LINKING BASIC HUMAN VALUES, RISK PERCEPTION, RISK BEHAVIOR AND ACCIDENT RATES: THE ROAD TO OCCUPATIONAL SAFETY

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ABSTRACT

To improve occupational safety, it is necessary to consider both management and individual approaches. The individual approach includes internal factors such as basic human values, risk perception, risk behavior and experience of accidents; the aim of this study is to observe the link between these. 104 workers from the forging and casting department of an Indonesian military tools manufacturer participated voluntarily in the study. They were asked to complete a set of questionnaires, consisting of a portrait value questionnaire to assess personal basic human values, a risk perception and safety questionnaire to assess risk perception and risk behavior, and a self-reported accident questionnaire. Structural Equation Modelling (SEM) and bivariate correlation were applied to observe the links between basic human values, risk perception, risk behavior and accident rates. The results show that the basic human value that influences risk perception is that of power. Risk perception correlates with risk behavior, and risk behavior correlates with accident rates. The implications of the results are that occupational safety can be achieved through individual approaches based on basic human values and risk perception.

Keywords: Accidents; Basic human value; Risk behavior; Risk perception; SEM

1. INTRODUCTION

Safety issues are given high priority in many industries. Safety is not only related to the absence of accidents and minimization of risk, but can also be seen as an important factor in work quality (Hollnagel, 2004), which will eventually affect the performance of industries as a whole. In fact, all efforts to enhance occupational safety have a common objective to not only minimize accidents, but also to minimize risk. If risk can be minimized, it can be expected that accidents will also be reduced. Therefore, research has been more focused on risk minimization.

Risk can be defined as the possibility of physical, social or financial harm or loss due to a hazard or uncertainty about outcomes (Rohrmann, 2005). McGregor (2006) also states that risk is a person's probable exposure to loss, harm or damage. Within the two definitions, risk is described in the context of two components: severity (which results from the occurrence of hazard), and the probability of a hazard occurring (Lehman et al., 2009). Therefore, occupational safety efforts are concentrated on reducing both the severity and probability of risk (e.g., Muñoz et al., 2017).

Considering the importance of safety, industries put considerable efforts into improving safety in the workplace. Such efforts fall in two common areas: engineering controls (including design

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installation, inspection and repair (Khowaja et al., 2016; da Costa et al., 2018)), and written systems (including policies, procedures, rules and audit programs (Widyanti et al., 2018)). Considering the importance of safety, industries put considerable efforts into improving safety in the workplace. However, accidents still happen in industry, implying the need for understanding of more than the engineering aspects and written systems (Mearns et al., 2003; Laurence, 2005; Liu et al., 2015).

To reduce both the severity and probability of risk, as described earlier, different approaches to the engineering aspect and written system are gaining more attention. The most discussed approach in this case is the behavioral approach (Siregar et al., 2015; Widyanti and Talha, 2017; Zuraida et al., 2017; Widyanti and Sutanto, 2017; Widyanti et al., 2018). Behavior related to risk is known as risk behavior. Rundmo et al. (2011) define it as the extent to which employees ignore safety regulations in order to get a job done or break rules or procedures to complete a job quickly. In some research, the risk behavior approach in relation to safety (also known as behavior-based safety) has been proven to be successful when implemented in the context of risk management and injury prevention (see for example Geller, 2005).

Improving risk behavior is greatly influenced by the lens through which individuals view the risk objective or risk perception (Oppong, 2015). Risk perception can be defined as a person's judgment (including their opinions and beliefs) of the risk associated with a hazard, and as awareness of hazards and the probability of incurring harm (Slovic, 2010). Risk perception falls into the category of subjective risk (i.e., perceived risk), but it must be underlined that risk itself (i.e., objective risk) exists whether people are aware of it or not, and regardless of whether they are concerned about it. Thus, risk perception is not free from bias, and biased risk perception can cause misjudgements of objective risk, which may affect risk behavior.

Risk perception research has gained more attention as part of risk and safety management. Theories on risk perception and the implications for accident prevention have been developed, for example the risk preference theory and risk homeostasis theory (Oppong, 2015). Risk preference theory states that people have a natural predisposition towards risk that is determined by their personality (Gallagher, 2005), gender, age and cultural settings (Rohrmann, 2005; Nordenstedt & Ivanisevic, 2010), and their basic human values and beliefs (Rundmo et al. 2011). On the other hand, homeostasis theory states that humans have a bearable level of comfortable risk and can adjust their behavior according to this bearable level. If risk is perceived as being greater than the bearable level, they will adjust their behavior to lower the risk, and vice versa. Based on the two theories, it can be underlined that risk perception plays an important role in accident prevention. Furthermore, Rundmo et al. (2011) propose three possible approaches to the relation between risk behavior and accidents, namely that accidents may result in risk perception; risk perception may cause accidents; and risk perception and accidents are both endogenous variables which are independent of each other.

Some research has hypothesized that the perception of occupational risk factors will affect safety behavior (e.g., Rundmo et al. 2011). In addition, Nordenstedt & Ivanisevic (2010) state that having better knowledge of risk perception can improve the quality of decision making in safety and lower the impact such decisions. Furthermore, other research has investigated the influence of risk perception on safety behavior (Brewer et al. 2004; Arezes & Miguel, 2008; Lund & Rundmo, 2009), with mixed results.

Risk perception is influenced by several factors. Recent research has underlined the importance of considering basic human values in risk perception. Schwartz et al. (2012) define basic human values as trans-situational goals, which vary in importance, and serve as guiding principles in the lives of individuals or groups. In addition, many researchers have proposed that basic human values function as standards that guide thought and action (Rohan, 2000; Feather, 2002).



Figure 1 Conceptual model of the relation between basic human values, risk perception, risk behavior, and risk accidents

Considering the importance of the constructs discussed above (i.e., basic human values, risk perception and risk behavior) in occupational safety, only partial and limited studies have been conducted to observe the relation between these, in particular the relation between the fundamental construct (i.e., basic human values) and the others. Study of basic human values and their relation with accidents is crucial as part of the effort to reduce occupational accidents, since, as stated previously, basic human values will guide thought (as well as risk perception in this case) and actions. Risk perception and actions in the workplace will influence safety behavior and accidents. It would appear that only Nordenstedt and Ivanisevic (2010) have observed the relation between basic human values and risk perception in disaster management. Brewer et al. (2004) and Reniers et al. (2016) found a relation between risk perception and risk behavior in the healthcare system, however only limited studies have been conducted in the

industrial setting. One example is the work of Rundmo et al. (2011), who studied risk perceptions and occupational accidents in the oil industry and gave a causal description of the relationship between the two variables.

The purpose of this study is to observe the relation between personal basic human values, risk perception, risk behavior, and experience of accidents. It is hypothesized that basic human values play a role in risk perception. Risk perception will influence risk behavior, which will subsequently influence the experience of accidents. Figure 1 shows the proposed model for the relation between basic human values, risk perception, risk behavior, and experience of accidents. A clear picture of the overall construct is expected to provide a valuable approach to behavior-based safety as a means of ensuring occupational safety.

2. METHODS

2.1. Participants

104 employees from the forging and casting production department of an Indonesian military tools manufacturer participated in the study (mean age = 38 years, SD = 7 years, all male). The number of respondents is limited due to the limited number of the workers in the military tools manufacturer or company. All had around 10 years' working experience with the company. They were asked to complete a set of questionnaires at the end of their working day. Permission for the data collection using the questionnaires was given by the employees' supervisor.

2.2. Measures

A set of questionnaires was used, consisting of a portrait basic human value questionnaire and a questionnaire about risk perception and safety.

2.2.1. Portrait value questionnaire

A portrait value questionnaire (PVQ) (Schwartz et al., 2001) was used to assess ten basic basic human values. It consisted of 40 statements and asked individuals to rate the degree to which they shared the views of this person in the statement (self-portrait). An Indonesian version of a PVQ that had already been translated and validated for Indonesia was used (see Johnson & Widyanti, 2011 for a further review). Respondents had to give ratings on a six point Likert scale, ranging from 1 (very much like me) to 6 (not like me at all). The ten basic human values measured were Conformity (related to the inclination to upset or harm others and violate social expectations); Tradition (related to respect of culture or religion); Benevolence (related to preservation of the welfare of people with whom one is in frequent personal contact); Universalism (related to protection of the welfare of all people and of nature); Self-Direction (related to independent thought and action); Stimulation (related to challenges in life); Hedonism (related to pleasure for oneself); Achievement (related to personal success); Power (related to social status and control or dominance over people and resources), and Security (related to the safety and stability of society). These ten basic human values were used since they have been proven to capture all human basic human values and to be related to many human behaviour factors. They are also the basic human values most commonly used in recent studies. The Indonesian version of the PVQ can be seen in Appendix A.

2.2.2. Risk perception and safety questionnaire

A risk perception and safety questionnaire (Rundmo et al., 2011) was also used. It consisted of 250 statements, including dimensions of the Demographic Information of respondents; Current Job Situation; Physical Working Environment; Experience of Risk – Hazards; Probability of Injury; Experience of Risks – Work Tasks; Job Satisfaction; Assessment of Safety; Safety and Accident Prevention; Occupational Health; Questions regarding Safety, Accidents and Near-Misses; Personal Support and Help from Others; and Safety Behavior.

For the purposes of this study, only questions related to risk perception were used. Other dimensions were excluded due to their impracticality (i.e., considering the length of the questionnaire). The respondents were instructed to give a rating based on a five point Likert scale. For questions regarding risk perception, the scale ranged from 1 (very safe) to 5 (very unsafe).

3. RESULTS AND DISCUSSION

All the data sets conformed to the validity and reliability criteria. The basic human values measured by the PVQ are shown in Table 1. Following PVQ analysis guidance (Schwartz et al. 2001), the PVQ values were centered to standardize individual differences in the use of the response scale. The means of all the PVQ questions for a given topic were subtracted from the subscale response for the topic in the centering process. Therefore, the centered basic human value could be negative. The higher the mean centered scores, the higher the tendency of the dimensions among the respondents. The risk perception of the respondents can be seen in Table 2.

PVQ Dimension	Mean centered score
Conformity	0.48
Tradition	0.16
Benevolence	0.00
Universalism	0.36
Self-direction	-0.17
Stimulation	-0.41
Hedonism	-0.74
Achievement	-0.54
Power	-1.07
Security	0.60

Table 1 Mean centered scores from the PVQ

Table 2 Risk p	perception	among the	respondents
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Perception types	Mean	SD
Perception of hazard	2.55	0.61
Perception of risk in job activities	2.22	0.49
Perception of probability of injury	2.21	0.74
Risk perception (overall)	2.33	0.31

To observe the relationship between the constructs, Structural Equation Modelling (SEM) (Hair et al., 2017) was applied in the analysis to test the direct and indirect effects of each variable in the proposed model. It was conducted using AMOS software (www.spss.com/amos). Cronbach's alpha was assessed to observe the relationship; a coefficient < 0.05 shows a significant correlation between the constructs. The higher the coefficient, the stronger the effect of a variable on others. The SEM results are shown in Figure 2.

The goodness of fit of the model, as can be seen in the parameter shown in Figure 2, shows that the resulting model is not able to describe the correlation between the variables well. A good model needs to meet various requirements, such as having significant chi-squares; the Comparative Fit Index (CFI) must be > 0.97; and the Root Mean Square Error of Approximation (RMSEA) must be < 0.05 (see Schermelleh-Engel & Moosbrugger, 2003 for a further review of the goodness of fit of a model using Structural Equation Modeling).

Further analysis, namely partial correlation analysis, was conducted to observe the relation between the basic human values and risk perception, between risk perception and risk behavior, and between risk behavior and accidents. The significant correlations can be seen in Table 3.



Figure 2 Results of the SEM analysis based on the proposed model

Variables that correlate	r	ρ
Basic human value (power) – risk perception	0.206	0.036
Risk perception – risk behavior	0.266	-0.006
Risk behavior – accident rates	0.243	0.013

Table 3 Correlation between research variables

It can be seen that a higher power of basic human value shows higher risk perception. As expected, a negative correlation was found between risk perception and risk behavior. Poor risk perception implies higher risk behavior. Finally, higher risk behavior shows a higher number of accidents.

In relation to basic human values and risk perception, the study shows that only the power of basic human value significantly correlates positively with risk perception, whereas the other basic human values do not significantly correlate with risk perception. Power, which is defined as social status and prestige, and control or dominance over people and resources, is manifested in control over people and resources in workplace safety. It can be understood that the control that is used to support and enforce co-workers in relation to safety will be perceived positively in minimizing risk, or in other words, power will relate to better risk perception. This result supports those of previous studies, that basic human values play an important role in risk perception in general (Slimak & Dietz, 2006; Nordenstedt & Ivanisevic, 2010; Muzikante & Renge, 2011). However, it should be noted that varying results have been found, in particular with regard to the specific basic human values that influence risk perception in various situations. For examples, Dake (1991) found that universalism, or egalitarianism, had a negative correlation with social risk-taking; conformity has been found to have a positive correlation with risk in perceived risk in internet buying (Park & Jun, 2003); and benevolence to have a

negative correlation with risk perception in alliance structuring (Das & Teng, 2001) and in online purchasing (Chang & Chen, 2008).

The negative correlation between risk perception and risk behavior is as expected. Respondents who perceived risk in a safe way would be more careful in their behavior. The results of this study are in line with those of previous studies, that risk perception relates to safety behavior (Rundmo et al., 2011). Furthermore, Arezes and Miguel (2008) also concluded that risk perception is a predictor of safety behavior in hearing preservation. As stated by Rundmo et al. (2011), risk perception may affect employee behavior. However, it is not necessarily a significant predictor of risk behavior. Perception and behavior may also be independent variables. Therefore, safety can be improved by changing individual risk perception, and vice versa.

The positive correlation between risk behavior and accidents in this study is in line with the results of previous studies. It is already well known that involvement in accidents tends to be associated with unsafe behavior, and conversely, that risk behavior is associated with accidents. This can be found in various situations, such as in driving (Ngueutsa & Kouabenan, 2016), in the health sector (Kouabenan et al., 2007) as well as in various workplaces (Gyekye, 2006; Gonçalves et al., 2008; Leiter et al., 2009; Khanzode et al., 2012).

The implication of the study results is that occupational safety can be obtained through individual approaches based on basic human value and risk perception. Whereas the conventional approach emphasises the importance of the engineering approach and written procedure, this study shows that the basic human values and perceptions approach can be applied in ensuring safety in the workplace. As stated by Weinstein (1989), personal experience is a powerful factor in self-protective behavior, since experience is widely believed to have a powerful impact on the recognition of risk and the willingness to take precautions. Thus, the basic human values approach should indeed be considered in improving safety behavior in the workplace.

This study has some limitations worth noting. First, we intended to measure accident rates in order to observe the relation not only between basic human values, risk perception and safety behaviour, but also in relation to accident rates. However, the restricted and confidential company data prevented us from doing this. The second limitation is that there was not a balanced number of respondents based on gender. Since previous studies (Nordenstedt & Ivanisevic, 2010) reveal that females tend to be more concerned about the risk of different hazards, further studies should consider gender differences in basic human values and risk perception. Third, the number of respondents was limited to 104 due to the limited number of workers in the military tools manufacturer. This limited number might result in a poor SEM model. Future studies involving more respondents may result in more statistical power and more facts for further investigation.

4. CONCLUSION

The aim of the study was to observe the link between basic human values, risk perception, risk behavior, and accident rates. Partial correlation shows that there are correlations between basic human values (i.e. power) and risk perception, between risk perception and risk behavior, and between risk behavior and accident. Thus, the results of the study show that occupational safety can be obtained through individual approaches based on basic human values and risk perception.

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APPENDIX A Indonesian Version of the Portrait Value Questionnaire

Bacalah setiap pernyataan di bawah ini. Berikan tanda silang (x) pada kotak di kanan yang sesuai dengan diri Anda.

- Memikirkan ide baru dan menjadi kreatif sangat penting bagi saya. Saya suka melakukan hal dengan cara sendiri.
 Menurut saya menjadi kaya itu penting. Saya
 - Menurut saya menjadi kaya itu penting. Saya ingin memiliki banyak uang dan barang-barang yang mahal.
- 3. Menurut saya setiap orang di dunia itu harus diperlakukan setara. Saya percaya bahwa semua orang memiliki kesempatan yang sama dalam hidup.
- 4. Menunjukkan kemampuan adalah hal yang penting bagi saya. Saya ingin orang lain mengagumi saya atas pekerjaan yang telah saya lakukan.
- 5. Penting bagi saya untuk hidup dalam lingkungan yang aman. Saya akan menghindari segala hal yang dapat mengancam keselamatan dan keamanan saya.
- 6. Melakukan banyak hal yang berbeda dalam hidup adalah hal yang penting bagi saya. Saya akan selalu mencari hal baru untuk dicoba.
- Saya percaya bahwa semua orang harus melakukan sesuai seperti yang telah diberi tahu. Saya berpikir semua orang harus selalu mengikuti peraturan setiap waktu, bahkan saat tidak ada orang yang mengawasi.
- 8. Penting bagi saya untuk mendengarkan orang yang berbeda dari saya. Bahkan ketika saya tidak setuju dengan mereka, saya masih ingin memahami mereka.
- 9. Penting bagi saya untuk tidak meminta lebih dari apa yang saya punya. Saya percaya bahwa orang-orang seharusnya puas dengan apa yang mereka punya.

Sangat mirip saya	Mirip saya	Agak mirip saya	Sedikit mirip saya	Tidak mirip	Tidakmirip sama sekali

10.	Saya mencari setiap kesempatan untuk bersenang-senang. Penting bagi saya untuk melakukan hal yang menyenangkan bagi saya			
11.	Penting bagi saya untuk mengambil keputusan sendiri mengenai hal-hal yang saya lakukan. Saya suka jika bebas merencanakan dan memilih aktivitas sendiri			
12.	Sangat penting bagi saya untuk membantu orang di sekitar. Saya peduli dengan kesejahteraan mereka			
13.	Menjadi sukses adalah penting bagi saya. Saya suka membuat orang lain kagum terhadap saya			
14.	Keamanan negara adalah hal yang penting bagi saya. Saya berpikir bahwa daerah saya harus siaga terhadap serangan dari dalam maupun luar			
15.	Saya suka mengambil risiko. Saya selalu			
16.	Penting bagi saya untuk bersikap baik. Saya ingin menghindari melakukan apapun yang orang lain anggap salah			
17.	Penting bagi saya untuk menjadi pemimpin dan memberi tahu orang lain apa yang harus dilakukan. Saya ingin orang-orang melakukan apa yang saya katakan			
18.	Penting bagi saya untuk menjadi setia kepada teman-teman saya. Saya ingin mengabdikan diri			
19.	Saya sangat percaya bahwa orang harus lebih peduli terhadap lingkungan. Menjaga			
20.	Agama adalah hal yang penting bagi saya. Agama adalah hal yang penting bagi saya. Saya			
21.	berusaha untuk mengikuti ajaran agama saya. Kebersihan dan keteraturan adalah hal yang penting bagi saya. Saya benar-benar tidak suka			
22.	dengan keadaan yang berantakan. Penting bagi saya untuk tertarik dengan banyak hal. Saya suka memiliki keingintahuan dan			
23.	mencoba untuk mengerti banyak hal. Saya percaya bahwa semua orang yang ada di dunia seharusnya hidup dalam keselarasan. Menyebarkan kedamaian kepada semua orang yang ada di dunia adalah hal yang penting bagi			
24.	saya. Menjadi ambisius adalah hal yang penting bagi saya. Saya ingin menunjukkan bahwa saya			
25.	mampu. Melakukan dengan cara yang tradisional adalah cara yang paling baik bagi saya. Penting bagi saya untuk menjaga tradisi yang telah saya			
26.	pelajari. Menikmati kesenangan hidup adalah hal yang penting bagi saya. Saya suka memanjakan diri saya sendiri			
27.	Penting bagi saya untuk merespon keinginan orang lain. Saya mencoba untuk mendukung			
28.	Saya percaya bahwa saya harus selalu menunjukkan rasa hormat kepada orang tua saya dan orang-orang yang lebih tua. Penting			

bagi saya untuk menjadi patuh.

- 29. Saya ingin semua orang diperlakukan secara adil, bahkan orang-orang yang tidak saya kenal. Penting bagi saya untuk melindungi orang lemah dalam masyarakat.
- 30. Saya suka kejutan. Penting bagi saya untuk memiliki hidup yang menggembirakan.
- 31. Saya mencoba untuk tidak jatuh sakit. Menjadi sehat adalah hal yang penting bagi saya.
- 32. Menjadi selangkah lebih maju dari orang lain adalah hal yang penting bagi saya. Saya ingin menjadi lebih baik dari orang lain.
- 33. Memaafkan orang yang telah menyakiti saya adalah hal yang penting. Saya mencoba untuk melihat kebaikan yang ada dalam diri mereka dan tidak mendendam.
- 34. Penting bagi saya untuk menjadi mandiri. Saya suka bergantung pada diri sendiri.
- 35. Memiliki pemerintahan yang stabil itu penting bagi saya. Saya peduli bahwa tatanan masyarakat harus dilindungi.
- 36. Penting bagi saya untuk selalu sopan terhadap orang lain setiap waktu. Saya berusaha untuk tidak pernah mengganggu atau menyinggung orang lain.
- 37. Saya sangat ingin menikmati hidup. Memiliki waktu yang baik sangat penting bagi saya.
- Penting bagi saya untuk menjadi rendah hati dan sederhana. Saya mencoba untuk tidak menarik perhatian
- Saya selalu ingin menjadi orang yang mengambil keputusan. Saya suka menjadi pemimpin.
- 40. Penting bagi saya untuk beradaptasi pada lingkungan. Saya yakin bahwa orang seharusnya tidak mengubah alam.