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Authentic leader, safe work: the influence of leadership on safety performance

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ABSTRACT

This study analyzed the influence of authentic leadership on the workers' safety performance, investigating the psychological mechanisms that explain the connection between authenticity and workplace safety. In addition, individual characteristics that could affect this behavior were also surveyed. The study was conducted based on a sample of 186 workers involved in projects within the oil industry. Results suggested that authentic leadership is associated with the feedback provided by supervisors as well as with worker's perception of justice and their safety performance. Furthermore, perception of justice seems to be a relevant route through which more authentic leaders would promote safe behaviors among their followers. It was also observed that individuals who are more conscientious and less prone to take risks are also those who engage more frequently in safe behavior in the workplace.

Keywords: Authentic leadership; perception of justice; personality; feedback; workplace safety.

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1 INTRODUCTION

Currently, the attention given to a company's social and environmental responsibility by their various stakeholders has been increasing (PUPIM, 2005). In light of the growing regulation and monitoring of governments and civil society in relation to the impacts caused by business, especially in companies whose activities involve a greater tendency for risk of accidents, there is a need for investing in ~~of~~ performance improvement in health, safety and the environment (HSE) (BURGHERR; HIRSCHBERG, 2008). In this context of requirements, compounded by the increased demand for production and processing in areas such as the oil industry, the existence of corporate strategies to control risks is essential (SOVACOOL, 2008). However, while business management systems have long been incorporating SMS issues, regardless of the type of model adopted by an organization, there are always people responsible for its administration, and their individual performance has been directly associated with the level of corporate safety and environmental protection (LARKIN; LARKIN, 2006). Thus, managing the so-called "human factor" in the safety context seems to be an important initiative (WESTABY, KRISTER, 2005).

Since leaders are depicted as individuals who hold great influence over their followers (BASS, 2008), this study sought to investigate the role of leaders in promoting safety behaviors. Current literature on leadership is pointing to the leaders' authenticity as a distinctive feature in times of crisis, particularly relevant when it comes to responding to social challenges, establishing relationships of trust and mobilizing followers to the adherence to high standards of performance and conduct (AVOLIO; LUTHANS; WALUMBWA, 2004; COOPER; SCANDURA; SCHIERSHEIM, 2005). However, the theory of authentic leadership is a relatively recent development in the literature - most existing studies on the subject are theoretical-conceptual with a few empirical studies concentrated in the United States and Canada (GARDNER; COGLISER; DAVIS; DICKENS, 2011). Therefore, this study also sought to contribute to the expansion of knowledge about authentic leadership and its nomological chain, linking the authenticity of the leader with safety behaviors at work, and investigating this relationship through a field study in the Brazilian context, more particularly in an industrial environment.

The survey was conducted with 186 workers at the operational level, working in a risky environment, i.e. in construction and assembly carried out by subcontractors who provide

these services to Petrobras (Petroleo Brasileiro S/A). The survey was conducted during the construction and industrial assembly phase, the most critical process in terms of risks. In addition, the study investigated the process by which authentic leadership would promote the safety behavior of subordinates, analyzing the role of perceived justice by the worker and of the use of feedback mechanisms by the leader as mediating factors of this relationship, also considering the influence of personality traits such as conscientiousness and risk propensity to analyze the safety behavior of the group studied.

2 THEORETICAL FRAMEWORK

2.1. Safety Performance

Accidents have been identified as a major cause of man-made disasters (BURGHERR; HIRSCHBERG, 2008). Only in large accidents recorded in the oil industry, over $13 billion in losses from material damage have been recorded in the period 1907-2007 (SOVACOOL, 2008). In organizations, all accidents occur due to the failure of safeguards that separate the risk of persons or property, causing them to encounter danger and causing loss of life, material damage and environmental damage. According to the safety literature, three factors may be involved in such violations of the barriers: human, technical and organizational, which are influenced by the levels of production and protection applied by the organization (REASON, 1997, p. 2). However, according to Chua and Goh (2004), all safety models that exist today - focused on energy transfer, on individuals as safety agents, or on the safety systems - are based on the premise that accidents are caused by multiple causes, with the organization performing an important role in the occurrence of such events. From this understanding, the safety area was leaving aside the focus on identifying those responsible directly involved in accidents, to develop a more comprehensive approach to the causes of accidents and consequently become more sophisticated and more robust in taking corrective and preventive actions.

In this study, behavioral aspects related to workers and their leaders that contribute to the prevention of accidents are the central point of interest, in so far as they could act directly on the prevention of some of their causes. The safety literature divides the behavior of individuals working in hazardous areas in two dimensions: safety compliance and safety participation (NEAL; GRIFFIN 1997, 2002; NEAL; GRIFFIN; HART, 2000). The first of them - safety compliance - involves essential activities that must be performed in order to maintain safety in the workplace, and includes adherence to requirements defined in standards, procedures and policies. The second - safety participation - describes spontaneous

behaviors that do not contribute directly to the personal safety of an individual, but do help develop an environment that promotes safety, and includes participation in volunteer activities, helping colleagues with safety issues and active involvement in safety dialogues. Several researchers use the approach based on these two dimensions in their research on the safety performance of individuals on the job (NEAL; GRIFFIN, 2002; 2006; INNESS; BARLING; TURNER, STRIDE, 2010; LU; YANG, 2010).

In organizations, unsafe behaviors are even more frequent than any other occurrences (IBRD; GERMAIN, 2007, p. 189). According to the *Health Safety Executive* (HSE, 2002), over 80% of accidents and incidents are related to unsafe behaviors. Some research evidence has suggested that behavior change techniques may lead to safer behavior and, consequently, to lower accident rates (HSE, 2002). Thus, the focus on safe behavior has been gaining increasing importance in the safety literature, aside from the exclusive focus on the set of procedures to be followed, to focus on the actions of individuals and habits to be cultivated in their daily work routine (O `DEA; FLIN, 2001).

2.2 Authentic Leadership and Safety Performance

Leadership is often considered as a factor of success or failure in organizations (Bass, 2008, p. 11), being treated as an important element in defining corporate strategies, the development of competitive advantages, and in encouraging commitment and improved organizational performance (COLLIER; FISHWICK; FLOYD, 2004). In scientific studies on leadership, different schools of thought sought to understand the factors that determine the effectiveness of leadership behaviors - House and Aditya named the latest models based on the work of Bass (1985), Burns (1978) and House (1977), which gave rise to the concept of charismatic, transformational and visionary leadership, "neo-charismatic" approaches. The discussion by Steidlmeiers and Bass (1999), about authentic transformational leadership, began the debate on the issue of authenticity in this field of knowledge (GARDNER *et al*., 2011).

Theories focused on leadership based on principles have been using a multidisciplinary perspective, based on the intersection between the areas of leadership, ethics and the positive school of organizational behavior (AVOLIO; GARDNER; WALUMBWA; LUTHANS, MAY, 2004). According to a recent definition of this domain (WALUMBWA; AVOLIO; GARDNER; WERNSING; PETERSON, 2008), authentic leadership refers to the leader's behaviors that promote both positive psychological capacities and a positive ethical climate, from his self-awareness, internalized moral perspective, balanced processing of information,

and relational transparency (p. 94). With consistency in their actions and views, authentic leaders would be more likely to form a network of collaborative relationships with their followers. Thus, leaders could, in a cascading effect, influence their followers to develop authenticity, forming a culture with those characteristics in the company (AVOLIO *et al*., 2004). However, due to the recent nature of the research on authentic leadership, few empirical studies have been conducted to verify these propositions, as evidenced in the literature review conducted by Gardner and colleagues (2011).

In the industrial sector, the effectiveness of leaders is often measured by the performance of their units in profitability and other factors relating to the business, as well as in matters relating to records of absenteeism and job security (BASS, 2008). Leadership commitment also seems to be a relevant factor for the success of organizational interventions, including actions for workplace safety (RODGERS; HUNTER; ROGERS, 1993). With respect to safety performance, the literature indicates that leadership actions seem to be relevant to promote safety behaviors among workers, according to studies by Dunbar (1975), the association between employee safety and leadership behavior depends on how subordinates perceive their leaders' interest for their welfare. Research suggests that management support is positively associated with performance in employee safety (COOPER, 2006).

In Brazil, empirical research on leadership is still relatively scarce. However, some studies conducted in recent years on both transformational leadership (e.g.: CAVAZOTTE; MORENO; HICKMANN, 2012; MACIEL; REINERT, 2009; MARCHIORI; VILAÇA; PINTO; FONSECA, 2010; MELO, 2009), and more recently on authentic leadership (e.g.: CAVAZOTTE; VILLAS BOAS, 2011), suggest that leaders could influence their employees' attitudes and behaviors in the professional environment. Authentic leadership is characterized by the leader's propensity to act in accordance with deep beliefs and values, creating greater credibility and promoting respect and trust amongst followers, as well as encouraging them to internalize these principles and regulate themselves voluntarily (AVOLIO; GARDNER, 2005, WALUMBWA *et al*., 2008). Thus the first hypothesis to be tested is formulated:

H1: The more authentic the leader, the better the safety performance of his followers.

2.3 Feedback and Safety Performance

Feedback from the supervisor about the performance of his subordinates is a driving stimulus, important for improving performance and even the skills and motivation of his followers (BASS, 2008, p. 402). Several studies suggest that there is a relationship between

the systematic provision of feedback to employees and their behavior in safety issues, in addition to the instructions given to the workers. Feedbacks, often with indications for training, have been identified as actions that promote results concerning safety in production environments, including mines, shipyards and laboratories (CAMERON; DUFF, 2007). A survey of the literature performed by Bass (2008) suggests that there is a significant improvement in the safety performance of workers who receive feedback once or twice a week.

Gramopadhye and Blackmon (1995) observed that positive feedbacks increase the prevalence of safety behavior. According to these authors, the effects of this process have been tested in various parts of the world, and its effectiveness has been consistently supported. The participation of managers and supervisors in safety activities seems to be important, as well as informal communication between leaders and their followers. However, some authors suggest that, in addition to participating, it is necessary that the leader also encourage his staff to become involved in safety (O `DEA; FLIN, 2001).

Authentic leaders are characterized as being capable of encouraging open communication involving their followers and sharing information (AVOLIO, GARDNER *et al*., 2004). Leaders faithful to ethical principles, more aware of their impact on others, and capable of maintaining with them more transparent relationships, open to divergence, as are the so-called authentic leaders, would be more likely to communicate with their followers regarding their performance and provide feedback using principles associated with its effectiveness in the literature on the subject (EARLY 1986; VANCOUVER, MORRISON, 1995). Thus, the following hypothesis is formulated:

H2: The effect of authentic leadership in safety performance is mediated by feedback: the more authentic the leaders, the more effective they will be in giving feedback, and the more effective the realization of feedback, the better the safety performance of their followers.

2.4 Perception of Justice and Safety Performance

According to Cropanzano and his collaborators (2007), the sense of organizational justice is a personal evaluation about the ethical and moral conduct of a company's managers. Thus, it constitutes itself from the relative point of view of the worker. The three-dimensional model of organizational justice divides it into distributive, procedural and interactional justice. Distributive justice focuses on content, relating to the distribution of resources such as salaries, promotions and even disciplinary sanctions (COHEN-CHARASH; SPECTOR, 2001; McFARLIN; SWEENEY, 1992). Procedural justice focuses on the procedures used to

distribute rewards, including performance appraisal systems. This component of justice especially affects how employees view the organization and their satisfaction with the system in general, contributing to higher levels of loyalty, trust and commitment (COHEN-CHARASH; SPECTOR, 2001; COLQUITT, CONLON, WESSON; PORTER; NG, 2001; FOLGER; KONOVSKY, 1989). The interactional justice relates to the human side of organizational practices, with emphasis on the leader-follower relationship. This dimension entails individual reactions and behaviors in relation to direct supervision (ASSMAR; FERREIRA; SOUTO, 2005; COHEN-CHARASH; SPECTOR, 2001; COLQUITT *et al*., 2001; CROPANZANO; BOWEN; GILLILAND, 2007).

The perception of organizational justice has the potential to generate benefits for organizations and their employees, such as increased organizational commitment, better performance and citizenship behaviors (Cohen-CHARASH; SPECTOR, 2001; CROPANZANO *et al*., 2007). Citizenship behaviors reflect spontaneous individual behaviors, which are not explicitly recognized by job descriptions or formal reward systems (ORGAN, 1988). Workers who exhibit such behaviors tend to also be more focused on improving the safety performance of other team members (HOFMANN; MORGESON; GERRAS, 2003) and engage in activities to make the workplace safer. They also tend to adhere to the safety management policies and have reduced involvement in work accidents (Gyekye; SALMINEN, 2005). Thus it would be possible to establish a relationship between the workers' perception of justice and their safety performance, even by means of the development of citizenship behavior.

Regarding the antecedents of organizational justice, i.e., elements capable of eliciting judgments of justice in the workplace, empirical studies have identified, among others, the culture and the organizational policies, compensation systems, and especially the leaders' behavior (ASSMAR *et al*. 2,005;-COHEN CHARASH; SPECTOR, 2001). The followers' confidence in their leaders is one of the factors that contribute to the creation of an environment conducive to personal and organizational efficiency (ASSMAR *et al*., 2005). Specifically in the context of authentic leadership, the justice issue seems particularly relevant. As the literature describes authentic leaders as being accustomed to act guided by inner convictions, encouraging diverse opinions and building collaborative networks in their teams (AVOLIO, GARDNER *et al*., 2004; WALUMBWA *et al*., 2008), the following hypothesis is formulated:

H3: The effect of authentic leadership on safety performance is mediated by perceptions of organizational justice: the more authentic the leaders, the greater the perceived justice of their followers and, consequently, the better their safety performance.

2.5 Personality and Safety Performance

As pointed out by Clarke (2006), few studies have attempted to identify individual differences relevant to safety behaviors at work. However, the relationship between personality traits and attitudes towards safety has been tested and confirmed in empirical studies of several other areas, such as traffic safety (MOEN, 2007; ULLEBERG; RUNDMO, 2003). Furthermore, since individual differences have been systematically related to different attitudes and behaviors at work, it is plausible to infer that aspects involving safety performance are also influenced by individual traits (HENNING; STUFFT; PAYNE; BERGMAN, 2009).

2.5.1 The Role of Conscientiousness

Of the five big personality dimensions proposed by the Five Factor Model (DIGMAN, 1990), consciousness seems to be particularly relevant to safety behavior at work (POSTLETHWAITE; ROBBINS; RICKERSON; MCKINNISS, 2009). A person highly conscious is described as responsible, organized, reliable, and persistent (HENNING *et al*., 2009). Conscious workers, when well educated, have less chance of having an accident in that they carry out what they have been assigned and remain alert to aspects adjacent to their main functions, such as safety and relationship with colleagues.

Conscientious individuals follow the rules and are aware of the expected behavior in a given situation. Previous research has shown that consciousness is positively related to safe behavior (ARTHUR; DOVERSPIKE, 2001; WALLACE; CHEN, 2006). Thus, the following hypothesis is formulated:

H4: The more conscious the workers, the better their safety performance.

2.5.2 The Role of Risk Propensity

According to Sitkin and Pablo (1992), the propensity to risk is the assessment of risk that the individual makes in a given situation, and can be seen as the cumulative tendency of an individual to assume or avoid a risky situation. According to Harwood and collaborators (2009), this can change over time as a result of education, training and experience. It is worth reinforcing that this is more an individual characteristic than situational (NICHOLSON; SOANE; FENTON-O'CREEVY; WILLMAN, 2005). Risk behaviors of workers are often

decisive for the occurrence of an accident. In organizations, the risk propensity has been associated with the occurrence of accidents at work (WESTABY, KRISTER, 2005).

Since individuals with higher risk propensity would be more likely to make hasty decisions and act with less caution (HENNING *et al*., 2009); it is expected that this trait is negatively related to safety performance. Thus the following hypothesis is formulated:

H5: The lower the risk propensity of the workers, the better their safety performance.

Given what has been explained above, the following model is proposed and will be tested in this study:

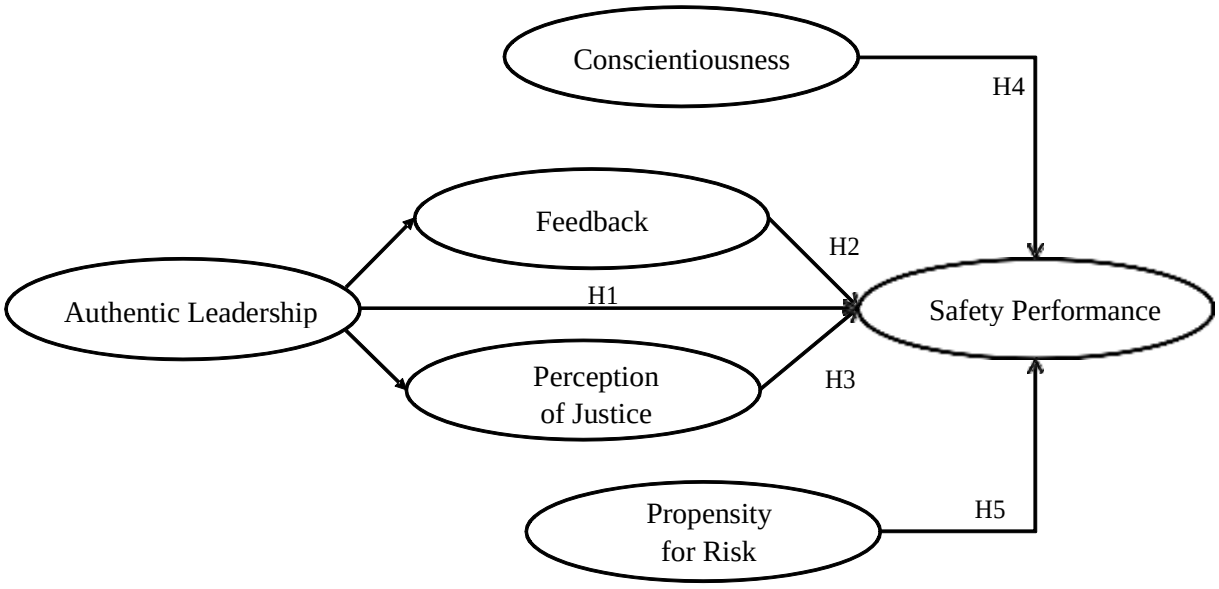

Figure 1: Research model

3 METHODOLOGICAL PROCEDURES

3.1 Sample and Data Collection

The sample used in this study consisted of 186 workers from 18 companies operating in five different states in the Northeast, Southeast and South of Brazil. To participate in the study, workers were randomly approached in the field, when they were working in construction contracted by Petrobras (Petróleo Brasileiro SA). These workers are employees of companies providing construction services and industrial assembly of large scale, such as refineries, oil platforms, ships and laboratories, and represent a wide range of technical and operational activities, including boilermakers, painters, masons, helpers, and some supervisors and overseers. Data collection was based on questionnaires on paper, answered without the

need for identification and deposited in a closed pouch of data collection used exclusively for conducting this study.

Of the total participants, 82% are men, 70% have more than three years of professional experience, and the vast majority (86%) did not hold a formal position of leadership during the period of data collection. The majority (72%) are less than 35 years old, and slightly more than half of the participants (52%) have a level of education corresponding to high school, with a small portion (4%) being post-graduates.

3.2 Measuring instruments

The research was based on a structured questionnaire, divided into five parts. In the first part, participants evaluated their immediate supervisor as to authentic leadership by means of the 16 items of the *Authentic Leadership Questionnaire* (WALUMBWA *et al*., 2008) available in Portuguese, which uses a 5-point Likert scales. The questionnaire was developed to investigate the follower's perception about the leader's self-awareness, internalized moral perspective, balanced processing of information and relational transparency. Examples of such questions are: "My immediate supervisor acknowledges when mistakes are made," and "My immediate supervisor makes decisions based on high standards of ethical conduct." According to Walumbwa and collaborators (2008), the original value for Cronbach's alpha of this instrument is 0.84.

In the second part, participants answered questions about their conscientiousness and stress level. Starting with the 10 items of Goldberg's Conscientiousness Scale of Five Factors (1992), which includes statements such as: "I like things in order" and "I pay attention to details". The original value of Cronbach's alpha for this measure is 0.74. Although the concept of stress was not the object of this study, such questions were used as a distraction mechanism to minimize contamination of the information by socially expected responses (PAULHUS, 1991). These questions were based on the work of Parker and Decotiis (1983) and comprised five items, among them: "I've been feeling restless or nervous due to my work" and "Sometimes I feel a tightness in the chest when I think about my work." The original value of Cronbach's alpha reported by some authors is 0.83. A five-point Likert scale was used.

The third part included the eight items of the questionnaire developed by Neal and collaborators (2000) used in empirical studies on safety performance (INNESS; BARLING; TURNER, STRIDE, 2010; LU; YANG, 2010; NEAL; GRIFFIN, 2006; ZACHARATOS , BARLING; IVERSON, 2005). The items assess two dimensions of safety performance safety compliance and safety participation - using a frequency scale ranging from 1 (never) to 9

(always). For safety compliance, the items assess adherence to company rules, such as: "I apply all safety procedures required to perform my job" and "I use all safety equipment necessary for my work." In regards to safety participation, the items reflect additional actions undertaken by the worker; for example: "I encourage my colleagues to wear safety equipment at work." The original value of Cronbach's alpha for the first subscale is 0.94, whereas for the second part of the instrument, the original alpha is 0.84.

The fourth part of the questionnaire aimed to measure the perception of justice, feedback from the immediate supervisor, and the risk propensity of participants who answered the questions using a five-point Likert scale. The four items used for the perception of justice were based on a scale created by Hodson and collaborators (1994), due to its size, to keep the questionnaire appropriately scaled to the data collection in the field, during the working hours of the participants. As an example of items used, it can be cited: "Many people here violate rules and nothing happens to them." According to the authors, the alpha of this measure is 0.70.

Then, the five items on feedback adapted by Herold and colleagues (1987) Hackman and Oldham (1974), whose original alpha is 0.81, were included. As examples of items used, it can be cited: "My supervisor gives me useful information on how I can improve my job performance" and "My supervisor is an excellent source of information about my job performance." Finally, the propensity to risk was assessed by means of the ten items of the Jackson scale (1994) with a Cronbach's alpha = 0.78. Examples of items ~~on~~ in this scale are: "I avoid dangerous situations" and "I would never fly a hang glider or a make parachute jump".

The fifth and final part of the questionnaire collected demographic data: gender, age, level of education, professional experience, total time worked in Petrobras projects and function in contracted company.

4 ANALYSIS AND RESULTS

The structural equation modeling is the ideal analysis tool when one wants to verify multiple dependency relationships between variables, as is the case in this study. However, depending on the number of parameters estimated by the technique and the restrictive assumptions assumed in maximum likelihood, the sample size is an important criterion in deciding on its adoption (HAIR *et al*., 1998; McQUITTY, 2004). As the sample obtained was less than the minimum required observations to accurately estimate all parameters and to test the hypotheses presented in this study, it was chosen to employ the hierarchical regression

analysis, which involves well-established techniques and is widely used in research in the social and behavioral sciences (TABACHNICK; FIDELL, 2007). For testing mediation, hierarchical regressions were performed following the procedures described by Baron and Kenny (1986). The calculations were performed using the SPSS v.18 for Windows (Statistical Package for Social Science) from the averages calculated for each participant in the scales used to measure the constructs involved in the proposed model.

Table 1 shows the averages, standard deviations and correlations between variables of the model studied. Furthermore, aiming to evaluate the reliability of the measuring instruments used, the Cronbach's alpha values for the metrics of each construct in the sample were calculated, and are also reported in Table 1.

Table 1 - Averages, standard deviations, correlations and Cronbach's Alpha

	Variables	Average	D.P.	1	2	3	4	5	
1.	**Authentic Leadership**	3.76	0.94	(0.90)					
2.	**Feedback**	3.16	1.32	0.59**	(0.92)				
3.	**Perception of Justice**	2.89	1.17	0.26**	0.39**	(0.78)			
4.	**Conscientiousness**	4.26	0.66	0.33**	0.29**	0.26**	(0.76)		
5.	**Propensity to Risk**	2.20	0.69	-0.12	0.01	-0.11	-0.28**	(0.71)	
6.	**Safety Performance**	7.96	1.04	0.47**	0.35**	0.26**	0.38**	-0.23**	(0.81)

Note: N = 186 *p < 0.05 ** p < 0.01
[a] Cronbach's alpha observed for each instrument on the diagonal in parentheses

To analyze the hypotheses studied was carried out, first, multiple regression to assess the direct effects of authentic leadership on the performance of real safety (Table 2). Conscientiousness and risk propensity of participants were included simultaneously in the analysis of personality variables proposed as relevant to safety. The coefficient of determination was significant (= 0.29, F = 24.59, p <.01). Likewise, the regression coefficients of the authentic leadership variables (= 0.38 t = 5.74, p <0.01), conscientiousness (= 0.22 t = 3.17, p <0.01) and risk propensity (= - 0.12, t = -1.85, p = 0.06), were found to be statistically significant; the first two with a confidence level of 99%, and the last with a confidence level of 94%. The results allow the rejection of H0, corroborating the hypotheses H1, H4 and H5 in the group studied.

Table 2 - Multiple Regression for Security Performance: Leadership and Personality

Variables		t	of the Model
Authentic Leadership	0.38	5.74**	
Conscientiousness	0.22	3.17**	
Propensity to Risk	-0.12	- 1.85*	
			0.29**

Note: N = 186 * p < 0,06 ** p < 0,01

For testing mediation, steps defined by Baron & Kenny (1986) were followed. According to these authors, the test mediation involves demonstrating that: 1) the independent variable is able to explain the variance in the mediator (effect of the VI in VM); 2) the mediating variable is able to explain the variance in the dependent variable (effect of the VM in VD); and 3) the effect of the first significant independent variable on the dependent ceases to be significant when the effects of the mediating variable are included in the model (partial or total reduction of the effect of VI in VD when the effect of VM is controlled).

Thus, linear regression was used to assess the initial effect of authentic leadership on feedback (VI effect on the VM). The determination coefficient was significant (= 0.35, F = 99.70, p <0.01), as well as the regression coefficient for the effect of authentic leadership variable (= 0.59 t = 9.95; p <0.01), which, as expected, is the same value observed for the correlation coefficient between these two variables in table 1. The results suggest that the perception of authentic leadership is associated with the effectiveness of the feedback given by supervisors to subordinates.

To complete the mediation feedback test in the relationship between authentic leadership and safety performance, a hierarchical regression was performed (Table 3). In the first block, the authentic leadership variable was included as an antecedent of safety behaviors (VI effect on the VD). The coefficient of determination was significant (= 0.21, F = 51.73, p <.01). The regression coefficient for the effect of the independent variable was also significant (= 0.47 t = 7.19, p <0.01). In the second block, the feedback variable was included (effect of VM on the VD), and there was a slight increase in the coefficient of determination (= 0.008), but this was not statistically significant. Likewise, the feedback variable showed no significant regression coefficient. These results confirm the association between authentic leadership and safety performance. However, with respect to H2, it was not possible to reject H0, i.e., one cannot conclude that feedback measures the relationship between authentic leadership and safety performance in this sample.

Table 3 - Hierarchical Regression for Safety Performance: Authentic Leadership and Feedback

Variables	t			
Authentic Leadership	0.47	7.19**	0.21**	
Authentic Leadership	0.40	5.00**		
Feedback	0.11	1.35	0.22**	0.008

Note: N = 186 * p < 0.05 ** p < 0.01

The same procedure was followed to verify the mediation of justice perception hypothesis in the relationship between authentic leadership and safety performance. Initially, there was a linear regression to assess the effect of authentic leadership as a predictor of perceived justice (effect of VI on the VM). the coefficients of determination (= 0.07, F = 13.56, p <0.01) and regression (= 0.26, t = 3.68, p <0.01) were calculated. They were significant, and as expected, the value of the latter is the same as that observed for the correlation coefficient between these two variables in Table 1. This observation suggests that authentic leadership is positively associated with perceived justice, although the portion of variance explained in the variable justice by authentic leadership is small (7%).

Next, were analyzed the effects of these two variables as antecedents of safety performance through hierarchical regression, to complete the test of the proposed mediating effects (Table 4). In the first block, was included authentic leadership (VI effect on the VD). The coefficient of determination of the model was statistically significant (= 0.21, F = 51.73, p <0.01) in the same way as the regression coefficient (= 0.47 t = 7.19, p <0.01). In the second block, the perceived justice variable was included (effect of VM on the VD), observing a statistically significant increase in the coefficient of determination of 0.21 to 0.24 (= 4.59, p <0, 05). It was also found a reduction in the effect of authentic leadership on safety performance (partial reduction of the effect of the VI on VD controlling for VM), observed by the decrease in the magnitude of the regression coefficient of the authentic leadership variable (= 0.43; t = 6.45, p <0.01). Furthermore, supporting the mediating effect, the perception of justice variable had a significant effect on the dependent variable in this analysis (= 0.14, t = 2.14, p <.05). Thus, for H3, one can reject H0. The results suggest that there was partial mediation of the perception of justice in the relationship between authentic leadership and safety performance in the group studied.

Table 4 - Hierarchical Regression for Safety Performance: Authentic Leadership and Justice

Variables		**t**		
Authentic Leadership	0.47	7.19**	0.21**	
Authentic Leadership	0.43	6.45**		
Perception of Justice	0.14	2.14*	0.24**	0.02*

Note: N = 186 * p < 0.05 ** p < 0.01

The results described above are shown schematically in Figure 2 as follows:

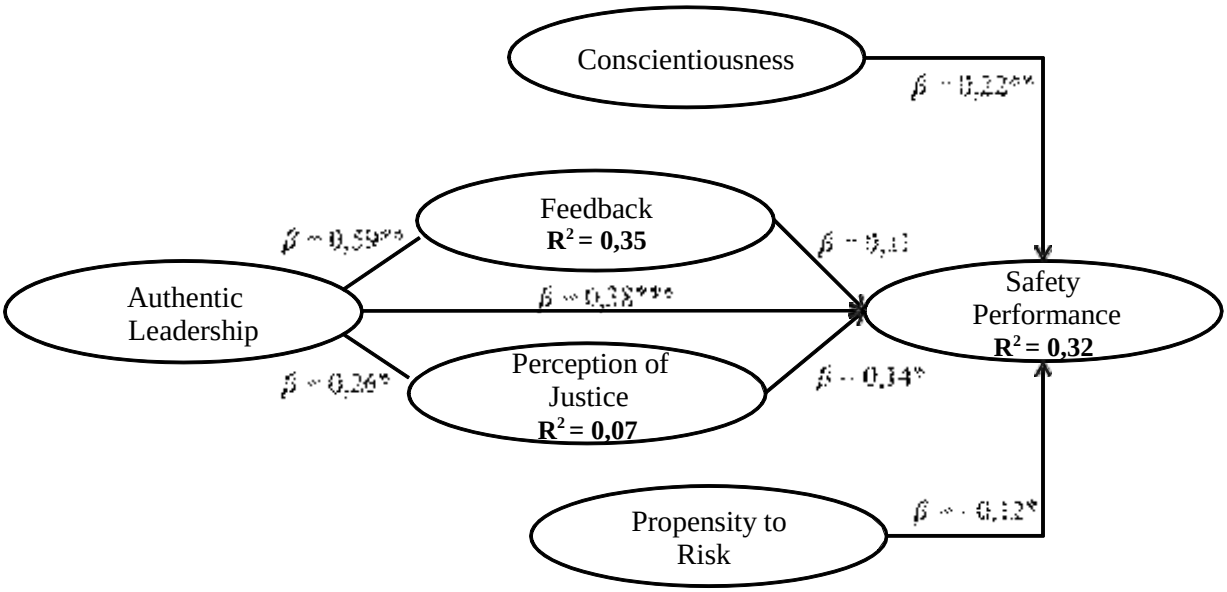

Figure 2. Results obtained for the proposed model[a]
Note: N = 186 * p < 0,10 ** p < 0,01 *** p < 0,001
[a] Values of the regression coefficients (β)and coefficients of determination ( ) on safety performance, without the inclusion of control variables

In line with the steps recommended by Spector & Branick (2011), in the previous steps, the effects of the factors theorized were checked without the inclusion of control variables in the models. Completing the procedure suggested by these authors, the effects of the background significantly related to safety performance were evaluated again, this time with the inclusion of control variables in the model before inclusion of the proposed variables. Thus, demographic variables (education level, age and length of experience) were included in the first block of the hierarchical regression; in the second block were added personality traits (risk propensity and conscientiousness); in the third block was added authentic leadership; and in the last block, was included organizational justice. The results are shown in Table 5. Demographic factors had no effect on safety performance. The personality trait most strongly associated with behavior in safety was conscientiousness.

The results in the following steps (e) corroborate previous findings on authentic leadership and the perception of justice, even when the effect of other variables is considered. This model was able to explain 32% of the variance in safe behavior.

Table 5 - Hierarchical Regression for Safety Performance: Full Model

Variables	Regression coefficients (β)			
	Model 1 Demographics	**Model 2 Personality**	**Model 3 Leadership**	**Model 4 Justice**
Time of Experience	0.09	0.08	0.05	0.06
Level of Education	0.04	0.06	0.06	0.05
Age	0.03	0.01	0.08	0.07
Propensity to Risk		-0.12*	-0.10	-0.09
Conscientiousness		0.34***	0.20**	0.19**
Authentic Leadership			0.39***	0.38***
Perception of Justice				0.12*
R^2	0.01	0.17***	0.31***	0.32***
		0.16***	0.13***	0.02*

Note: N = 186 * p < 0.10 ** p < 0.01 *** p < 0.001

Once it was observed in previous analyses that authentic leadership seems to be associated with both feedback (effect of VI on the VM), and with the perception of justice (the first stage, the effect of VI on VD), and the feedback is significantly associated with the perception of justice (r = 0.39, p <0.001, Table 1) (effect of VM on the VD) hierarchical regression was also performed taking as criterion the perception of justice, to complete the steps proposed by Baran and Kenny and to verify if the feedback factor is a mediator of the relationship between authentic leadership and perceived justice (effect of VI on the VD for controlling VM) (Table 6). Thus, the authentic leadership variable is included in the first block. The coefficient of determination was significant (= 0.07, F = 13.56, p <.01). Similarly, the regression coefficient was statistically significant (= 0.26 t = 3.68, p <0.01). In the second step, the feedback variable was included, and, therefore, there was a statistically significant increase, the coefficient of determination of 0.07 (= 17.97, p <0.01) of the perception of justice. The effect of authentic leadership on the perception of justice weakened, its regression coefficient was reduced and was no longer significant; whereas the feedback variable was significant (= 0.36, t = 4.24, p <0.01). These results suggest total mediation of the effect of authentic leadership on the perception of justice through feedback, i.e. the effect of authentic leadership on justice is entirely mediated by feedback.

Table 6 - Hierarchical Regression for the Perception of Justice: Authentic Leadership and Feedback

Variables	t		
Authentic Leadership	0.26	3.68**	0.07**

Authentic Leadership	0.05	0.59		
Feedback	0.36	4.24**	0.14**	0.07**

Note: N = 186 * p < 0.05 ** p < 0.01

Given these results, the proposed model has been revised to better reflect the conclusions of the analysis presented above. The adapted model seen in Figure 3 includes the values of regression and determination coefficients observed in the full model (with controls) for safety performance (Table 5) and *post hoc* analysis for mediation of feedback (Table 6).

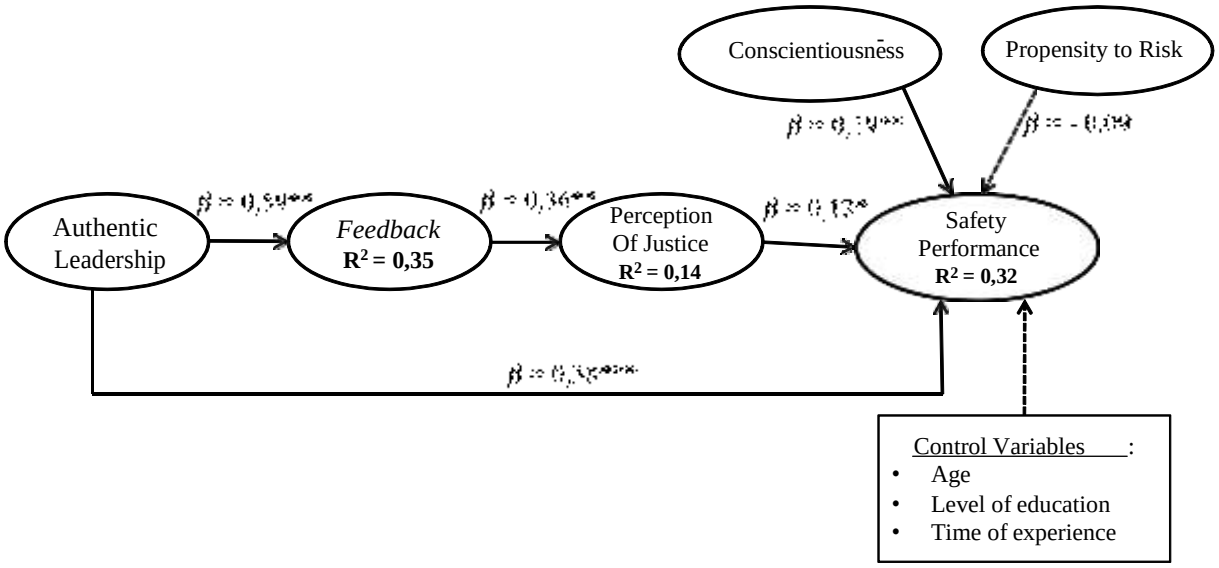

Figure 3. Results obtained for the adapted model [b]
Note: N = 186 * p < 0,10 ** p < 0,01 *** p < 0,001
[b] Values of the regression coefficients (β)and coefficients of determination ( ) on safety performance, including control variables

5 DISCUSSION AND CONCLUSION

This study aimed to investigate the influence of authentic leadership on the safety performance of employees in the industrial sector. The results suggest that this type of leadership, which has an explicit moral dimension (AVOLIO; GARDNER, 2005; WALUMBWA *et al*., 2008), seems to favor the safety performance of workers. It was also observed that the association between authentic leadership and safety performance is confirmed even when the effects of personality traits mentioned by the literature as relevant to workplace safety, such as high conscientiousness (ARTHUR; DOVERSPIKE, 2001) and low propensity to risk (Westaby, Krister, 2005), are controlled. The results also indicate that authentic leadership seems to be associated with feedback given by supervisors to their subordinates, and the general perception of justice in the organization. These associations were expected, since one of the characteristics of authentic leaders would be open

communication in engaging with subordinates (AVOLIO *et al*., 2004). However, the observation of these effects in empirical research is an original contribution of this study.

The results of this research also suggest that the influence of authentic leadership on the safety performance of workers is through the perception of justice. This mediator mechanism would be another result of the moral dimension of authentic leadership, in terms of self-regulated positive behaviors associated with it (AVOLIO; GARDNER, 2005). This observation resonates in safety literature in which such factors as the leadership support has been associated with safety behavior (COOPER, 2006; HOFMANN *et al.* 2,003; HOFMANN; MORGESON, 1999). Likewise, the fact that the perception of justice promoted by authentic leaders fosters safety performance supports the international academic literature on the topic, noting that workers treated with justice tend to be more disciplined and behave altruistically (COHEN-CHARASH; SPECTOR, 2001), two sub-dimensions related to safety performance. However, the specific associations between authentic leadership, justice and safety observed in this work is a further contribution to this field of knowledge.

The results of the study do not support the assertion that the effect of authentic leaders on safety performance is mediated by feedback, i.e., the process whereby the leader promotes authentic safety behavior appears not to be via the feedback promoted by the leader. However, it was observed that feedback seems to be one of the mechanisms through ~~by~~ which authentic leaders foster a greater sense of justice among their subordinates, which finds support in the literature that discusses trust as an important element of effective feedback (EARLY 1986). Although the results suggest that feedback helps to maintain a climate of justice in the workplace, and that justice favors safety, future studies may clarify whether qualitative aspects related to the feedback provided by the supervisor would be directly associated with safety discipline (BLACKMON; GRAMOPADHYE, 1995). It is noteworthy that the weak association between the feedback given by the leader and safety behaviors in the study group may be a consequence of the restricted power of the scale used in this study to discriminate specific aspects of applied feedback. Future studies could verify this issue through the use of broader metrics of evaluation of the feedback. Another suggestion is to also consider the feedback given by other members of the company, not only direct supervisors.

Another limitation of the study relates to the sample size and the domain surveyed. All participants worked in companies with a high degree of risk - construction and assembly in the oil and energy sector. In addition, the companies surveyed have a favorable safety performance compared to the average of the Brazilian market, given that this is a criterion

used by Petrobras in bidding for contracts. For future research, it is suggested to expand the sample, including firms with poor performance in work safety. Such studies should seek to gather sufficient sample data so that more robust analysis tools, such as structural equation models, can be applied.

Finally, since the safety information was provided by the workers themselves, there may be some degree of inaccuracy in their account. However, this strategy was the most convenient, keeping in mind the data collection from the field, as well as the absence of specific performance evaluations regarding safety in companies. Furthermore, the direct observation of this behavior by pairs and by superiors would also entail a more limited accuracy metric (NEAL *et al*. 2000). It is worth mentioning that although this is the strategy most commonly adopted in research on individuals' safety performance at work (NEAL; GRIFFIN, 2002; 2006; INNESS; BARLING; TURNER, STRIDE, 2010; LU; YANG, 2010), survey research based on self-assessments are subject to bias, which is a limitation of this work. Future studies could test the proposed relationships using alternative tools or assessment sources, and cross-check this information with aggregate data on safety behaviors in groups of employees of a set of companies or organizational units.

From a practical standpoint, the results can provide the organization with ~~of~~ information to improve HSE management systems, developing leaders and awareness of employees, and even their selection. Encouraging authenticity in the companies would be recommended as a useful addition to the management of safety in hazardous areas. Thus, authenticity could also be used as an objective criterion for succession planning and promotions to management positions in the areas most accustomed to risk within a company; as well as in industries where risk is a strategic issue. In relation to leadership development, aspects of authenticity can be handled in training programs, in order to be promoted among supervisors and managers, to encourage greater adherence of employees to safety. Moreover, even in the selection stage, the assessment of conscientiousness and propensity to risk could be objective criteria to be incorporated into the selection process, especially in the recruitment of staff for highly dangerous functions.

This work represents a contribution to the advancement of knowledge about authentic leadership and safety performance because empirical studies investigating the association between the two are rare until now. The resumption of the issues related to leadership and ethics in business, particularly in time of crisis experienced by most of the nations of the developed world, takes as its premise the notion that genuine and high values should guide the

conduct of leaders, so they can positively influence organizations from all sectors to overcome the challenges it presents. Especially in Brazil, where matters relating to ethics have been the subject of constant debate, by both public opinion and the academic environment, the association between the moral conduct of leaders and job performance provides additional arguments for their appreciation, encouragement and monitoring, not only in companies operating in the industrial sector, but in all organizations.

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