacks associated with studying the social context in a project based environment which arise when culture is used as the metric.

Secondly, an objective of the present study is to help leaders and managers understand in what ways they are able to influence the social context of their projects (i.e. culture or climate), in order to produce more effective outcomes. Cultural change, however, is in an extremely difficult and long-term process (Cummings & Worley, 2005). Some experts even doubt if it is possible at all to bring about fundamental cultural changes in large firms. Those who have accomplished such feats, estimate that the process takes from six to fifteen years (Lau, Kilbourne & Woodman, 2003; Uttal, 1983; as cited by: Cummings & Worley, 2005). To illustrate the difficulty of change programs in general: it is known that over 70% percent of all change programs either stall prematurely or fail altogether (Boonstra, 2004). Climate researchers, in contrast, acknowledge the influence of management on social contexts (Ekvall, 1987; Glick, 1985; Guion, 1973; James & Jones, 1974; Koys & DeCotiis, 1991). From this it follows that climate is more susceptible to change than culture, and thus better fits the objectives of the present study.

These arguments combined, have led to the fact that safety climate is the addressed construct in the current study.

As mentioned above, an objective of the present study is to help leaders and managers understand in what ways they are able to influence the safety climate of their projects, in order to produce more effective outcomes. Until now, only a few studies have tried to identify the ways in which leadership influences the existing safety climate (e.g., González-Romá, Peiró & Tordera, 2002; Luria, 2008; Zohar & Tenne-Gazit, 2008). The results of these studies suggest that one specific leadership style, called *Transformational Leadership*, is of particular importance in safety climate formation. Transformational leadership is associated with strong personal identification with the leader, the creation of a shared vision of the future, and a relationship between leaders and followers based on far more than just the simple exchange of rewards for compliance (Keegan & den Hartog, 2004). Although the link between transformational leadership and safety climate has been studied by only a few researchers (e.g. Dragoni, 2005; Zohar & Tenne-Gazit, 2008), the available literature does suggest a positive relationship between the two constructs. Therefore, it will receive wide attention in the current study.

Another relationship that has been studied by only a few researchers, is the relationship between leadership and organizational safety climate on the one hand, and organizational *safety performance* –meaning: the extent to which the work is actually carried out safely within the organization– on the other (e.g., Mearns, Whitaker & Flin, 2003; Wu, Chen & Li, 2008). This is quite remarkable, since the improvement of safety performance is a key issue for many organizations, especially in the construction sector. In addition, as far as the knowledge of the present author goes, no one has ever studied the relationship between leadership, safety climate and safety performance within a project based environment before. Especially given the fact that a large proportion of the work in the construction sector is carried out in projects, such a study is thoroughly warranted.

Taking into account the arguments presented above, the aim of the present study is to shed light on the relationships between leadership, safety climate and safety performance within construction projects. In order to do so, the present study will strive to answer the following question: *To what extent are leaders able to influence the safety performance of their project, and what is the role of safety climate within this relationship?*

To answer this question, the current author combines previous research on safety climate, safety performance and leadership style, in order to develop a single conceptual model. In the theoretical framework presented below, firstly, we turn to what safety climate exactly *is*, as well as what makes it a topic worth studying.



Secondly, the concept of transformational leadership is clarified and its added value to the present study will be highlighted. Afterwards, the interactions between the different variables in the present study will receive wide attention. Finally, the conceptual model and the corresponding hypotheses of the current study are presented.

## **2. Theoretical Framework**

### **2.1 Safety Climate**

In past decades, safety measures used in hazardous work environments were mostly based on purely retrospective data –also called ‘lagging indicators’- such as fatalities, lost time accident rates and incidents (Flin, Mearns, O’Connor & Bryden, 2000). More recently, however, a shift towards ‘leading indicators’ such as safety audits or measurements of safety climate can be noticed. Flin (1998) argues that these leading indicators are predictive measures which enable safety condition monitoring, thus reducing the need to wait for system failures in order to identify weaknesses and to take remedial actions. Falbruch and Wilpert (1999) speak of switching from ‘feedback’ to ‘feedforward’ control.

The importance of measuring indicators by using safety perception surveys –in other words: measuring safety climate– is stressed by several researchers (e.g., Cooper & Philips, 2003; Silva, Lima & Baptista, 2004). Gyekye and Salminen (2009) share this point of view and name the following advantages of measuring safety climate. Firstly, it has proven to be an effective tool in the identification of precursors to accident occurrence, which in turn has led to effectively decreased accident rates. Secondly, safety perception surveys provide proactive information about safety problems, *before* they develop into accidents and injuries. Subsequently, this offers guidance to management in the development of specific safety programs. A third advantage is the fact that safety perception analyses are relatively inexpensive, when compared to other proactive means of accident prevention (such as safety audits). Therefore, in organizations where money is an issue, a safety perception analysis is likely to be a more tempting tool, compared to the more expensive alternatives. The fourth and final advantage refers to the information about safety management, from the employees’ perspective, that safety perception analyses provide. By highlighting these advantages, Gyekye and Salminen (2009) offer an insightful view regarding the importance of measuring safety climate. Seo et al. (2004) also stress the advantages

of the use of safety climate measures. In addition to the arguments presented by Gyekye and Salminen, they state that a safety climate survey is able to focus on safety efforts to improve problematic areas (Cox & Cheyne, 2000), which may also improve other functions of a company (including productivity). Furthermore, they consider a safety climate survey a valuable tool for identifying trends in an organization's safety performance as well as establishing external benchmarks (Cox & Cheyne, 2000; Coyle, Sleeman & Adams, 1995). Other authors also underpin the value of safety climate and see it as a way of taking the "safety temperature" of a workplace (Budworth, 1997), which provides a snapshot of that workplace's "state of safety" at a given point in time (Cheyne, Cox, Oliver & Tomas, 1998; Huang, Chen, DeArmond, Cigularov & Chen, 2007; Vinodkumar & Bhasi, 2009). A driving force behind this shift of focus, is the awareness that organizational, managerial and human factors, rather than purely technical failures, are prime causes of accidents, especially in hazardous work environments (Weick, Sutcliffe & Obstfeld, 1999).

A widely recognized definition of organizational climate has been presented by Schneider (1990), who conceptualized it as being *"the shared perceptions of the employees concerning the practices, procedures, and the kind of behaviours that get rewarded, supported and expected in a setting"*. However, in an organization, multiple climates often exist simultaneously. Therefore, climate is best regarded as a specific construct having a referent – that is, a climate must be a climate *for* something. Previously studied types of climate include, for instance, team climate for innovation (e.g., Anderson & West, 1998; Klein & Sorra, 1996), organizational climate for (customer) service (e.g., Burke, Borucki & Hurley, 1992; Schneider, Wheeler & Cox, 1992; Schneider, White & Paul, 1998) and climate for safety –both at the organizational and group level– (e.g., Zohar & Luria, 2005). In accordance with previous research, safety climate in the current study is defined as being *"the employees' shared perceptions of safety policies, procedures, practices, as well as the overall importance and the true priority of safety at work"* (Griffin and Neal, 2000; Vinodkumar & Bhasi, 2009; Zohar, 1980).

There are two different group-level parameters with which climate can be measured, once it has developed in an organizational unit or project. These are *climate level* and *climate strength*. When speaking of *climate level*, one refers to the aggregated members' rating of climate perception items, regarding a particular focal performance facet –e.g., innovation, customer service, employee safety– (Chan, 1998; Lindell & Brandt, 2000; Zohar & Luria, 2005). In other words, if a focal performance facet is rated high by the organizational members, it is perceived to have a high priority within the existing organizational climate. Congruently, a low

rating is an indication of a focal facet with lower priority. Because enacted practices frequently diverge from formal policies and procedures, perceived priorities are often deduced by attending to situations which present competing operational demands (e.g., productivity vs. safety). Thus one looks at trade-offs being made, and one is able to identify the true priorities within the existing climate (Zohar & Tenne-Gazit, 2008). When assessing *climate strength*, one looks at the agreement or consensus of individual climate perceptions. The greater the consensus, the stronger the climate (Zohar & Tenne-Gazit, 2008).

As will be argued in the discussion section of the present research report, the concept of climate level and the concept of climate strength both have considerable value for climate research. Climate strength, however, is not included as a variable in the present study. Reason for the exclusion of climate strength, lies in the fact that climate strength is *group-level construct* and, accordingly, needs to be *measured at the group-level*. In order to analyse a construct at the group level, a large number of respondents, from a large number of different project teams, is warranted. However, an expected shortage of project teams –and respondents in general–, undermined the prerequisites for climate strength analyses. Since climate level *can* be measured at the individual level, it is much less hindered by shortcomings in respondent response. So although both climate level and climate strength are certainly topics worth studying, the present study only offers possibilities for the analysis of climate level. Therefore, the focus of the present study lies solely on climate *level*, and not on *climate strength*.

## **2.2 The Transformational Leader**

From the 1980s onwards, researchers have paid considerable attention to the concept of *transformational* leadership. This particular leadership style represents the more emotional and symbolic aspects of leadership; which help us understand how leaders influence their followers to make self-sacrifices and put the needs of the mission or organization above their materialistic self-interests (Yukl, 2006). The importance of transformational leadership is stressed by both authors of general leadership literature (e.g., Bass, 1997) and of specialist project management literature (e.g., Partington, 2000).

Yukl (2006) argues that most, if not all, theories of transformational leadership developed in the past decades, are strongly influenced by the ideas of James McGregor Burns. Over thirty years ago, Burns (1978) made a distinction between *transforming leadership* and *transactional leadership*. According to Burns,

transforming leadership “*appeals to the moral values of followers, in an attempt to raise their consciousness about ethical issues and to mobilize their energy and resources to reform institutions*”. Transactional leadership, in contrast, concerns “*providing pay and other benefits in return for work effort*”. In other words, a transforming leader focuses on the *intrinsic motivation* (e.g., fulfilment), whereas a transactional leader focuses on *extrinsic motivation* (e.g., wage/salary). But where Burns is more concerned with the moral elevation of followers and social reform, the newer theories of transformational leadership are more concerned with the attainment of pragmatic task objectives (Yukl, 2006). Since the current study focuses on pragmatic task objectives (i.e. safety performance), newer theories might provide useful insights. One of these newer theories, developed by Bass (1985, 1996), has received more literary attention than any of the others (Yukl, 2006). Therefore, this valuable piece of literature will now be discussed.

According to the conceptualization of Bass (1985), transformational leadership comprises four different components. The first, *idealized influence*, concerns the charismatic role modelling behaviour of the leader. People trust the leader, they are proud to be associated with the leader and see the leader as a role model. *Inspirational motivation*, the second component, refers to the ability of the leader to articulate an evocative or appealing vision for the team or the organization, in order to provide meaning to followers’ work. Transformational leaders create new visions, mobilize commitment to these visions and are able to transform individual followers and even organizations (Bass, 1985; 1997). Taking these first two components into account, it is understandable that some researchers associate transformational leadership with terms such as ‘charismatic’ or ‘visionary’ leadership (Bryman, 1996; Grint, 1997). Incidentally, many writers use the terms ‘transformational leadership’ and ‘charismatic leadership’ interchangeably. However, though a certain overlap between the two leadership styles exists, there are also some important distinctions (Yukl, 2006). Therefore, using the terms interchangeably would be incorrect. In the current study, the perceived charisma of a leader is seen as a manifestation of idealized influence, as described above.

The third component, *individualized consideration* relates to the interaction between leader and followers. More specifically: a transformational leader coaches his followers and shows the behaviour of a mentor. The leader communicates frequently with his followers and the communication is of high quality. Lastly, the fourth component of transformational leadership is called *intellectual stimulation*. It refers to the leader’s encouragement of followers to reframe problems, challenge existing assumptions and approach old situations in new ways (Bass, 1985; 1997).

Thus, followers are stimulated intellectually and are driven towards improvement. The combination of these four behavioural components, is what makes someone a transformational leader (Bass, 1985).

In general, it can be said that transformational leadership is associated with strong personal identification with the leader, the creation of a shared vision of the future, and a relationship between leaders and followers based on far more than just the simple exchange of rewards for compliance (Keegan & den Hartog, 2004). Furthermore, in contrast to *transactional* leaders –who tend to focus on the existing status quo and fostering performance on well-defined tasks to meet established performance goals– transformational leaders promote creativity and highlight the necessity for change (Avolio, 1994; Bass & Riggio, 2006; Conger & Kanungo, 1992). Considering this, it is not surprising that transformational leadership is frequently linked (indirectly) to innovation in recent literature (e.g., Bass & Riggio, 2006; Eisenbeiss, van Knippenberg & Boerner, 2008). Moreover, transformational leaders are known to enhance followers self-efficacy (Pillai & Williams, 2004) as well as their intrinsic motivation (Shin & Zhou, 2003).

## **2.3 Leadership, Climate and Performance: A Conceptual Model**

### *2.3.1 Transformational Leadership and Safety Climate*

The notion that leaders can exert major influence on climate formation, has been around from the 1950's onwards (Dragoni, 2005; Kozlowski & Doherty, 1989; Lewin, 1951; Likert, 1967; McGregor, 1960; Ostroff, Kinicki & Tamkins, 2003; Schein, 1985). In addition, more recent empirical findings consistently offer support for the idea that safety climate perceptions and transformational leadership are positively related (Barling, Loughlin & Kelloway, 2002; González-Romá et al., 2002; Hofmann & Morgeson, 1999; Hofmann, Morgeson & Gerras, 2003; Zohar, 2002; Zohar & Luria, 2004; Zohar & Tenne-Gazit, 2008). Specifically, in a meta-analysis conducted by Nahrgang et al. (2006), a corrected correlation estimate ( $r_c$ ) of .61 between leadership and safety climate level was found. So several studies make it likely that transformational leadership and safety climate are related, but what is the actual underlying mechanism that connects these two constructs?

Dragoni (2005) explains the relationship between transformational leadership and safety climate as a social learning process. Subordinates repeatedly observe and interact with their leader in order to interpret group- and organization-level practices. According to the principle of least effort, subordinates are likely to focus on situations

in which the leader faces competing operational demands (e.g., productivity vs. safety), thus informing them about what is prioritized, valued and supported (Ashforth, 1985; Zohar, 2003). Zohar & Tenne-Gazit (2008) support this explanation, and state that when such perceptions are shared due to the commonality of the leader's messages and practices, they constitute the core meaning safety climate.

Based on the empirical findings described above, the following hypothesis is proposed.

*Hypothesis 1: Transformational Leadership is positively related to safety climate.*

Now that the relationship between transformational leadership and safety climate is properly clarified, the connection between transformational leadership and safety performance will be highlighted. Also, the specific safety performance variables of the present study will be introduced. Finally, the second and third hypothesis of the current study are presented.

### *2.3.2 Transformational Leadership and Safety Performance*

The relationship between transformational leadership and organizational performance has been studied by several different researchers. In a longitudinal study performed by Keller (2006), for example, it was found that transformational leadership predicted one-year-later technical quality, schedule performance and cost performance. Also, transformational leadership predicted the five-year-later profitability and speed to market. Other researchers focused on team outcomes, instead of organizational outcomes. For instance, the link between transformational leadership and team performance was investigated by Schaubroeck, Lam and Cha (2007), in their cross-cultural study of financial service teams. They discovered that transformational leadership influenced team performance through the mediating effect of team potency, an effect supported by both data from the United States and Hong Kong. Another longitudinal study, in the form of a randomized field experiment, studied the effects of transformational leadership on individual performance outcomes. The results showed that the leaders in the experimental group –which had received transformational leadership training–, had a more positive influence on direct followers' development and on indirect followers' performance than did the leaders in the control group –which had received eclectic leadership training– (Dvir, Eden, Avolio & Shamir, 2002). A more recent study by Walumbwa, Avolio and Zhu (2008) also found an effect of transformational leadership on individual performance

outcomes. This effect was fully mediated by the interaction of identification and means efficacy, and partially mediated by the interaction of self-efficacy and means efficacy.

Geyer and Steyrer (1998) take on a different approach, and compare the effects of transformational and transactional leadership on the objective performance in banks. Their results favour the transformational leadership style, acknowledging its effect on performance over and above transactional leadership. Moreover, Geyer and Steyrer argue that the core dimensions of transformational leadership are more strongly related to *long-term* than to *short-term* performance. However, *individualized consideration* was found to be positively related to short-term performance, but negatively related to long term performance. Lastly, a longitudinal study performed by Yammarino, Spangler and Bass (1993) showed an effect of transformational leadership of Naval Officers on fleet performance. Overall, the leadership-performance connection has been generally well established as positive within scientific literature (Bass, 1990; Yammarino, et al, 1993; Yukl, 1989); especially for transformational leadership.

Most likely, the positive relationship between transformational leadership and performance extends to the domain of safety. Performance, in essence, is nothing more than the realization of goals and objectives. Whether the goals set are financial or developmental in nature, or are concerned with efficiency or efficacy, is of less importance. If transformational leadership is thought to have a positive influence on performance, this means that a transformational leader makes it easier for his followers to attain the goals and objectives set. The same is true for required preconditions, such as safety. Although it is not an organizational goal, contributing to safety requires effort and commitment from employees and it is considered part of employee performance. In conclusion, it can be stated that –logically speaking– a transformational leader should have a positive influence on the attainment of goals, objectives and required preconditions by their employees. Thus, in the context of the present study, it can be expected that a transformational leader exerts a positive influence on the safety performance of his subordinates.

However, in order to test this expectation, the proper safety performance variables must first be selected. Several safety studies use a *subjective* safety performance measure as an outcome variable (e.g. Neal, Griffin & Hart, 2000; Shang & Lu, 2009). On first sight, this might seem less desirable than using a measure of *objective* safety performance as the outcome variable, but the opposite is quite true. In their study on safety climate and safety performance in container terminal operations in Taiwan, Shang and Lu (2009) argue for the use of subjective safety

performance. Based on earlier research, they stress that hard (objective) performance –such as raw financial statistics, cost statistics, commissions and services rendered- might be less fitting than soft (subjective, perceptual or responsive) performance, where safety studies are concerned. This because of the major drawback that near accidents or accidents with no injury as a result, are often not reported; and thus excluded from objective performance measures. Glendon and Litherland (2001) argue that objective performance measures are often insufficiently sensitive, of dubious accuracy, retrospective, and ignorant to risk exposure. Therefore, in the current study, subjective safety performance measures are used as the outcome variables.

In research regarding subjective safety performance, Neal et al. (2000) and Clarke and Ward (2006), amongst others, distinguish between *safety participation* and *safety compliance*. Safety participation is defined as “*helping co-workers promoting the safety program within the workplace, demonstrating initiative, and putting effort into improving safety in the workplace*” and safety compliance as “*adhering to safety procedures and carrying out work in a safe manner*” (Neal, et al., 2000). Safety participation is regarded a form of *contextual performance*; although the safety participation behaviours may not directly contribute to workplace safety, they do develop an environment that supports safety. Safety compliance, on the other hand, is best seen as a form of *task performance*, since it is concerned with the core safety activities that need to be carried out by individuals to maintain workplace safety (Griffin & Neal, 2000). In accordance with these previous studies, safety participation and safety compliance are used as the outcome-variables in the present study.

This leads us to the second and third hypothesis of the present study, which express the expectations regarding the relationship between transformational leadership and the two aspects of subjective safety performance.

*Hypothesis 2a:* Transformational leadership is positively related to safety participation.

*Hypothesis 2b:* Transformational leadership is positively related to safety compliance.



### 2.3.3 Safety Climate and Safety Performance

Not only does previous research indicate a positive relationship between transformational leadership and safety performance and between transformational leadership and safety climate, it also seems to point towards a positive connection between safety climate and safety performance. Specifically, prior studies have demonstrated the existence of a positive relationship between safety climate and safety performance on the individual, group and organizational level (e.g., Mearns et al, 2003; Siu, Phillips & Leung, 2004; Smith, Cohen, Cohen & Cleveland, 1978; Varonen & Mattila, 2000). On first sight, suggesting that safety climate and safety performance are related to each other might look like 'stating the obvious'. However, the different research findings on this topic are not always congruent and compatible with each other. For example, some authors only find a relationship between certain dimensions of safety climate and safety performance (e.g. Mearns et al., 2003), while others present results that support a model containing mediating variables (e.g. Griffin & Neal, 2000). In this section, studies on the relationship between safety climate and safety performance will be discussed and a potential explanation for the results found will be presented.

In a study by Mearns et al. (2003), safety climate surveys were administered in the oil and gas industry, in two separate years. Both subjective safety performance (reports from the respondents) and the objective safety performance (official accident statistics) were related to certain safety climate scales. More specifically, they found that especially *communication* played an important role in the way that safety climate predicts safety performance. However, where the *managerial safety practices* were concerned, the results showed a high variability across the different oil and gas installations. Perhaps the lack of attention to different leadership styles accounts for the high variability, seeing as they might affect climate differently, thus preventing the researchers from adequately studying management component of climate. Since the current study *does* include leadership style as a variable, these complications are not expected.

In another study, performed by Griffin and Neal (2000), a model including mediator factors was tested and confirmed. The results supported the proposition that the relation between safety climate and subjective safety performance (consisting of safety compliance and safety participation), was mediated by knowledge of safety procedures, compliance motivation (i.e. the motivation to perform safety-related tasks) and participation motivation (i.e. the motivation to participate in activities supporting safety in the organization). When one looks closely at the mediators in this study, certain links with transformational leadership appear to

be present. As discussed earlier, a transformational leader stirs the motivation of his followers as well as increasing the quality of communication and problem solving within his team. The qualitatively high communication of a transformational leader might enhance the knowledge of safety procedures and also a transformational leader may stimulate compliance motivation and participation motivation. Following this rationale, a link between transformational leadership and the mediator factors in the study by Griffin and Neal (2000) –knowledge of safety procedures, compliance motivation and participation motivation– might not be unthinkable.

Several other studies indicate a direct relationship between safety climate and subjective safety performance (Shang & Lu, 2009; Vinodkumar & Bhasi, 2009; Zhou, Fang & Wang, 2008). The studies performed by Shang and Lu (2009) and Vinodkumar and Bhasi (2009) focused on employees in Taiwanese container terminal operations and the Indian chemical industry, respectively. The results of both studies showed that a higher rating of the existing safety climate level was negatively related to subjective safety performance (i.e. the number of self-reported accidents). Thus, these studies point toward a direct positive relationship between safety climate and safety performance.

Zhou and his colleagues (2008) studied safety climate and human safety behaviour in the Chinese construction sector. In their study, they focused on the effects of safety climate and personal experience on safety performance (i.e. employee safety behaviour). They found that safety climate factors have a more significant influence on an employee's safety behaviour than personal experience factors. However, joint control of both safety climate and personal experience was suggested as the most effective way to increase safety performance. With these results, this study also offers considerable support to the idea that safety climate and safety performance are directly positively associated.

The final study that will be discussed is the meta-analysis performed by Clarke (2006). She examined the relationships between safety climate, subjective safety performance (i.e. safety participation and safety compliance), and occupational accidents and injuries. The results found in the study offered support for the expected positive association between safety climate and safety performance. Furthermore, the relationship between safety climate and occupational accidents and injuries was found to be moderated by study design. Only *prospective designs* (i.e. where accidents and injuries were measured *after* the measurement of safety climate) demonstrated validity generalization. These findings suggest an existing relationship between safety climate on the one hand, and subjective *and* objective safety performance on the other.

Based on the available literature on the relationship between safety climate and safety performance, a positive correlation between the two constructs is also expected in the current study. Altogether, this leads to the fourth and fifth hypothesis of this study:

*Hypothesis 3a:* Safety climate is positively related to safety participation.

*Hypothesis 3b:* Safety climate is positively related to safety compliance.

#### *2.3.4 Leadership, Climate, Performance: A Conceptual Model*

As illustrated above, it is likely that transformational leadership can be linked to both safety climate and safety performance. In addition, the link between safety climate and safety performance is also probable. Given these relationships exist, it is interesting to study how the three variables interact with each other in a combined model. The existing literature offers a few studies which shed light on the interaction between leadership, climate and performance processes. These studies shall now be discussed. Afterwards, the final hypotheses of the present study will be presented. Lastly, the conceptual model of the current study is graphically depicted and explained.

In a study performed by Clarke and Ward (2006), which was carried out in a U.K.-based manufacturing organization, the authors propose a model including mediator factors. In this model, the relationship between leader influence tactics (both transformational and transactional) and subjective safety performance (in this case, safety participation) are hypothesized to be (partially) mediated by safety climate. The two transformational leader influence tactics (i.e. the use of inspirational appeals and consultation of the subordinates) were initially positively correlated with safety participation. After safety climate was added to the model, however, safety climate was found to fully mediate the relationship between inspirational appeals and safety participation, and found to partially mediate the relationship between consultation and safety participation. Furthermore, the analysis of the two transactional leader influence tactics (i.e. seeking a coalition with the subordinates and the use of rational persuasion) offered somewhat different results. Here, coalition was found to have a direct effect on safety participation, and the relationship between rational persuasion and safety participation was found to be mediated by safety climate. Based on these results, the study offered support for the proposed model. Thus, Clarke and Ward illustrated that leaders are able to influence safety participation by using both

transformational and transactional influence tactics and that safety climate (partially) mediates the relationship between transformational leadership and subjective safety performance.

Another study which addresses all three concepts (i.e. leadership, climate and performance), was performed by Zohar (2002). As was the case in the study by Clarke and Ward (2006), the research done by Zohar also acknowledges the complementary influence of transformational and transactional leadership, on the safety behaviour of group members. He found that transformational and constructive leadership predicted injury rate, while corrective leadership (i.e. transactional leadership) provided indirect, conditional prediction. Furthermore, the results indicated that the relationship between transformational leadership and safety behaviour was mediated by preventive action, a safety climate subscale which addresses the extent to which a supervisor acts proactively towards safety issues and his subordinates. Based the results found in his study, Zohar concludes that leadership dimensions associated with greater concern for group-members' welfare, arising from closer, individualized relationships, promote supervisory safety practices creating higher safety climates, and hence, safer behaviour. This is in accordance with the arguments presented in the current study.

Lastly, research by Wu et al. (2008) offered further support for the supposed relationship between leadership, climate and performance. In their study, correlations were found between safety leadership, safety climate and safety performance. Moreover, path analysis indicated that safety climate partially mediated the leadership-performance relationship. Incidentally, two components of safety leadership –these being safety caring and safety coaching– appear to have characteristics similar to those of transformational leadership. According to Wu et al., safety coaching consists of two concepts: *vision* and *credibility*. Vision can be directly compared with *inspirational motivation*, one of the four components of transformational leadership. Logically, credibility of the leader is a requisite for a vision to be accepted by subordinates, which concerns both transformational leadership and safety leadership. Safety caring is hypothesized to consist of *collaboration, feedback and recognition, and communication*. These concepts appear to have much in common with *individualized consideration*, a component of transformational leadership. Collaboration, feedback and recognition and communication, are all (to a large extent) part of the interaction between a transformational leader and his followers and the high quality communication that characterizes this interaction. Following this rationale, Wu et al. may have – unknowingly– incorporated several measures of (fragments of) transformational

leadership into their analysis. This idea offers additional support for the expectations in the current study.

Altogether, the studies described above have resulted in the expectation that safety climate mediates the relationship between transformational leadership and safety performance. The final hypotheses of the present study address this expectation.

*Hypothesis 4a:* Safety climate mediates the relationship between transformational leadership and safety participation.

*Hypothesis 4b:* Safety climate mediates the relationship between transformational leadership and safety compliance.

Based on the preceding discussion of the research literature, a conceptual model which graphically represents all hypotheses of the present study is presented below (see figure 1).



**Figure 1**

*Conceptual model of the present study, showing the mediating role of safety climate in the relationship between transformational leadership on the one hand, and safety participation and safety compliance on the other.*

## 3. Method

### 3.1 Respondents and Procedure

A total of 17 project teams, from 10 different construction companies in the Netherlands, participated in the present study. A questionnaire was sent out to 85 project employees, and was returned by 77; resulting in a 90,6% response rate. The project teams had an average size of 7,66 respondents (SD = 5,66). The average age of the respondents was 37 years and 5 months (SD = 11,57). At the time, all respondents were engaged in a project in the construction sector, with the average respondent working 39 hours a week (SD = 3,11). Most of the respondents (97,4%) had received middle- or lower-level education (lower than college).

In order to recruit respondents for the current study, the current author identified approximately thirty construction companies in the Netherlands, which were engaged in project-based working. These were found with the use of the present authors (email)contacts. Also, an internet search for potential companies was conducted. After a company was identified, a dialogue was started with either a (safety) manager in that organization or with a manager of a specific project in that organization. This dialogue primarily took place via telephone. However, if a given manager couldn't be reached by phone, an email was sent. Goal of the telephone conversation (or email) was to inform the manager about the general idea behind the study. Also, the practical value and the possible beneficial implications that the study might provide were highlighted. Of course, confidentiality concerning the data was guaranteed. If the manager was willing to let a project team participate in the study, a meeting was scheduled to further clarify the aims and procedure of the study.

In the course of this meeting, it was decided which project (or projects) of an organization was going to participate in the study. Two main criteria were used for the selection of a given project. The first criterion was the amount of construction workers that were currently engaged in the project (the more the better). The second, even more important criterion, was the extent to which it was feasible to involve a project, from a logistical point of view. This because the employees of the identified projects were either asked to come to the office (the canteen), or they were visited at the worksites (in construction sheds). Projects at very remote locations where therefore often not selected for participation. Depending on which was most convenient for a given project at a given time and date, the questionnaires were either filled in at the office or at the construction site.

Before the questionnaires were handed out to be filled in, the project members received a verbal presentation from the current author, explaining the goals of the current study as well as providing instructions for completing the questionnaire (these instructions were also included in the questionnaire itself). It was chosen to use physical questionnaires, instead of digital ones. This because computers at the workplaces were scarce, or non-existent. Furthermore, physical questionnaires are expected to result in a higher response rate. Additionally, a printed questionnaire provided the opportunity for multiple respondents to fill in the questionnaires simultaneously, thus saving time for the participating company.

All project members were asked to fill in the questionnaire, but it was emphasised that their participation was entirely voluntary. The current author was present while the respondents completed the questionnaire. This was done in order to answer respondents' questions and to prevent questionnaire-related discussions amongst respondents. After completion, the respondents were thanked for their efforts.

### **3.2 Measurements**

The questionnaire used in the present study was assembled in order to measure *transformational leadership, safety climate, safety participation and safety compliance*. The scales –and subscales– used to measure these dimensions, will now be discussed.

#### *3.2.1 Transformational Leadership*

*Transformational leadership* was measured using a hitherto unpublished 70-item Dutch version of the Multifactor Leadership Questionnaire (MLQ-5X: Bass & Avolio, 1995), provided by dr. B.H.J. Schreurs of Utrecht University. The MLQ is seen as the most common measure of transformational leadership<sup>1</sup> (Eisenbeiss, et al., 2008; Judge, Woolf, Hurst & Livingston, 2006; Yukl, 1998). Respondents were asked to rate the extent to which their immediate supervisor showed the behaviour illustrated by a given item. Items were measured using a 5-point rating scale and the possible answers were labelled: 1 (*Not at all*), 2 (*Once in a while*), 3 (*Sometimes*), 4 (*Fairly often*) and 5 (*Frequently, if not always*).

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<sup>1</sup> In addition to transformational leadership, the original MLQ –and the questionnaire used in the present study– also measures two other leadership styles (i.e. *transactional leadership* and *passive leadership*) and an outcome measure of transformational leadership (i.e. *extra effort*). However, since the focus of the present study lies solely on transformational leadership and safety performance outcomes, the results of these two leadership styles were not included in this research report.

Four subscales of the MLQ were used to measure transformational leadership: *charisma*, *inspirational leadership*, *individual consideration* and *intellectual stimulation* (an overview of all subscales and their respective items is found in appendix 8.1). Every subscale was subjected to a reliability analysis, in order to assess the inter-item correlations and to determine the Cronbach's alpha. Based on the results from the analysis, it was determined whether it was warranted to exclude items from the subscale in order to increase reliability. All subscales of transformational leadership and their respective reliability coefficients, are also conveniently depicted in table 1.

The subscale *charisma*, consisted of 9 items. Items included, for instance: 'It makes me proud to be associated with my immediate supervisor' and 'My immediate supervisor is a symbol of success'. The subscale proved to be reliable, with a Cronbach's  $\alpha$  of .86.

*Inspirational leadership*, the second subscale, was measured with the use of 8 items. These include, for example: 'My immediate supervisor has a clear strategical vision, which he transfers on to me' and 'My immediate supervisor sometimes gives me a pep-talk'. Reliability analysis ascertained a Cronbach's  $\alpha$  of .77, thus proving the subscale reliable.

The third subscale, *individual consideration*, was represented by 10 items, including: 'My immediate supervisor gives me personal attention when needed' and 'My immediate supervisor gives me feedback on my performance every now and then'. The reliability analysis showed a Cronbach's  $\alpha$  of .81 and thus the third subscale was also proven reliable.

*Intellectual stimulation*, the fourth and final subscale of transformational leadership, was measured using 11 items. Examples of such items are: 'My immediate supervisor's ideas force me into rethinking some of my own ideas' and 'My immediate supervisor makes me look at problems from a different perspective'. The reliability analysis presented several notable results. Firstly, when closely examining the inter-item correlations, it appears that two items show very little coherence with the rest of the items. These are the items 'His ideas have forced me to re-evaluate some of my own ideas' and 'He has me looking at problems, in a way that allows me to improve my ability to think with a problem-solving-mentality'. Not surprisingly, given the low inter-item correlations, the reliability analysis suggested the exclusion of these two items. The lack of inter-item correlation might be caused by the way these items are formulated. Both items appear to have a more 'forcing character' than the other items. Seeing as transformational leaders try to increase the internal motivation of their subordinates, instead of forcing them to engage in a given



activity, the respondents might have perceived these items differently from the rest of the items in this subscale. In accordance with the results from the reliability analysis, it was decided to exclude the items mentioned above. The initial Cronbach's  $\alpha$  was found to be .78, but after the exclusion of the two items, the Cronbach's  $\alpha$  was raised to .80.

Secondly, several other items also demonstrated low inter-item correlation with each other. This suggests that multiple factors might be present in this subscale. In order to obtain a more clear image of the factor structure of the subscale, an exploratory factor analysis (i.e. principal components analysis) was performed. Using varimax rotation, a three factor-structure was revealed. It was found that all factors address a different domain of intellectual stimulation (see appendix 8.2 for the results of the factor analysis and further discussion on the findings) and by doing so they provide an accurate representation of this versatile construct. Combined with the fact that the subscale intellectual stimulation was proven to be reliable, present author has come to the conclusion that the items of the subscale (minus the two that have been excluded) give a sufficient representation of the construct they are supposed to measure.

After ascertaining the reliability of all subscales, the factor structure of the main scale (i.e. transformational leadership) was examined. In order to do this, the four subscales of transformational leadership were inserted into a single factor analysis. It was expected that a four-factor structure would be revealed, thus supporting the theory that Transformational Leadership is indeed measured with the use of four different components. However, the results of the factor analysis clearly revealed a one-factor structure, with all subscales showing high factor loadings on that factor. These results suggest that all subscales measure the same dimension, instead of four different aspects of one construct. These findings might be explained by the small sample size of the present study ( $N = 77$ ), which, traditionally, is not big enough to perform a factor analysis. Furthermore, previous studies do support the four-factor structure of transformational leadership (e.g. Bass, 1995; Eissenbeis, et al., 2008). These arguments combined have led the present author to the conclusion that, although not confirmed in the current study, the aforementioned four dimensions do measure separate aspects of transformational leadership and therefore should be regarded as being distinct from each other.

### *3.2.2 Safety Climate*

*Safety climate* was measured using a 21-item questionnaire developed by Katz-Navon, Naveh & Stern (2005), which was translated to Dutch by the current author.

Some items were slightly adapted, to better fit the present study. All references in the items to a 'supervisor' were adjusted per project, in order to correctly refer to the job title used by that particular organization. This was done in order to prevent confusion as to which supervisor or manager the item was referring. Each item was measured using a 5-point rating scale and the possible answers were labelled: 1 (*I totally disagree*), 2 (*I mostly disagree*), 3 (*I neither agree nor disagree*), 4 (*I mostly agree*) and 5 (*I totally agree*). The main scale (i.e. safety climate) consists of four subscales, these being: *safety procedures*, *safety information flow*, *managerial safety practices* and *priority of safety*. An overview of all scales and their respective items is found in appendix 8.1. Additionally, all reliability coefficients of the safety climate subscales can be found in table 1.

The subscale *safety procedures* was represented by 4 items. Examples of such items include: 'In my project team, there are many written procedures' and 'In my project team, the safety procedures are detailed'. Reliability analysis proved the subscale to be reasonably reliable (Cronbach's  $\alpha = .72$ ). When examining the inter-item correlations, it was found that the two items just mentioned show relatively low coherence ( $r = .26$ ), while the rest of the items show sufficient inter-item correlation. Difficulty in rating these items might have arisen from the formulation of the items. Respondents may have found it difficult to distinguish between 'many procedures' on the one hand, and 'detailed procedures' on the other. Therefore, in future research, it might be sensible to formulate these items more clearly, in order to decrease ambiguity and prevent confusion among respondents.

*Safety information flow*, the second subscale, was also measured using 4 items. These items included: 'In my project team, the employees are informed about new updates of the safety rules and regulations' and 'In my project team, the employees are informed about potential hazards'. The reliability analysis showed a Cronbach's  $\alpha$  of .85 for this subscale, indicating sufficient reliability.

The third subscale, *managerial safety practices*, consisted of 6 items, for instance: 'In my project team, the immediate supervisor approaches team members during work to bring safety issues to their attention' and 'In my project team, the immediate supervisor gets annoyed with workers who ignore safety rules'. This subscale was proven reasonably reliable by the reliability analysis (Cronbach's  $\alpha = .76$ ). Remarkably, the correlation of one item ('In my project team, the immediate supervisor makes sure that there are no risks present within the team') with the other items, was found to be fairly low. This might be caused by the item's formulation, which is somewhat ambiguous as to who actually performs the safety enhancing actions. It might indicate that the supervisor himself makes sure that the workplace is

safe, or it might indicate that he makes sure his subordinates do so. If a respondent interprets this item as meaning the first example, and the supervisor actually displays the behaviour from the second example, a low rating might be assigned to this item. However, a second respondent might interpret this item in accordance with the second example, and assign a high rating to this item. Because of the ambiguous nature of this item, it was decided to delete it from this subscale. As a result, Cronbach's  $\alpha$  rose to .78.

The final subscale, *priority of safety*, consisted of 7 items. These items included, for example: 'In my project team, in order to get the work done, one must ignore some safety issues' and 'In my project team, whenever pressure builds up, the preference is to do the job as fast as possible, even if that means compromising on safety'. All items of this subscale were recoded, in order to have a higher item-rating correspond with a higher priority of safety. When this subscale was submitted to a reliability analysis, a Cronbach's  $\alpha$  of .81 was found; thus indicating sufficient reliability.

As was the case with transformational leadership, the examination of the factor structure of safety climate was also hindered by the small sample size of the present study. Factor analysis revealed only one factor, with all subscales showing high factor loadings. This would indicate that the subscales all measure the same dimension, instead of four separate dimensions of one construct. However, the small sample size does not traditionally justify a factor analysis and it makes the conclusion drawn from the results highly doubtful. Therefore, the four-factor structure of safety climate presented by Katz-Navon et al. (2005) will be attained, meaning it is assumed that the four subscales do measure separate aspects of safety climate, and therefore should be regarded as being separate factors.

### 3.2.3 Safety Performance

*Safety Performance* was measured using two scales (*safety participation* and *safety compliance*), with a total of 14 items collected from studies by Clarke and Ward (2006), Neal and Griffin (2006) and Probst and Brubaker (2001). All items were translated to Dutch by the present author. A slight adaptation was made in the rating scale, which was originally designed to reflect the extent to which respondents agreed with statements about different behaviours. However, since safety performance is the outcome measure, the present author considered it more valuable to assess the *frequency* to which the actual behaviour was displayed by the respondent. Thus, the respondents were asked to rate the items on a 5-point scale, with the following possible answers: 1 (*Not at all*), 2 (*Once in a while*), 3

(*Sometimes*), 4 (*Fairly often*) and 5 (*Frequently, if not always*). In addition, in line with the safety climate scales, all references to a supervisor were adjusted per project to fit the job title of the supervisor used in a particular organization.

The first scale of safety performance is called *safety participation*. This scale, consisting of 9 items, assesses the extent to which individuals participate in safety-related activities at work. Items included, for instance: 'I voluntarily carry out tasks or activities that help to improve workplace safety' and 'In this project, people work safely, even when the immediate supervisor is not present'. The reliability analysis revealed a Cronbach's  $\alpha$  of .80, thus proving the scale to be reliable. However, the reliability analysis also suggested the elimination of the item 'I refrain from involvement in safety initiatives, based on the fact that I don't regard them as being part of my responsibility'. Remarkably, this was the only item in the scale that was recoded, so that a higher rating corresponded with higher safety participation. The item showed very weak correlations with the rest of the items, and it was therefore decided to exclude it from the scale. After the exclusion, Cronbach's  $\alpha$  was raised to .82. When further studying the inter-item correlations, another notable issue arises. Several other items, also show low inter-item correlation with each other. This might indicate the presence of multiple factors within this scale. To provide a clear view of the factor structure of this scale, a factor analysis (with varimax rotation) was performed. The results revealed a two-factor solution (see appendix 8.3). Notably, the four items that describe a *specific type of safe behaviour* (e.g. carrying out a risk assessment, or improving the effectiveness of health and safety systems) all high factor loadings for the first factor. In contrast, three items which describe safe behaviour in more global, abstract terms, show positive factor loadings for the second factor. It is likely that this is the underlying mechanism that causes the extraction of two factors from this scale. However, since both specific safety behaviour and global safety behaviour can be regarded as different parts of safety participation, the two-factor solution is quite acceptable. Additionally, the scale has proven itself to be reliable. These arguments combined, have led the present author to conclude that the scale gives a sufficient representation of the construct it is supposed to measure.

The second scale, *safety compliance*, was assessed with the use of 5 items and measured the extent to which individuals complied with the given safety rules and procedures. Examples of such items are: 'How often do you use all the necessary safety equipment to do your job?' and 'How often do you use the correct safety procedures for carrying out your job?'. This scale was found to have a Cronbach's  $\alpha$  of .71, thus proving the scale reasonably reliable. However, the reliability analysis

also showed that the exclusion of two items would result in a Cronbach's  $\alpha$  of .87. The items-to-be-deleted were: 'How often do you ignore safety rules and regulations at work?' and 'How often do you take shortcuts in safety guidelines in order to get the job done faster?'. It was remarkable to notice that these two items, were the only two items of the scale that were recoded. Seeing as a similar result was found in the safety climate scale *priority of safety*, this might indicate that the respondents had difficulty switching between the rating of positively and negatively formulated items. When looking at the inter-item correlations, it becomes apparent that the two items only correlate highly with each other; showing almost no coherence with the other items. Two possible causes for this discrepancy can be found. Firstly, these two items were formulated by Probst and Brubaker (2001), while the three other items were developed by Neal and Griffin (2006). Where Neal and Griffin focus on the extent to which one complies with safety procedures and regulations, Probst and Brubaker focus on the extent to which the respondent ignores these issues. Secondly, in the present study, all items of this scale show a skewed distribution. However, the items developed by Probst and Brubaker show negative skewness, whereas the items formulated by Neal and Griffin show positive skewness. The occurrence of this contrast in answer patterns, might be due to the fact that the items of Probst and Brubaker are formulated *negatively* (i.e. safe behaviour is indicated by a low rating on this item), in contrast to the items presented by Neal and Griffin. This might have led to difficulties in interpretation by the respondents, thus influencing the ratings assigned to the respective items. Based on these findings, the current author decided to exclude the items of Probst and Brubaker from this scale. As a result, the inter-item correlations clearly indicated a one-factor structure for this three-item scale. Also, the reliability of the scale increased notably, as Cronbach's  $\alpha$  was raised to .87.

The safety performance scales and their respective reliability coefficients are once more conveniently depicted in table 1.

#### *3.2.4 Background Variables*

In addition to all (sub)scales mentioned above, several background variables were included in the questionnaire. These variables were *gender*, *age*, *marital status*, *educational level*, and *the amount of working hours (in the project) on a weekly basis*. The entire questionnaire, as it was presented to the respondent, can be found in appendix 8.4.

**Table 1**

Overview of all (Sub)scales and their Respective Reliability Coefficients.

| <b>Scale</b>                       | <b>Cronbach's <math>\alpha</math></b> |
|------------------------------------|---------------------------------------|
| <b>Transformational Leadership</b> |                                       |
| <i>Charisma</i>                    | .86                                   |
| <i>Inspirational Leadership</i>    | .77                                   |
| <i>Individual Consideration</i>    | .81                                   |
| <i>Intellectual Stimulation</i>    | .80                                   |
| <b>Safety Climate</b>              |                                       |
| <i>Safety Procedures</i>           | .72                                   |
| <i>Safety Information Flow</i>     | .85                                   |
| <i>Managerial Safety Practices</i> | .78                                   |
| <i>Priority of Safety</i>          | .81                                   |
| <b>Safety Performance</b>          |                                       |
| <i>Safety Participation</i>        | .82                                   |
| <i>Safety Compliance</i>           | .87                                   |

## 4. Results

### 4.1 Correlations

The first five hypotheses of the present study focus on relationships between variables. Therefore, the Pearson correlation coefficients of all scales and subscales included in the current study are shown in table 2.

**Table 2**

*Pearson Correlation Coefficients Among the Transformational Leadership, Safety Climate and Safety Performance Scales and Subscales.*

| Variable                              | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10  | 11   | M    | SD  |
|---------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|------|------|-----|
| <b>1. Transformational Leadership</b> | -     |       |       |       |       |       |       |       |       |     |      | 2.85 | .53 |
| 2. Charisma                           | .91** | -     |       |       |       |       |       |       |       |     |      | 2.96 | .68 |
| 3. Inspirational Leadership           | .79** | .61** | -     |       |       |       |       |       |       |     |      | 2.48 | .58 |
| 4. Individual Consideration           | .90** | .80** | .53** | -     |       |       |       |       |       |     |      | 2.95 | .64 |
| 5. Intellectual Stimulation           | .88** | .71** | .62** | .76** | -     |       |       |       |       |     |      | 3.01 | .54 |
| <b>6. Safety Climate</b>              | .46** | .41** | .23*  | .50** | .43** | -     |       |       |       |     |      | 3.36 | .50 |
| 7. Safety Procedures                  | .28*  | .25*  | .09   | .35** | .26*  | .75** | -     |       |       |     |      | 3.31 | .66 |
| 8. Safety Information Flow            | .37** | .34** | .17   | .40** | .36** | .87** | .56** | -     |       |     |      | 3.35 | .76 |
| 9. Managerial Safety Practices        | .49** | .43** | .32** | .45** | .49** | .70** | .42** | .49** | -     |     |      | 3.34 | .63 |
| 10. Priority of Safety                | .20   | .17   | .09   | .26*  | .15   | .64** | .27*  | .47** | .15   | -   |      | 3.45 | .68 |
| <b>11. Safety Participation</b>       | .37** | .34** | .24*  | .33** | .39** | .32** | .10   | .39** | .21   | .22 | -    | 2.74 | .64 |
| <b>12. Safety Compliance</b>          | .23   | .18   | .08   | .28*  | .24*  | .49** | .32** | .50** | .40** | .22 | .27* | 3.58 | .70 |

Note. \*  $p < .05$ , two-tailed

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

According to Hypothesis 1, transformational leadership is positively related to safety climate. The results support this statement ( $r = .46$ ,  $p < .01$ ), thus confirming the first hypothesis. Furthermore, it was expected –according to Hypothesis 2a and 2b– that transformational leadership would also show a positive relationship with safety

participation and safety compliance, respectively. A significant positive relationship was found for safety *participation* ( $r = .37, p < .01$ ), however, the results show that no correlation existed between transformational leadership and safety *compliance* ( $r = .23, p = ns$ ). Subsequently, Hypothesis 2a was confirmed but Hypothesis 2b was rejected. Hypotheses 3a and 3b, state that safety climate is positively related to safety participation and safety compliance, respectively. The results support the relationship between safety climate and safety participation ( $r = .32, p < .01$ ), as well as the relationship between safety climate and safety compliance ( $r = .49, p < .01$ ). Based on these findings, both Hypothesis 3a and Hypothesis 3b were confirmed.

#### **4.2 Mediation Analysis**

According to Baron and Kenny (1986), four requirements have to be met, in order to ascertain the mediating role of a variable. The first requirement is that the independent variable has to be significantly related to the dependent variable. Secondly, the independent variable should also be significantly related to the mediator variable. Thirdly, the mediator variable has to be significantly related to the dependent variable. The fourth, and final, requirement is that the significant relationship between the independent and the dependent variable disappears (or is reduced) after the mediator variable is added to the model. If the inclusion of the mediator variable results in the complete disappearance of the relationship between the independent and the dependent variable, a *complete* or *full* mediation effect is present. When the relationship between the independent and dependent variable is reduced (but is still significant) after the inclusion of the mediator variable, a *partial* mediation effect is found.

Hypothesis 4a states that the relationship between transformational leadership and safety participation is mediated by safety climate. Transformational leadership has been shown to be related to safety participation (Hypothesis 2a) and to safety climate (Hypothesis 1). Also, safety climate has been shown to be related to safety participation (Hypothesis 3a). This means that the first three requirements set by Baron and Kenny (1986) are met. To test the fourth requirement, a hierarchical regression analysis is used. The results of the regression analysis are found in table 3.



**Table 3**

*Results of Hierarchical Regression Analysis for the Influence of Transformational Leadership and Safety Climate on Safety Participation<sup>2</sup>.*

| Model                       | Unstandardized Coefficients |            | Standardized Coefficients | t     | Sig.   |
|-----------------------------|-----------------------------|------------|---------------------------|-------|--------|
|                             | B                           | Std. Error | Beta                      |       |        |
| 1. (Constant)               | 1.485                       | .379       |                           | 3.915 | .000** |
| Transformational Leadership | .447                        | .131       | .374                      | 3.418 | .001** |
| 2. (Constant)               | .956                        | .512       |                           | 1.866 | .066   |
| Transformational Leadership | .347                        | .146       | .289                      | 2.380 | .020*  |
| Safety Climate              | .242                        | .159       | .185                      | 1.521 | .133   |

Note. \*  $p < .05$ , two-tailed

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

The regression analysis shows that, when comparing model 1 ( $B = .45$ ,  $p < .01$ ) to model 2 ( $B = .35$ ,  $p < .05$ ), the introduction of safety climate does reduce the effect of transformational leadership. However, the relationship is still found to be significant. These findings prove that no complete mediation is present, but suggest that a partial mediation effect might be present. In order to test if this is the case, one has to assess whether or not the change (i.e.  $\Delta B$ ) is significant. This is done with the use of the Aroian version of the Sobel test<sup>3</sup>, as suggested by Baron and Kenny (1986). The test was performed using an online testing environment (Preacher & Leonardelli, 2006). The results of the Aroian Sobel test are shown in Table 4.

**Table 4**

*Results of the Aroian Sobel Test for the Significance of the Mediation Effect of Safety Climate, on the Relationship Between Transformational Leadership and Safety Participation.*

|   | Z-Value | Std. Error | Sig. |
|---|---------|------------|------|
| Transformational Leadership<br>Safety Climate | 1.752   | .058       | .080 |

<sup>2</sup> In model 1, only transformational leadership is included as a predictor. In model 2, safety climate is added as a second predictor, in order to assess the effect it has on the relationship between transformational leadership and safety participation.

<sup>3</sup> The Aroian version of the Sobel test is conducted with the use of the following formula:  $z\text{-value} = a \cdot b / \sqrt{b^2 \cdot s_a^2 + a^2 \cdot s_b^2 + s_a^2 \cdot s_b^2}$ , where  $a$  is the unstandardized regression coefficient for the association between the independent variable and the mediator,  $s_a$  is the standard error of  $a$ ,  $b$  is the unstandardized coefficient for the association between the mediator and the dependent variable (when the independent variable is also a predictor of the dependent variable), and  $s_b$  is the standard error of  $b$ . This Aroian version of the Sobel test is recommended because it does not make the unnecessary assumption that the product of  $s_a$  and  $s_b$  is vanishingly small (Preacher & Leonardelli, 2006).

The Aroian Sobel test shows that the relationship between transformational leadership and safety participation is not significantly reduced ( $Z = 1.752, p = ns$ ). From these findings it can be concluded that the relationship between transformational leadership and safety participation is not mediated by safety climate. Thus, Hypothesis 4a is rejected.

According to Hypothesis 4b, the relationship between transformational leadership and safety compliance is mediated by safety climate. Although transformational leadership was found to have a relationship with safety climate (Hypothesis 1) and safety climate was found to have a relationship with safety compliance (Hypothesis 3b), no relationship was found between transformational leadership and safety compliance (Hypothesis 2b). Because no relationship between transformational leadership and safety compliance was found, not all prerequisites for mediation analysis were met. Therefore, no hierarchical regression analysis was performed to test for mediation, and Hypothesis 4b was rejected.

### **4.3 Additional Analyses**

Although all analyses regarding the hypotheses have now been performed, several findings indicate that it would be valuable to perform additional analyses. When looking at the results of the regression analysis, in table 3, it is remarkable that when the supposed mediator variable (i.e. safety climate) is added to the model, the relationship between safety climate and safety participation was not found to be significant ( $B = .242, p = ns$ ). However, the relationship between transformational leadership and safety participation was still found to be significant ( $B = .347, p < .05$ ). These results might indicate that it is not safety climate that mediates the relationship between transformational leadership and safety participation, but that it is transformational leadership that mediates the relationship between safety climate and safety participation<sup>4</sup>. A hierarchical regression analysis was performed to assess these relationships; the results are shown in table 5.

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<sup>4</sup> The probability of the existence of this relationship is further discussed in the discussion section.

**Table 5**

*Results of Hierarchical Regression Analysis for the Influence of Safety Climate and Transformational Leadership on Safety Participation.*

| Model                       | Unstandardized Coefficients |            | Standardized Coefficients | t     | Sig.   |
|-----------------------------|-----------------------------|------------|---------------------------|-------|--------|
|                             | B                           | Std. Error | Beta                      |       |        |
| 1. (Constant)               | 1.363                       | .498       |                           | 2.734 | .008** |
| Safety Climate              | .414                        | .146       | .317                      | 2.833 | .006** |
| 2. (Constant)               | .956                        | .512       |                           | 1.866 | .066   |
| Safety Climate              | .242                        | .159       | .185                      | 1.521 | .133   |
| Transformational Leadership | .347                        | .146       | .289                      | 2.380 | .020*  |

Note. \*  $p < .05$ , two-tailed

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

The results show that, initially, safety climate was significantly related to safety participation. However, when transformational leadership was added to the model, the effect of safety climate disappeared completely, while the effect of transformational leadership was found to be significant. According to the requirements established by Baron and Kenny (1986), these findings suggest that complete mediation is present. In order to determine whether this is indeed the case, another Aroian Sobel test was performed. The results of this test are shown in table 6.

**Table 6**

*Results of the Aroian Sobel Test for the Significance of the Mediation Effect of Transformational Leadership, on the Relationship Between Safety Climate and Safety Participation.*

|                             | Z-Value | Std. Error | Sig. |
|-----------------------------|---------|------------|------|
| Safety Climate              | 1.758   | .082       | .079 |
| Transformational Leadership |         |            |      |

The outcomes of the Aroian Sobel test reveal that the relationship between safety climate and safety performance is not significantly mediated by transformational leadership ( $Z = 1.758$ ,  $p = ns$ ). Although all requirements for mediation were met, apparently the  $\Delta B$  of safety climate was not significantly reduced. Therefore, the idea that the relationship between safety climate and safety participation is mediated by transformational leadership is rejected.

Since no significant mediation effects were found for the main scales, it was decided to further examine the relations among the subscales. This might present a

more clear image of the way the different dimensions influence each other. The first interesting results were found when analyzing the relationship between transformational leadership, safety information flow (subscale of safety climate) and safety participation. Transformational leadership was found to be significantly related to safety information flow ( $r = .37, p < .01$ ) and was already proven to be significantly related to safety participation (Hypothesis 2a). Furthermore, safety information flow was also found to be significantly related to safety participation ( $r = .39, p < .01$ ). Hierarchical regression analysis was performed to test whether safety information flow mediated the relationship between transformational leadership and safety participation<sup>5</sup>. The results are shown in table 7.

**Table 7**

*Results of Hierarchical Regression Analysis for the Influence of Transformational Leadership and Safety Information Flow on Safety Participation.*

| Model                       | Unstandardized Coefficients |            | Standardized Coefficients | t     | Sig.   |
|-----------------------------|-----------------------------|------------|---------------------------|-------|--------|
|                             | B                           | Std. Error | Beta                      |       |        |
| 1. (Constant)               | 1.485                       | .379       |                           | 3.915 | .000** |
| Transformational Leadership | .447                        | .131       | .374                      | 3.418 | .001** |
| 2. (Constant)               | 1.033                       | .407       |                           | 2.542 | .013*  |
| Transformational Leadership | .320                        | .136       | .268                      | 2.361 | .021*  |
| Safety Information Flow     | .243                        | .096       | .288                      | 2.545 | .013*  |

*Note.* \*  $p < .05$ , two-tailed  
\*\*  $p < .01$ , two-tailed

The results from the hierarchical regression analysis reveal several notable results. Firstly, the strength of relationship between transformational leadership and safety participation is reduced when safety information flow is added to the model, but was still found to be significant ( $B = .447, p < .01$ , in model 1;  $B = .320, p > .05$ , in model 2). Secondly, safety information flow also shows a significant relationship with safety participation in model 2 ( $B = .243, p < .05$ ). These findings suggest that partial mediation might be present. An Aroian Sobel test was performed to determine whether this is indeed the case. The results are shown in table 8.

<sup>5</sup> Further theoretical arguments for the existence of this relationship are presented in the discussion section.

**Table 8**

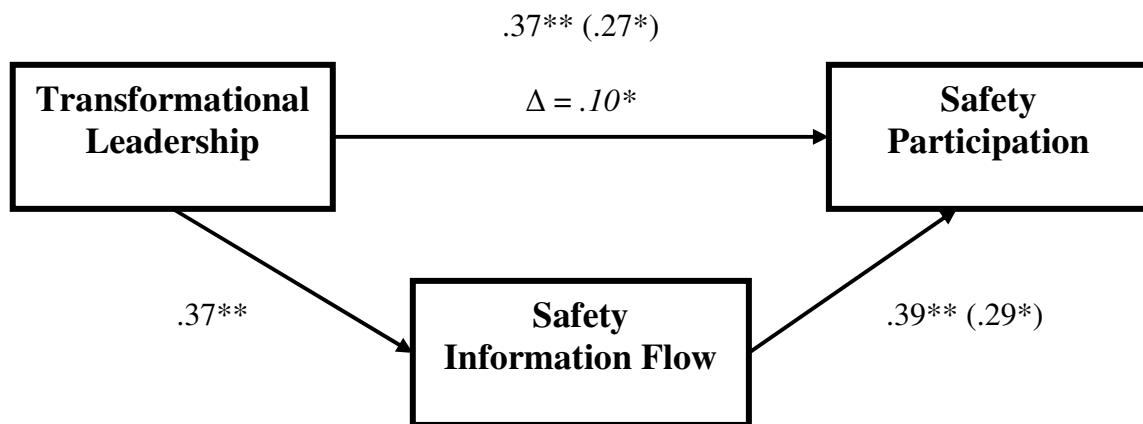
*Results of the Aroian Sobel Test for the Significance of the Mediation Effect of Transformational Leadership, on the Relationship Between Safety Information Flow and Safety Participation.*

|  | <b>Z-Value</b> | <b>Std. Error</b> | <b>Sig.</b> |
|--|----------------|-------------------|-------------|
| Transformational Leadership<br>Safety Information Flow | 1.979          | .055              | .048*       |

*Note.* \*  $p < .05$ , two-tailed

According to the results of the Sobel test, the strength of the relationship between transformational leadership and safety participation was significantly reduced by the introduction of safety information flow into the model. Therefore, the results support the claim that the relationship between transformational leadership and safety participation is partially mediated by safety information flow.

Based on the findings in the present study, a conceptual model is presented (see figure 2). Conveniently, both the initial correlations and the correlations from the hierarchical regression analysis (between parentheses) are depicted. The theoretical and practical implications following from the results, will be discussed in the discussion section.



*Note.* \*  $p < .05$ , two-tailed  
\*\*  $p < .01$ , two tailed

**Figure 2**

*Conceptual model showing that the relationship between transformational leadership and safety participation is partially mediated by safety information flow.*

## 5. Discussion and Conclusion

### 5.1 On the Findings of the Present Study

The aim of the present study was to shed light on the relationships between leadership, safety climate and safety performance within construction projects. By doing so, the present author hopes to offer leaders and managers in the construction sector some insight into ways in which they are able to influence the social context of their projects, in order to produce more effective safety outcomes. Especially given the fact that the construction sector has been marked as one of the Netherlands most dangerous work environments (Ministry of Social Affairs and Employment & National Federation of Christian Trade Unions, 2009), such a study was thoroughly warranted.

#### 5.1.1 *The Role of Safety Information Flow*

The results show that a transformational leader is able to affect the level of safety participation of his subordinates through his influence on the safety information flow. This is partially in line with the study by Clarke and Ward (2006), who found that safety climate mediates the relationship between transformational influence tactics and safety participation. Furthermore, the identification of safety information flow as the mediator, is in line with the study by Mearns et al. (2003). They argued that *communication* played an important role in the way that safety climate predicts safety performance. Safety information flow refers to how employees perceive the amount of information they receive through routine circulation of safety information and training (Katz-Navon, et al., 2005). Evidently, the way employees perceive information concerning safety is affected by the level of effective communication in the project. Given the fact that transformational leaders are characterized by their use of high quality communication, it likely that they exert a positive influence on the safety information flow in the project. Subsequently, this manifests in a better understanding of the safety program, which in turn might have a positive effect on safety participation. Specifically, a better understanding of the safety program might lower the threshold to demonstrate initiative, to put effort into improving safety in the workplace and to help co-workers promote the safety program (this being the definition of safety participation by Neal, et al., 2000). Following this rationale, it is quite understandable that safety information flow was found to be the dimension that mediates the relationship between transformational leadership and safety participation.

### 5.1.2 A Closer Look at the Leadership-Climate-Performance Triad

While it might be sensible that safety information flow mediates the relationship between transformational leadership and safety participation, it is remarkable that the other subscales of safety climate do not show a similar effect. When looking at the relationships between the safety climate subscales and the safety performance scales several results catch the eye. Firstly, it stands out that only the main scale (i.e. safety climate) and the subscale safety information flow show a significant positive relationship with safety *participation*. This makes it likely that the relationship between safety climate and safety participation is mostly due to the influence of safety information flow. Secondly, the influence of a transformational leader on safety climate, mostly takes place via safety information flow; a statement supported by the results of the conducted Sobel tests. Thirdly, when looking at the relationship between the safety climate (sub)scale(s) and safety *compliance*, one notices that all subscales show a significant positive relationship with safety compliance. Safety compliance is concerned with adhering to safety procedures and carrying out work in a safe manner (Neal, et al., 2000). These findings seem to suggest that while the level of safety participation is mostly influenced by the way information is transferred in a project, safety compliance is also influenced by the way the safety procedures are formulated, the way the manager exhibits safety practices and the true priority of safety within the project.

When examining the role of transformational leadership with regard to the above, the following can be said. The results show that transformational leadership is mostly related to informational safety flow, managerial safety practices and, to a lesser extent, to safety procedures. However, no relationship was found between transformational leadership and priority of safety. Although these results might seem unexpected at first, a closer look indicates that the results make sense. As said before, the high quality communication of a transformational leader is likely to positively influence the informational safety flow. Furthermore, seeing as a transformational leader often acts as a role model, the positive relationship with safety management practices was to be expected. Where the safety procedures are concerned, it is likely that a supervisor is only able to influence them to a certain point, since they are often developed by a safety department or manager. This would explain the lower (but still significant) relationship between transformational leadership and adherence to safety procedures. Lastly, transformational leadership seems to have no significant relationship with the priority of safety. It is likely that employees derive the priority of safety from the top management, which perhaps will either demand the employees to work quickly or safely, thus reducing the influence of

the direct supervisor in this aspect. These arguments combined support the findings concerning the relationships between transformational leadership and the safety climate subscales.

Another remarkable finding, is that transformational leadership was found to be unrelated to safety compliance. This would indicate that the transformational behaviour of a supervisor will not result in the employees adhering to safety procedures and carrying out their work in a safe manner. On the other hand, two *subscales* of transformational leadership *do* seem to be related to safety compliance. These are the subscales individualized consideration and intellectual stimulation. Apparently, while the idealized influence and inspirational motivation components of transformational leadership have no relation to safety compliance, the other two do affect it significantly. Reason for this discrepancy might be that neither the charisma of a supervisor, nor his vision of the future, is something that helps the employees to work more safely. Individualized consideration, in contrast, is concerned with high quality communication and acting as a mentor and a role model. Furthermore, intellectual stimulation refers to the ability of a leader to encourage followers to reframe problems, challenge existing assumptions and approach old situations in new ways (Bass, 1997). In other words, it is concerned with letting subordinates think for themselves and enhancing their ability to solve problems. It is quite reasonable to assume that a leader who communicates clearly, sets the example himself, and learns subordinates to deal with problems themselves, can affect the extent to which employees adhere to safety procedures and work in a safe manner. This might explain why individual consideration and intellectual stimulation *are* related to safety compliance, while idealized influence and inspirational motivation are not.

The last finding that will be discussed is the fact that transformational leadership showed not to be a mediator in the relationship between safety climate and safety participation. This relationship was not expected to be found in the current study, but there are arguments that suggest that this relationship might exist. It might be that a high level safety climate (wherein employees have knowledge of safety procedures, the safety information flow is efficient and of high quality, the managers exhibit safety practices themselves and safety has a high priority); might have a positive effect on the transformational behaviour of a leader. It is reasonable to suggest that such an environment makes it easier for a supervisor to display transformational leadership skills. Subsequently, an increase of transformational behaviour would result in higher safety participation, as a transformational leader might stimulate the employees to demonstrate initiative, to put effort into improving safety in the workplace and to help co-workers promote the safety program. But although these arguments might be



theoretically sound, in line with the expectations of the present study, the existence of these relationships was not confirmed.

## **5.2 Limitations of the Present Study**

Naturally, the present study also has some limitations. The first limitation is the fact that the current study is cross-sectional in nature. Strictly speaking, one can never draw conclusions concerning causality from purely cross-sectional data. In order to ascertain a causal relationship one has to use either a longitudinal or an experimental research design (Goodwin, 2005).

Secondly, the small sample size ( $N = 77$ ) is also a limitation of the present study. A small sample might not give an adequate representation of the population, thus making it difficult to generalize results and conclusions to that population. Additionally it can be said that, technically speaking, the performed factor analyses also required a larger sample size.

As is the case with most studies on the leadership-performance connection (Bass, 1990; Yammarino, et al., 1993; Yukl, 1989), the present study was also conducted using a single source of data (i.e. the subordinates) to report about leadership behaviour and performance at a single point in time. This brings us to the third limitation of the present study. Yammarino et al. (1993) state that the leadership-performance connection is difficult to assess when all information about these dimensions is obtained from the same source (usually subordinates of the leader in question). This because subordinates may hold stereotypes and implicit theories about which leadership and performance behaviours are associated. Also, positive behaviour might be attributed to leaders who are perceived as being effective, without actual observation of that behaviour. Because the employees' perceptions of their own performance or that of their supervisor might systematically influence their view of leadership, Yammarino and his colleagues stress that independent multisource data for leadership and performance are necessary. In future research, this is something to keep in mind.

The fourth and final limitation has to do with the measurement of transformational leadership. The subscales charisma, individual consideration and intellectual stimulation were all found to be very strongly related to the main scale (correlation coefficients were .91, .90 and .88, respectively). These findings suggest that the subscales might not measure a dimension of transformational leadership, but rather (transformational) leadership itself. An explanation for these results might be that the differences in formulation of the items were too subtle. As a result, the respondents

might have had a hard time distinguishing between the items. This, in turn, might endanger the validity of the transformational leadership scale. Because of the small sample size of the present study, it is difficult to draw strong conclusions where the validity of the (sub)scales is concerned. However, the present author would advise future researchers to make sure that respondents are able to adequately distinguish between the different items. For example, items could be formulated more concretely, instead of in global, descriptive terms. This might make it easier for respondents to grasp the real meaning of a given item, since it is more easily applicable to their own work environment. Subsequently, it is expected that respondents are better able to distinguish between the different items of the subscales.

### **5.3 Directions for Future Research**

In order to further clarify the complex relationships between leadership, climate and performance, more research is needed. Based on the existing literature and the findings of the current study, several areas of investigation are identified which –in the opinion of the present author– deserve more attention in the future. These will now be discussed.

Firstly, as became apparent in the present study, communication plays a vital role in the relationship between transformational leadership, safety climate and safety participation. Therefore it might be valuable to compare projects and organizations with different types and quality of communication, in order to assess to which extent communication influences safety performance measures. Furthermore, it is interesting to further explore the way in which leaders –with different dominant leadership styles– communicate. This might give us insight into the effectiveness of different leadership styles, and show us which (combination of) leadership style(s) related communication has the most potential to improve safety performance.

Secondly, it might be that behaviours associated with other leadership styles also have a positive relationship with safety climate and safety performance. This statement is supported by Clarke and Ward (2006), who found that both transformational and transactional influence tactics may have a positive influence on safety climate and safety performance. Further investigation of the role of other leadership styles (especially transactional leadership) is therefore warranted. Especially since all safety climate subscales show to be positively related to safety compliance, it is interesting to further investigate the antecedents of safety climate. It might be that the most effective way to improve safety performance is not displaying

the behaviour associated with one particular leadership style. Rather, several effective behaviours from different leadership styles might be combined, to maximize the positive influence of a leader on safety performance. To tell us whether this is indeed the case, more research is needed.

Thirdly, the focus of the present study lied solely on projects. In the future it might be valuable to further study the existing differences between projects and the organization as a whole, where the influence of (transformational) leadership on safety performance outcomes is concerned. This comparison is of particular interest because it deals with the transition from work climate to organizational culture. Leaders are able to influence climate, but to exert influence on organizational culture is much harder (Denison, 1996). This because organizational culture is deeply rooted, and therefore difficult to change. Although a leader might try to positively influence the safety climate and safety performance of his project, it is likely that this will only have an effect when this (to a certain extent) is in line with the organizational culture. When a 'safe project' is part of an 'unsafe organization', the project becomes an isolated cultural island, with values and practices different from those in the rest of the organization. This might result in the employees experiencing friction between the work climate in the project on the one hand, and the organizational culture on the other. Seeing as culture is difficult to change, it is reasonable to assume that the climate will be changed in order to resolve the existing friction. Considering this, it is doubtful that a project is able to develop a high safety climate and performance, when this is highly incongruent with the organizational culture. Therefore, it might be a good idea for future researchers to also examine the organizational culture, when assessing the climate within a project. By doing so, they might be able to identify organizational culture factors which inhibit or stimulate the development of safe behaviour in projects. Additionally, the short-term effects (changes in the project climate) and long-term effects (changes in the organizational culture) could be assessed in this way.

The final suggestion for future research has to do with the different ways in which safety climate can be measured. As discussed in the theoretical framework of the present study, climate can be measured in two ways. The first option is to measure the climate *level*, as was done in the present study. The second possibility is to measure the climate *strength*. Because the present author is of opinion that the studying of climate strength can be highly beneficial for further clarifying the relationships between leadership, climate and performance, an extra chapter on climate strength is added to the present research report (see chapter 6).

#### **5.4 Practical Implications**

As explained in the introduction of the present research report, the main question that this study wanted to answer is: *To what extent are leaders able to influence the safety performance of their project, and what is the role of safety climate within this relationship?* Several practical implications can be distilled from the results of the present study, which at least provide a partial answer to this question.

In general, it can be said that some transformational leadership behaviours show a positive relationship to safety performance. In contrast, others seem to be less effective. The outcomes show that it is not the charisma of a leader, not his vision of the future, that stimulates employees to work more safely. Rather, the communication of the leader, him being a mentor and a role model and setting the example, and his capability to constructively let his subordinates deal with problems themselves, are probably the most effective transformational behaviours for the improvement of safety performance. Therefore, leaders should mostly focus on their communication, making sure it is of high quality. Information regarding safety should be adequately transferred to the employees and should be made widely available. Furthermore, transformational leaders should not rely on their charisma or vision of the future, if they want to improve the safety performance of their project. Conversely, they *should* make sure their employees are able to think for themselves, and are able to deal with occurring problems. Also, leaders and managers have to set the example; they have to practice what they preach. By acting as a role model, a leader demonstrates commitment to the safety program and disseminates the importance he assigns to safety.

#### **5.5 Conclusion**

The present study shows us that safety information flow mediates the relationship between transformational leadership and safety participation. Also, it seems that communication plays an important role in this relationship. Conversely, safety climate does not mediate the relationship between transformational leadership and safety compliance, nor do the safety climate subscales. However, several transformational leadership behaviours are positively related to safety compliance. Also safety climate showed to be related to both safety participation and safety compliance. Future research should focus on further clarifying the ways in which leaders are able to influence safety climate and safety performance.

## 6. Theoretical Discussion: Climate Strength

Because of practical limitations, the present author was not able to pay attention to the concept of climate strength in the current study. However, climate strength is a construct with considerable conceptual appeal and it might prove highly valuable in future climate research. Therefore, in this theoretical discussion, the present author will further elaborate on climate strength. First, the origins of climate strength are discussed. Subsequently, its relationship to situational strength and ambiguity will receive wide attention. Afterwards, the relationship between climate strength and transformational leadership will be discussed. Lastly, final arguments for the studying of climate strength are presented. In this way, the present author hopes to stimulate other researchers to further explore the features and qualities of climate strength. Hopefully, it will lead to safer work environments, with less accidents and injuries with dire consequences.

### 6.1 The Origins of Climate Strength

When assessing *climate strength*, one looks at the agreement or consensus of individual climate perceptions. The greater the consensus, the stronger the climate (Zohar & Tenne-Gazit, 2008) and thus, the better defined climate has become as a group-level property (Bliese, 2000; Bliese & Halverson, 1998; Chan, 1998; Dickson, Resick & Hanges, 2006; Lindell & Brandt, 2000; Schneider, Salvaggio & Subirats, 2002). Three conceptual, literary contributions have stimulated the emergence of climate strength as a scientific construct. The first of these is the work on *compositional models* in psychology by Chan (1998), which focuses on the functional relationships of constructs at different levels of analysis (e.g., individual level, team level, organizational level) that deal with the same content but are qualitatively different at different levels. Secondly, research on dispersion theory (DT) by Brown and Kozlowski (1999), in which within-unit agreement is a focal construct, also contributed to the studying of climate strength. The third and final literary contribution to the emergence of climate strength studies is found in the works on culture strength. These three segments of literature, and their relevance to climate strength, are discussed below.

### 6.1.1 Compositional Models

Stated simply, the function of a composition model is to explain how one construct should be represented at different levels of analysis (James, 1982; Schneider et al., 2002). Different kinds of compositional models exist; Chan (1998) therefore developed a typology to set them apart. Taking previous research into account (cf. Brown, Kozlowski & Hattrup, 1996; Rousseau, 1985), Chan identified five types of compositional models: *additive models*, *direct consensus models*, *referent shift models*, *dispersion models* and *process models*. In *additive models* the summation of lower level variables form group constructs; in *direct consensus models* the consensus among lower level variables is the meaning of the group-level construct; in *referent shift models* the lower level variables formed by consensus are conceptually distinct from the original lower level variables; in *dispersion models* the variance of the lower level variables is the meaning of the group-level construct; and, finally, within *process models* lower level process parameters are analogous to the group-level process parameters (Chan, 1998; Schneider et al., 2002).

Two of the five types mentioned above are of particular interest to climate strength research. These are the direct consensus-type models and the dispersion-type models. In a direct consensus model, the shared perceptual agreement at the individual level of analysis is seen as functionally isomorphic to the construct at the organization level of analysis (Chan, 1998). From this it follows, that the use of within-group agreement at the group-level of analysis, is a condition sine qua non when assessing the group-variable. After all, if there is no shared perception, or if there is high within-group variability, it implies that the group-level construct does not exist. Thus, the group has no shared meaning (Klein, Conn, Smith & Sorra, 2001). In climate research, this model is probably the one most frequently discussed (Chan, 1998; Schneider et al., 2002). Traditionally, researchers need to show one or several indicators of sufficient within-group agreement, in order to use aggregation and study climate at the unit-level. The existence of direct consensus (agreement) is shown by demonstrating that the average within-group agreement across units is sufficient (James, Demaree & Wolf, 1984) or by proving the presence of a significant main effect across units (Dansereau & Alutto, 1990).

Where in direct consensus models within-unit agreement is a prerequisite for aggregation, in dispersion models it rather is a focal construct (Chan, 1998; González-Romá et al., 2002). As González-Romá et al. (2002) adequately state: dispersion (or its opposite, within-unit agreement) is, by definition, a unit-level characteristic. Therefore, in dispersion models, within-unit agreement is used as the operationalization of a unit-level construct (Chan, 1998; González-Romá et al.,

2002). Although dispersion constructs are relatively rare, at least within the organizational research field (Brown & Kozlowski, 1999; Klein et al., 2001), climate strength is one of the few examples that can be found (Brown & Kozlowski, 1999; Chan, 1998; Lindell & Brandt, 2000; Salvaggio, Schneider & Subirats, 2000).

In conclusion, it can be said that both the direct consensus model and the dispersion model contributed to the emergence of climate strength research by addressing the concept of within-group agreement. This important development has rightfully led researchers to viewing climate strength as a scientific construct worth studying.

### *6.1.2 Dispersion Theory*

Literature on the *Dispersion Theory (DT)* has also been important for the shift towards studying climate strength (González-Romá et al., 2002). As is the case in dispersion models of composition, within-unit agreement is also a focal construct in dispersion theory. Developed by Brown and Kozlowski (1999), DT served as an initial effort to surpass the dominant dichotomous view of emergence of higher level constructs, nursed by the direct consensus model of composition. It stresses that constructs measured at the individual level of analysis (for instance, psychological climate) unite through processes of social interaction to emerge as unit-level constructs (for instance, work team climate). The extent to which higher level constructs emerge, is measured through within-unit agreement. Thus, Brown and Kozlowski (1999) argue, the more within-unit agreement is present, the more meaningful a unit characteristic becomes and the more that unit can be characterized by that phenomenon. When applying this to climate research, the climate strength (i.e. within-unit agreement) can be seen as an indicator of the degree of emergence of work units' climate (González-Romá et al., 2002).

By drawing attention to the use of within-unit agreement as a focal construct, research on the dispersion theory has (partly) paved the way for present day climate strength research.

### *6.1.3 Culture Strength*

There has been considerable debate as to what exactly is the difference between culture and climate (Denison, 1996). Although Denison (1996) concludes that climate and culture research traditions should be viewed as differences in interpretation, rather than differences in phenomenon, the two traditions are mostly seen as distinct from one another. Nevertheless, culture and climate actually address a common phenomenon: the creation and influence of social contexts in organizations (Denison,

1996). Therefore, exploring research themes from culture research to study in a climate-context (and vice versa) might prove very useful. In the present case, the culture phenomenon analogous to climate strength, *culture strength*, might offer valuable insights. Borrowing and transferring the concept of culture strength to climate research, in the form of climate strength, has increased the studying of the topic (Schneider et al., 2002).

In research concerning high variability in culture, different authors present different models. Martin (1992), for example, speaks of the deviance model of culture, where Trice and Beyer (1993) call it the dissensus model of culture. While both these models address the lack of agreement among culture members, there is little consensus in literature of whether a culture in which there is deviance or dissensus, can be classified as being a *fragmented culture* or if one cannot speak of culture at all (Martin, 1992). If one adopts the definition of culture by Deal and Kennedy (1982), "*The way we do things around here*", the existence of culture becomes doubtful. After all, if there is high variance in a given culture (i.e. low culture strength), there is no clear way of *how things are done around here*. Thus, one could conclude that no culture exists. On the other hand, as Trice and Beyer (1993) pose, where one draws the line on whether a culture exists (or not) is, at best, a paradox. The fact that culture researchers are inclined to use mostly qualitative measures (Denison, 1996), and thus have not been particularly adamant about adequately trying to index agreement or culture strength in a quantitative form, provides at least partial support for this statement.

The importance that should be accorded to culture strength is still subject of debate (Wilderom, Glunk & Maslowski, 2000). The main issue is that research on the effect of culture strength on performance shows inconsistent results (Kotter & Heskett, 1992). Some authors claim that in a stable environment high culture strength can positively influence (the predictability of) performance, while in volatile environments a strong culture might sooner become a liability (Cummings & Worley, 2005; Sorensen, 2002). Logically speaking, this finding is not surprising. After all, if there is a clear *way to do things around here* a strong culture might enhance efficiency in decision making and operational processes. If *the way we do things around here* tends to change frequently, as is the case in a volatile environment, creativity might be stunned by a strong culture and it may become more difficult to exploit new environmental opportunities (Cummings & Worley, 2005; Sorensen, 2002).

But regardless of the effects and practical usability of culture strength according to the literature, the topic of culture strength has considerable conceptual appeal, as



Schneider and his colleagues (2002) so righteously pose. The idea that members of a (sub)culture share values and beliefs is a component of essentially all definitions of organizational culture, and this 'sharedness' is considered its defining basis (Trice & Beyer, 1993). This characteristic is also true for climate definitions and therefore importing the concept of culture strength to climate research, in the form of climate strength, can be seen as an important step towards better understanding of social contexts in organizations, teams and projects. In this way culture strength has contributed, and still contributes, to the emergence of climate strength literature.

## **6.2 On Climate Strength, Situational Strength and Ambiguity**

Previous studies which address the moderator influences of climate strength, have yielded contradictory and inconclusive results (González-Romá et al., 2002). Moreover, in studies where within-group variability was measured with the aid of climate strength measurements, it appeared that climate perceptions may vary (Luria, 2008). An explanation for these results may be sought in the idea of *situational strength*, a concept proposed by Mischel (1973, 1976). *Situational strength* refers to the degree of ambiguity present in a given context. In a situation with little ambiguity (i.e. a strong situation), people tend to perceive events similarly, have uniform expectations about appropriate behaviour and responses and necessary skills to perform that behaviour are induced. Conversely, in weak situations (i.e. situations with a high level of ambiguity), events are not perceived in the same way, leading to inconsistent or even non-existent expectations about appropriate behaviour (González-Romá et al., 2002; Luria, 2008; Mischel, 1973; 1976; Schneider et al., 2002). Because people in weak situations lack consistent expectations about appropriate behaviour, individual differences will determine behaviour more clearly than would be the case in strong, unambiguous situations (Mischel, 1973; 1976). From this it follows, that people's responses will have small variability in strong situations, while the variability of response will be high in weak situations (González-Romá et al., 2002; Luria, 2008; Mischel, 1973; 1976; Schneider et al., 2002). In other words, degree of consensus on the perceived importance of a climate facet may be higher in some units than in others, resulting in more consistent and uniform behaviour regarding that specific facet in units with more consensus. This means that ambiguity and situational strength might have a huge impact on climate strength and act as its antecedents..

Two common approaches regarding climate strength antecedents are found in the literature (González-Romá et al., 2002; Luria, 2008). The first approach focuses

on *leadership* –and is thus termed ‘the leadership approach’–, where it is assumed that “leaders create climate” (Lewin, 1951) and that their communication behaviour creates consensus (González-Romá et al., 2002; Kozlowski & Doherty, 1989; Luria, 2008; Zohar, 2002; Zohar & Luria, 2004). The second approach focuses on *social interaction* –and is thus termed ‘the interactive approach’– and assumes that (horizontal) social interaction within a group creates consensus (González-Romá et al., 2002; Klein et al., 2001; Luria, 2008).

Since the emphasis of the present study lies on the influence of leaders, only the leadership approach will be discussed below. However, the present author in no way discourages further studying of the interactive approach.

### **6.3 Leadership as an Antecedent of Climate Strength**

The foundation for the assumption that leadership may function as an antecedent of climate strength, was laid approximately two decades ago. In their study on the quality of leader-member exchange, Kozlowski and Doherty (1989) found that there was greater consensus among work-unit members on a number of organizational climate measures when the quality of leader-member exchange was high, than was the case in work-units with low quality supervisor relationships. This suggests that the interaction between leaders and members may be a potential determinant of within-unit consensus regarding climate perceptions –in other words, climate strength– (González-Romá et al., 2002). Herein, the nature and quality of interaction with leaders might serve as imperative filters in the interpretation processes that provide the formative basis for climate perceptions of the subordinates (Luria, 2008). This means, that a high quality leader is associated with high quality communication (Linden & Graen, 1980), which in turn stimulates higher consensus about relative priorities among group members, thus promoting climate strength (Luria, 2008). González-Romá et al. (2002) offered support for this thought, by demonstrating that leaders use informing behaviour (Yukl & van Fleet, 1992) to shape unit member’s perceptions of the unit, thus promoting within-unit agreement in regard to unit perception.

Luria (2008) utters some criticism on the role of leader-member exchange as antecedent of climate strength, posing that the theory focuses on the leader’s relationship with each individual group member, thus making an explanation of a group level construct such as climate strength problematic. Instead, he proposes the use of the full-range leadership model (Bass, 1990; Bass & Avolio, 1997), which may offer a better explanation of the relationship between leadership and climate strength.

In the full-range leadership model, as discussed in the theoretical framework of the present study, a vital role is reserved for transformational leadership. The relationship between transformational leadership and climate strength will now be discussed.

### *6.3.1 Transformational Leadership & Climate Strength*

Given the characteristics of transformational leadership (as discussed in the theoretical framework of the present study), Zohar and Tenne-Gazit (2008) present several reasons why it is likely that it affects climate strength. Firstly, they argue, transformational leaders will nurse closer relationships with their subordinates, which is characterized by small power distance and the individualized consideration component mentioned earlier (Bass, 1990; Yukl, 2006). Furthermore, mutual trust and openness sustains this relationship (House & Shamir, 1993), as does the richness of verbal communication between leaders and their subordinates (Klauss & Bass, 1982). Thus, transformational leaders create more opportunities for sharing and clarifying perceptions (Kozlowski & Doherty, 1989) and offer better articulation of task cues (Kirkpatrick & Locke, 1996). In this way group members are provided with better information for assessing what is prioritized, supported and valued, which in turn leads to the fact that the development of shared cognitions is promoted, resulting in a stronger climate (Zohar & Tenne-Gazit, 2008).

Secondly, they pose, the leadership practices of transformational leaders are expected to exhibit greater consistency across situations. This assumption is made based on the fact that transformational leaders rely on values and visions as their logics of action (Bass, 1990; Burke, Stagl, Klein, Goodwin, Salas & Halpin, 2006; Conger & Kanungo, 1992; Shamir, House & Arthur, 1993). In contrast, non-transformational leaders often need to re-interpret organizational procedures and policies, before applying them in different under conditions in their units (Zohar & Luria, 2005). Because non-transformational leaders lack the adoption of higher order referents (i.e. values and visions) they are expected to act less consistently than do transformational leaders (Zohar & Tenne-Gazit, 2008).

The third and final reason Zohar and Tenne-Gazit (2008) espouse, concerns the tendency of transformational leaders to act consistently especially in situations where the safety or welfare of their subordinates is at stake. Rooted in the motivational base of transformational leadership, these leaders promote the individualized empowerment of followers (Bass, 1990), which is coupled with the alignment of individual goals with those of the group and the larger organization. The authors base this assumption on earlier research (Zohar & Luria, 2004) in a military context, in which the inherent risk of military field operations forces leaders to incorporate the

competing demands of mission accomplishment and safety considerations into their leadership role. Reason (1997) states that similar daily dilemmas are present in civil organizations whose operations implicate employee safety and health. Thus, it can be expected that transformational leadership will promote higher climate strength, especially when the focal facet of said climate is associated with subordinates welfare or safety (Zohar & Tenne-Gazit, 2008).

Taken altogether, the literature and theory discussed above clearly illustrates the relationship between leadership and climate strength, as well as the positive influence that can be expected of transformational leadership.

#### **6.4 Conclusion**

In the opinion of the present author, the studying of climate strength might shed more light on the relationships between transformational leadership, safety climate and safety participation. The results of the present study show that especially communication is of particular importance in these relationships. As stated above, communication is used to reduce ambiguity and strengthen a given situation. To give an example in the context of the present study: less ambiguity concerning the safety program would result in a stronger situation, with a stronger safety climate. It is the communicative power of a transformational leader that plays a key role in this relationship. But, ultimately, it is climate strength that gives us an indication of to what degree the employees perceive safety events similarly. Therefore, it might be highly valuable to further investigate the influence that safety climate strength has on the relationships between transformational leadership, safety climate and safety participation.

By including safety climate strength in future research, the underlying mechanisms of how leaders are able to influence safety climate and safety performance might be further clarified. Hopefully, in the near future, this will lead to a reduction of accidents and injuries in the workplace.

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## 8. Appendix

### 8.1 Contents of the Questionnaire

The questionnaire used in the present study, was constructed to measure different leadership styles, safety climate and subjective safety performance. Below, the items of the questionnaire are presented (in Dutch), as are their corresponding scales. The questionnaire itself, as it was presented to the respondents, can be found in appendix 8.4.

***Construct:*** Leiderschap

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**Schaal:** Transformationeel Leiderschap

**Subschaal:** *Charisma*

- Items:*
1. Hij zorgt ervoor dat ik goed in mijn vel zit.
  2. Het maakt me trots om met hem in verband te worden gebracht.
  3. Ik vertrouw hem voor 100%.
  4. Hij heeft een speciale gave om te zien wat er voor mij echt belangrijk is.
  5. Hij is een symbool voor succes.
  6. Ik heb respect voor hem.
  7. Hij maakt me enthousiast over de te vervullen opdrachten.
  8. Hij vergroot mijn optimisme voor de toekomst.
  9. Ik heb vertrouwen in hem, als het gaat om zijn vermogen om moeilijke problemen op te lossen.

**Subschaal:** *Inspirational Motivation*

- Items:*
1. Ik kan mijn gestelde werkdoelstellingen niet bereiken zonder zijn hulp.
  2. Zonder zijn toekomstvisie, zou ik het moeilijk hebben om mijn doelstellingen te realiseren.
  3. Hij heeft een visie die hij op mij overbrengt.
  4. Hij prikkelt me om beter en harder te werken.
  5. Hij stelt me in staat om meer te doen, dan wanneer hij niet in de buurt zou zijn.
  6. Ik ga verder in het willen bereiken van doelstellingen dankzij zijn invloed.
  7. Hij geeft me soms een pep-talk.
  8. Hij prikkelt me zodat mijn inspanningen uitsteken boven die van mijn collega's.

Subschaal: Individualized Consideration

- Items:*
1. Hij geeft me persoonlijke aandacht wanneer het nodig is.
  2. Hij geeft me af en toe feedback over mijn prestaties op het werk.
  3. Hij behandelt me als een individu.
  4. Hij zoekt uit wat ik wil en geeft dan aan hoe ik dat kan bereiken.
  5. Hij zal zijn waardering tonen als ik goed werk lever.
  6. Hij besteedt veel tijd aan mij coachen, wanneer ik het nodig heb.
  7. Hij geeft me advies wanneer ik het nodig heb.
  8. Hij is bereid de rol van persoonlijk leraar op zich te nemen als ik hulp nodig heb.
  9. Hij geeft veel hulp aan nieuwkomers.

Subschaal: Intellectual Stimulation

- Items:*
1. Zijn ideeën hebben me gedwongen om over enkele van mijn ideeën opnieuw na te denken.
  2. Hij laat me naar problemen kijken op een manier die me toelaat mijn vaardigheden om probleemoplossend te denken te verbeteren.
  3. Hij zorgt ervoor dat ik problemen op een andere manier bekijk.
  4. Hij heeft ervoor gezorgd dat ik problemen, die vroeg raadsels waren, nu op een nieuwe manier bekijk.
  5. Hij verschaft me redenen om mijn manier van denken omtrent problemen te veranderen.
  6. Hij benadrukt het gebruik van het verstandelijk vermogen om een hindernis of obstakel weg te werken.
  7. Hij verlangt dat ik mijn mening staaf met goede argumentatie.
  8. Hij pakt de kern van complexe problemen snel aan.
  9. Hij legt de nadruk op zorgvuldig probleemoplossend denken voordat ik actie onderneem.
  10. Hij zorgt ervoor dat ik grondig nadenk alvorens een actie te ondernemen.
  11. Hij zorgt ervoor, dat ik mijn mening opbouw via een goed onderbouwde redenering, in plaats van een mening te gebruiken die niet onderbouwd is.

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**Schaal:** Transactioneel Leiderschap

Subschaal: Contingent Reward

- Items:* 1. Telkens wanneer ik het nodig acht, kan ik met hem onderhandelen.
2. Hij toont me dat hij mijn prestaties naar waarde weet te schatten.
  3. Er is een strikte afspraak over wat hij van mij verwacht en wat daar als beloning tegenover staat.
  4. Hij geeft me beloningen, afhankelijk van de steun die ik aan hem verleen.
  5. Hij feliciteert me als ik goed werk lever.
  6. De samenwerking die ik aan hem verleen, bepaalt de beloning die ik krijg.
  7. Ik krijg de afgesproken beloning als ik me hou aan de met hem gedane afspraken.
  8. Ik heb een ongeschreven overeenkomst met hem over de moeite die ik ergens voor doe en hoe ik daarvoor beloond zal worden.
  9. Hij maakt het verband duidelijk, tussen de moeite die ik voor het bedrijf doe en de beloning die het bedrijf mij geeft voor mijn prestaties.
  10. Hij geeft me een teken van waardering wanneer mijn prestaties de norm evenaren of zelfs overschrijden.

Subschaal: *Active Management by Exception*

- Items:* 1. Hij treedt op als ik de doelstellingen van het project niet haal, waarvoor hij verantwoordelijk is.
2. Hij vestigt de aandacht op onregelmatigheden, vergissingen en afwijkingen van het vooropgestelde doel.
  3. Hij grijpt in, wanneer ik fouten maak.
  4. Hij vestigt zijn aandacht op afwijkingen van de norm.
  5. Hij neemt maatregelen om te weten wanneer dingen de foute kant op gaan.

Subschaal: *Passive Management by Exception*

- Items:* 1. Hij vind het best om mij mijn werk te laten uitoefenen op dezelfde manier, zelfs als veranderingen noodzakelijk blijken.
2. Hij vermijdt het veranderen van mijn werkrouines.
  3. Hij is tevreden met mijn prestaties, zolang de oude manier van werken nog oké gaat.
  4. Het is duidelijk dat hij de mening heeft: 'als het niet kapot is, dan moet je het niet herstellen'.
  5. Zolang alles naar wens verloopt, denkt hij niet aan verbeteringen.

---

**Schaal: Laissez-Faire Leiderschap**

- Items:* 1. Hij vermijdt het geven van informatie over hoe ik mijn werk moet uitoefenen.
2. Hij toont niet dat hij belang hecht aan de resultaten van mijn werk.
  3. Hij vermijdt het zelf nemen van beslissingen.
  4. Hij laat me mijn werk doen zonder dat hij zich daarmee bemoeit.
  5. Als ik hem niet lastig val, valt hij me ook niet lastig.
  6. Hij heeft niet veel invloed gehad op mijn prestatieniveau.
  7. Hij is meestal afwezig wanneer ik hem nodig heb.
  8. Hij is moeilijk te vinden wanneer er zich problemen voordoen.
  9. Alles wat ik doe, is OK voor hem.
  10. Ik ken zijn mening niet als er discussies zijn.

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**Schaal: Extra Effort**

- Items:* 1. Hij brengt me ertoe dat ik meer presteer dan het niveau dat ik van mezelf zou verwachten.
2. Hij motiveert me om meer te doen dan ik van te voren had gedacht.
  3. Hij verhoogt mijn motivatie om ergens in te slagen.

***Construct: Veiligheidsklimaat***

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**Schaal: Veiligheidsprocedures**

- Items:* 1. In mijn projectteam is er sprake van veel schriftelijk vastgelegde procedures.
2. In mijn projectteam hebben de veiligheidsprocedures betrekking op alle werkgerelateerde zaken.
  3. In mijn projectteam zijn de veiligheidsprocedures gedetailleerd.
  4. In mijn projectteam zijn de veiligheidsprocedures veelomvattend.

---

**Schaal: Veiligheidsinformatiestroom**

- Items:* 1. In mijn projectteam zijn werknemers geïnformeerd over vernieuwingen binnen de veiligheidsregels- en procedures.
2. In mijn projectteam zijn werknemers geïnformeerd over mogelijke veiligheidsrisico's.
  3. In mijn projectteam zijn er veel veiligheidstrainingen.

4. In mijn projectteam wordt er informatie over veiligheid verstrekt.

---

**Schaal: Veiligheidsgedragingen van het Management**

- Items:*
1. In mijn projectteam benadert mijn directe leidinggevende teamleden tijdens het werk om veiligheidskwesties aan te kaarten.
  2. In mijn projectteam houdt mijn directe leidinggevende ons scherper in de gaten, wanneer een teamlid een veiligheidsregel overtreedt.
  3. In mijn projectteam neemt mijn directe leidinggevende veiligheidsprestaties mee in beoordelings- en/of promotiegesprekken.
  4. In mijn projectteam ergert mijn directe leidinggevende zich aan teamleden die de veiligheidsvoorschriften negeren.
  5. In mijn projectteam verzekert mijn directe leidinggevende dat er geen risico's in het team aanwezig zijn.
  6. In mijn projectteam creëert mijn directe leidinggevende een werksfeer, waarin mensen kunnen zeggen over veiligheid wat ze maar willen.

---

**Schaal: Prioriteit van Veiligheid**

- Items:*
1. In mijn projectteam is het nodig om sommige veiligheidszaken te negeren om het werk gedaan te krijgen.
  2. In mijn projectteam is het zo dat wanneer de werkdruk toeneemt, de voorkeur uitgaat naar het zo snel mogelijk werken, zelfs als dit ten koste gaat van de veiligheid.
  3. In mijn projectteam is het zo dat personeelstekort de veiligheidsstandaarden in het gedrang brengt.
  4. In mijn projectteam worden veiligheidsvoorschriften en -procedures genegeerd.
  5. In mijn projectteam zijn veiligheidsvoorschriften en -procedures niets meer dan een manier om te zorgen dat het bedrijf niet kan worden aangeklaagd.
  6. In mijn projectteam is het negeren van veiligheid acceptabel.
  7. In mijn projectteam maakt het niet uit hoe het werk wordt gedaan, zolang er geen ongelukken gebeuren.

---

***Construct:* Veiligheidsprestatie****Schaal: Veiligheidsdeelname**

- Items:* 1. Ik ben betrokken bij de ontwikkeling van gezondheids- en veiligheidsdoelen en/of verbeterplannen.
2. Ik ben betrokken bij het bespreken van de effectiviteit van gezondheids- en veiligheidssystemen.
3. Ik ben betrokken bij de uitvoering van risico-assessments.
4. Ik ben betrokken bij het onderzoeken van gezondheid en veiligheid.
5. Ik voer vrijwillig taken of activiteiten uit die helpen om de veiligheid op de werkplaats te verbeteren.
6. Ik zie af van betrokkenheid bij veiligheidsinitiatieven, op grond van het feit dat ik het niet als mijn verantwoordelijkheid zie.
7. In mijn projectteam werken de mensen veilig, zelfs wanneer de directe leidinggevende niet aanwezig is.
8. Ik promoot het veiligheidsprogramma in het projectteam.
9. Ik steek extra moeite in het verbeteren van de veiligheid op de werkplaats.

---

**Schaal:** Veiligheidsinschikkelijkheid

- Items:* 1. Hoe vaak gebruikt u alle benodigde veiligheidsuitrusting om uw werk uit te voeren?
2. Hoe vaak gebruikt u de correcte veiligheidsprocedures om uw werk uit te voeren?
3. Hoe vaak zorgt u voor het hoogst haalbare veiligheidsniveau wanneer u uw werk uitvoert?
4. Hoe vaak negeert u veiligheidsregels en -voorschriften?
5. Hoe vaak houdt u zich niet helemaal aan de veiligheidsrichtlijnen, met als doel het werk sneller gedaan te krijgen?

## 8.2 Factor Analysis: Intellectual Stimulation

The transformational leadership subscale intellectual stimulation, was subjected to a factor analysis. When taking look at the factor loadings of the different items (see table 9), it seems the items can roughly be divided into three groups (i.e. the three factors). The first factor, on which three items show a high factor loading, is concerned with the revision of one's own ideas and a renewed approach to existing problems. The second factor, on four items have a high factor loading, is concerned with a 'think first, act later' mentality and providing sufficient argumentation when presenting an idea or opinion. The third factor is concerned with undertaking action. The three items that deal with action show high positive factor loadings. In contrast, the items which solely address thinking-processes rather than action, and the items that deal with argumentation, show little to no relation with this factor. In addition, an item addressing the ability of the immediate supervisor to quickly deal with complex problems, shows a positive factor loading for factor two as well as factor three. This might indicate that in this case, the immediate supervisor serves as a role model and stimulates his subordinates to revise their own ideas and seek new approaches to existing problems and shows how to adequately convert these into action.

Based on the findings discussed above, it makes sense that intellectual stimulation shows a three factor structure.

**Table 9**

*Results of the Factor Analysis with Varimax Rotation for the Transformational Leadership Subscale Intellectual Stimulation.*

|   | <b>Components</b> |             |             |
|---|-------------------|-------------|-------------|
|   | <b>1</b>          | <b>2</b>    | <b>3</b>    |
| Hij zorgt ervoor dat ik problemen op een andere manier bekijk   | <b>.648</b>       | .370        | .298        |
| Hij heeft er voor gezorgd dat ik problemen, die vroeger raadsels waren, nu op een nieuwe manier bekijk                                | <b>.745</b>       | .206        | .031        |
| Hij verschaft me redenen om mijn manier van denken omtrent problemen te veranderen  | <b>.776</b>       | .062        | .053        |
| Hij benadrukt het gebruik van het verstandelijk vermogen om een hindernis of obstakel weg te werken                                   | .276              | <b>.795</b> | -.051       |
| Hij verlangt dat ik mijn mening staaf met goede argumentatie  | .091              | <b>.777</b> | .185        |
| Hij pakt de kern van complexe problemen snel aan  | .140              | -.033       | <b>.848</b> |
| Hij legt de nadruk op zorgvuldig probleemoplossend denken voordat ik actie onderneem  | -.183             | .441        | <b>.696</b> |
| Hij zorgt ervoor dat ik grondig nadenk alvorens een actie te ondernemen   | .413              | .159        | <b>.589</b> |
| Hij krijgt me zover dat ik mijn mening opbouw via een goed opgebouwde redenering in plaats van een niet-gestaafde opinie te gebruiken | .368              | <b>.584</b> | .341        |



### 8.3 Factor Analysis: Safety Participation

**Table 10**

*Results of the Factor Analysis with Varimax Rotation for the Safety Performance Scale Safety Participation.*

|  | <b>Components</b> |             |
|--|-------------------|-------------|
|  | <b>1</b>          | <b>2</b>    |
| Ik ben betrokken bij de ontwikkeling van gezondheids- en veiligheidsdoelen en/of verbeterplannen       | <b>.814</b>       | .239        |
| Ik ben betrokken bij het bespreken van de effectiviteit van gezondheids- en veiligheidssystemen        | <b>.841</b>       | .069        |
| Ik ben betrokken bij de uitvoering van risico-assessments  | <b>.817</b>       | .173        |
| Ik ben betrokken bij het onderzoeken van gezondheid en veiligheid                                      | <b>.806</b>       | -.067       |
| Ik voer vrijwillig taken of activiteiten uit die helpen de veiligheid op de werkplaats te verbeteren   | <b>.563</b>       | .331        |
| In mijn projectteam werken de mensen veilig, zelfs wanneer de directe leidinggevende niet aanwezig is. | -.019             | <b>.753</b> |
| Ik promoot het veiligheidsprogramma in het projectteam   | .313              | <b>.770</b> |
| Ik steek extra moeite in het verbeteren van veiligheid op de werkplaats                                | .129              | <b>.898</b> |

## **8.4 Questionnaire**

See next page for a copy of the questionnaire used in the present study.