Personality Trait Based Intervention for Workplace Accident Prevention

Yassierli[1*], Nurhayati[1], Marisa Anatasia[1], and Shamsul Bahri[2]

1. Faculty of Industrial Technology, Institut Teknologi Bandung, Bandung 40132, Indonesia
2. Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Selangor, Malaysia

*e-mail: yassierli@mail.ti.itb.ac.id

Abstract

Previous research has suggested that some traits may be useful as the predictors of risk behaviours behaviors. Therefore, personality traits seem to play a role in accident involvement. The purpose of this study is was to explore the relationship between the personality traits based on the Big Five Inventory (BFI) and worker accident experiences in order to elaborate personality traits based intervention for workplace accident prevention. A cross cross-sectional study was conducted among 173 workers in a cement company using a set of questionnaires consisting of respondents' characteristics, BFI, and self-reported accident experience. The correlations were computed using Goodman Kruskal's Gamma. A negative correlation between Extraversion dimension and accident experience was found to be approaching significant (G=-0.273, p = 0.061). Workers with lower Extraversion dimensions, based on BFI, are recommended to have priority needs be prioritized for training or to be assigned to less hazardous workplaces.

Abstrak

Intervensi Berdasarkan *Traits* Kepribadian dalam Pencegahan Kecelakaan Kerja. Penelitian terdahulu menyatakan bahwa beberapa *traits* dapat digunakan untuk memprediksi perilaku yang berisiko pada kecelakaan kerja. Oleh karena itu, tampaknya *traits* kepribadian memegang peranan penting pada keterlibatan dalam kecelakaan. Tujuan penelitian ini adalah untuk mengeksplorasi hubungan antara *traits* kepribadian berdasarkan *Big Five Inventory* (BFI) dengan pengalaman keterlibatan pekerja pada kecelakaan kerja dalam rangka mengelaborasi intervensi manajemen berbasis perilaku dalam mencegah kecelakaan kerja. Penelitian bersifat *cross-sectional* yang dilakukan terhadap 173 pekerja industri semen menggunakan seperangkat kuesioner yang terdiri atas karakteristik responden, BFI dan pengalaman kecelakaan kerja (*self-reported*). Uji korelasi dilakukan menggunakan Goodman Kruskal's Gamma. Ditemukan korelasi negatif antara dimensi *Extraversion* dan pengalaman kejadian kecelakaan kerja yang mendekati signifikan (G = -0,273, *p* = 0,061). Pekerja dengan dimensi Extraversion yang lebih rendah, berdasarkan BFI, direkomendasikan untuk mendapatkan prioritas dalam pelatihan atau ditugaskan pada area kerja yang memiliki *hazard* lebih rendah.

Keywords: accident proneness, Big Five Inventory (BFI), personality traits, workplace

1. Introduction

Workplace accident is still the major concern in Indonesia. Though there has been a slight decline in fatality and the accident rates of workplace accidents in Indonesia in the last four years, the numbers are still of concern. There were a total of 2,375 workplace accidents with death in 2014 with the fatality rate of 14.14 [1]. Financially, the accidents should considerably have affected the business continuity of Indonesian companies. The Indonesian government social security agency, PT. Jamsostek spent a total of about IDR 652 billion for insurance payments in 2014 [1]. The financial impact should have been much higher if the total costs had been computed with the inclusion of medical costs, insurance compensation and disability payments, lawsuit costs, lost production time, damage equipment, or even wasted materials. It should be noted that the aforementioned accident rates and costs are taken from registered active members of the government insurance company that are only a small portion of Indonesian workers.

Companies have spent tremendous efforts to prevent workplace accidents. Organized attempts appeared to be initiated in the early 1900 when workers' compensation laws were regulated in the US [2]. As a result, accident became a cost to companies. A number of safety approaches have been implemented at workplace to redesign their work systems to reduce the cost through minimizing the probability and impact of accidents. The

approaches include engineering, management, audit, system safety, ergonomic, environmental and behavioral approaches [3,4]. All of these approaches are still used today as part of company's safety initiatives. However, strategies to anticipate human error as the main cause of most accidents remain unsatisfying [5].

There have been several definitions of human errors in the literatures. Human error can be defined as *any significant deviation from an expected standard of human performance* [3]. The error can be differentiated as design error, communication error and management system error. To understand how human errors can cause accidents, researchers have proposed a number of human error models and frameworks, including Wicken's information processing model, Rasmussen's skills-rules-knowledge model of decision making, and Reason's Generic Error Modeling System [6]. Reason argues that human error problem can be viewed as the person and the system approaches [7]. Therefore, error management should be able to limit the incidence of dangerous errors and be able to create error-tolerant systems.

Related to a behavioral approach as part of safety initiatives, researchers have proposed personnel selection as a method to reduce the possibility of human errors at workplace. We classify this strategy as personality trait-based intervention. It is assumed that certain types of behavior due to differences in personality traits can drive the emergence of an unsafe act. On our previous work using Marston's tetra-logy of behavior type, referring to the DISC (Dominance, Influence, Steadiness, and Conscientiousness) traits, we found an association between the Conscientiousness trait in public self and accident involvement, though the correlation was low [8]. Furthermore, we found that the Influence trait in public self on DISC has a correlation with lower perception toward safety climate [9]. The challenge of using the DISC is that each DISC trait may vary to direct the behaviors shown by an individual in public self, private self, and perceived self [8].

In this study, a simpler assessment of personality traits was used namely the Big Five personality. The Big Five prototype seems to have a similarity with the broad foundation of personality measurement as defined by the DISC [10]. We found the Big Five personality model as a valid and general taxonomy for personality structure. The Big Five Personality that we used comprises: Factor I: Extraversion/introversion (or Surgency), which later will be called as Extraversion; Factor II: Friendliness/hostility (or Agreeableness), which later will be called as Agreeableness; Factor III: Conscientiousness (or Will), which later will be called as Conscientiousness; Factor IV: Neuroticism/emotional stability (or Emotional Stability), which later will be called as Neuroticism; and Factor V: Intellect (or Openness), which later will be called as Openness/ Intellect [11].

Moreover, the model of the Big Five Inventory (BFI) has been widely used in numerous studies as a framework to explore personality criteria in relation to a job [4, 11]. Such a correlation has been studied in the transportation safety area [5,11-14] using drivers as the sample. A limited number of studies has focused on the industrial workplace setting. In the present study, a cement company has been chosen due to its high fatality risk [15].

The main goal of the present study is to identify worker characteristics that may be associated with a high accident risk based on their history in accident invol-vements at an industrial workplace setting. If a correlation exists, those with a high correlation with previous accident involvement is considered to have priority needs for training or to be assigned to a less hazardous workplace. We hypothesized that certain BFI personality types have a high correlation with accident involvement at workplace.

2. Methods

A set of questionnaires was distributed to respondents. The questionnaire consists of three sections. The first section includes items on the subject's personal demographic and working information, such as age, gender, educational degree, the working unit, and the working year in the company. No information about the personal name and identity was asked for confidentiality. The second segment was the BFI which was intended to evaluate the personality traits. The English version of the BFI was translated into Indonesian language, and validated using back-translation by an expert translator. The questionnaire consists of 44 statements for which respondents were requested to indicate an agreement using a 5-point Likert-type scale ranging from "strongly disagree" to "strongly agree". The last portion of the questionnaire was constructed to assess respondents' involvement in accidents at the workplace. The respondents' experiences on the accidents at their workplaces were assessed by asking their involvement during the last five years.

A consent form and a set of the questionnaires were distributed to workers after the permission from their supervisors was obtained. Prior to giving their consent, the respondents were asked to read the purpose of the study and their right to refrain from answering any questions. The respondents took less than 10 minutes to complete the questionnaire. Assistance was provided to explain wording or terminology if the respondents' needed further inquiry. All data were kept confidentially from the company.

A total of 173 field workers of a cement company participated in this study. It has been reported that cement companies were among those in the industry with high fatality rates [15]. The participation was voluntary and the respondents were not inquired about.

Table 1. Respondents' Profiles

Characteristics	Involved in accident(s) (*n*=23)	Not involved in accidents (*n*=108)
Gender		
Male	100%	100%
Female	-	-
Age		
<30 years old	13.04%	11.11%
30-50 years old	78.26%	71.30%
>50 years old	8.70%	17.59%
Education		
Up to Senior High	95.65%	94.44%
Diploma Degree	4.35%	4.63%
Bachelor Degree	-	0.93%

their personal identities. Among the 173 survey data collected, only 131 survey data (76%) were considered complete. The respondents' experiences were divided into two categories: 'not involved in accidents' and 'involved in accident(s)' in the last five years. There are 23 respondents (18%) that have been involved in accident(s) in the last five years. The respondents' demographic characteristics are presented in Table 1.

The obtained data were processed as the following. The questionnaire's construct validity was calculated using Pearson product moment correlation coefficient. The validity test resulted in a significant correlation among all manifest variables with latent variables ranging between 0.219 and -0.728 (p<0.05). Reliability A reliability testing was conducted based on internal consistency reliability using Alpha Cronbach. The reliability test shows fair to good levels of reliability values of the translated BFI, in which: extraversion (0.48), agreeableness (0.64), conscientiousness (0.76), neuroticism (0.58), and openness (0.68). Finally, the normality test was performed based on the Kolmogorov-Smirnov test, and the results indicated that the data for each BFI dimension were normally distributed. The average score of each BFI dimension was then computed. The Goodman Kruskal's Gamma was used to compute the relationship between the BFI dimensions and the respondents' accident experiences. It was assumed that those who have not been involved in accidents are better than those who have been involved in accident(s) during the last five years.

3. Results and Discussion

In general, the respondents' BFI profile can be seen in Table 2. Most of respondents can be categorized with the high scores in Extraversion, Agreeableness, Conscientiousness, and Openness, but low scores in Neuroticism. The lowest value was found for Neuroticism trait (not

involved in accidents = 2.470, involved in accidents = 2.587), while the highest value was found for Conscientiousness trait (or Will) (4.89).

The Goodman Kruskal's Gamma coefficient values can be seen in Table 3. The correlation was found to be negative and approaching significant between Extra-version and accident experience (G = -0.273, p = 0.061). This result indicates that respondents with lower Extraversion have more propensities to get involved in accidents than those with higher Extraversion. Other correlations were found to be not significant.

Table 4 demonstrates the percentage of respondents for each BFI dimension if the dimension is grouped into low and high, after the values have been normalized. However, there is no difference in the proportion of the respondents for each trait after categorization.

Further investigation found that there were nine trait profiles with low Extraversion dimension among the respondents that were involved in the accidents during the last five years (69.6%), as shown in Fig. 1. Although they were not involved in any accidents during the last five years, it is worth noting that there were six profiles with low Extraversion (6.48%) that might have high higher propensity to get involved in accidents in the future based on the result of this study (Fig. 1). A Further study with a higher number of respondents is needed to find out other profiles of low Extraversion people.

This study is aimed at investigating the relationship between personality dimensions and accident involvement in order to identify the personality-trait based intervention for workplace accident prevention. We assumed that if trait-related accident involvement is identified, personnel selection can be used for a practical strategy to minimize the risk of accidents at workplace. Those who are perceived to be high risk due to their dimensions can be

Table 2. Results of the BFI Assessment (*N=131*)

	Not involved in accidents (*n*=108)		Involved in accidents (*n*=23)	
	Mean	S.D.	Mean	S.D
Extraversion	3.57	.329	3.42	.286
Agreeableness	4.07	.362	4.04	.403
Conscientiousness	3.94	.392	3.81	.520
Neuroticism	2.47	.363	2.59	.422
Openness/Intellect	3.58	.327	3.58	.447

SD = Standard Deviation

Table 3. Correlation Coefficients among BFI Dimensions and Accident Experience

Trait	gamma	*p*-value
Extraversion	-.273	.061
Agreeableness	-.006	.968
Conscientiousness	-.150	.334
Neuroticism	.195	.211
Openness/Intellect	-.059	.713

Table 4. Percentage of Respondents for Each BFI Dimension Category (*N=131*)

Trait	Not involved in accidents (n=108)		Involved in accidents (n=23)		Total	
	Low	High	Low	High	Low	High
Extraversion	44.44%	55.56%	69.57%	30.43%	48.85%	51.15%
Agreeableness	48.15%	51.85%	43.48%	56.52%	47.33%	52.67%
Conscientiousness	48.15%	51.85%	52.17%	47.83%	48.85%	51.15%
Neuroticism	40.74%	59.26%	30.43%	69.57%	38.93%	61.07%
Openness/Intellect	45.37%	54.63%	56.52%	43.48%	47.33%	52.67%

placed in low risk positions. Along with this assumption is a model proposed by Christian, *et al*. (2009) [16]. In their model, personality characteristics (e.g. conscientiousness, locus of control, risk taking) are part of distal person-related factors which are correlated with safety performance and safety outcomes.

Our main results indicate that, among the five personality dimensions defined by the model of the Big Five Inventory (BFI), Extraversion dimension is negatively correlated with accident experience(s). This means that individuals with a high Extraversion dimension, characterized by sociable, forceful, energetic, adventurous, enthusiastic, and outgoing personalities, are less likely to experience accident experience(s) [17]. The negative correlation between Extraversion and accident experience can be explained as extravert individuals possibly enjoy the attention given by others, but they might experience higher anxiety due to the potential negative attention when they get involved in near-miss and/or accidents [18].

This finding might seem to be contradictive with our previous study using DISC [8]. We argue that the results of our current study cannot be compared with our previous study because our previous study evaluated the correlation between the respondents' behavior type and their perception toward safety. However, the current study focuses on the relationship between respondents' personality dimensions and their accident experiences. The Extraversion dimension in BFI appears to be comparable with talkative (I), assertive (D), outgoing (I), outspoken (D), dominant (D), forceful (D), enthusiastic (I), sociable (I), and adventurous (D) traits in DISC behavior type [9]. Based on our previous study, (I) the public self was negatively related to workers' safety commitment and their perceptions toward safety climate. In addition, (D) the private self is positively correlated with the workers' safety priority and non- acceptance risks [8]. Both results mean that individuals that have social images characterized by a desire of acknowledgement of their ability and freedom from controls, have a tendency toward a lower safety commitment, and
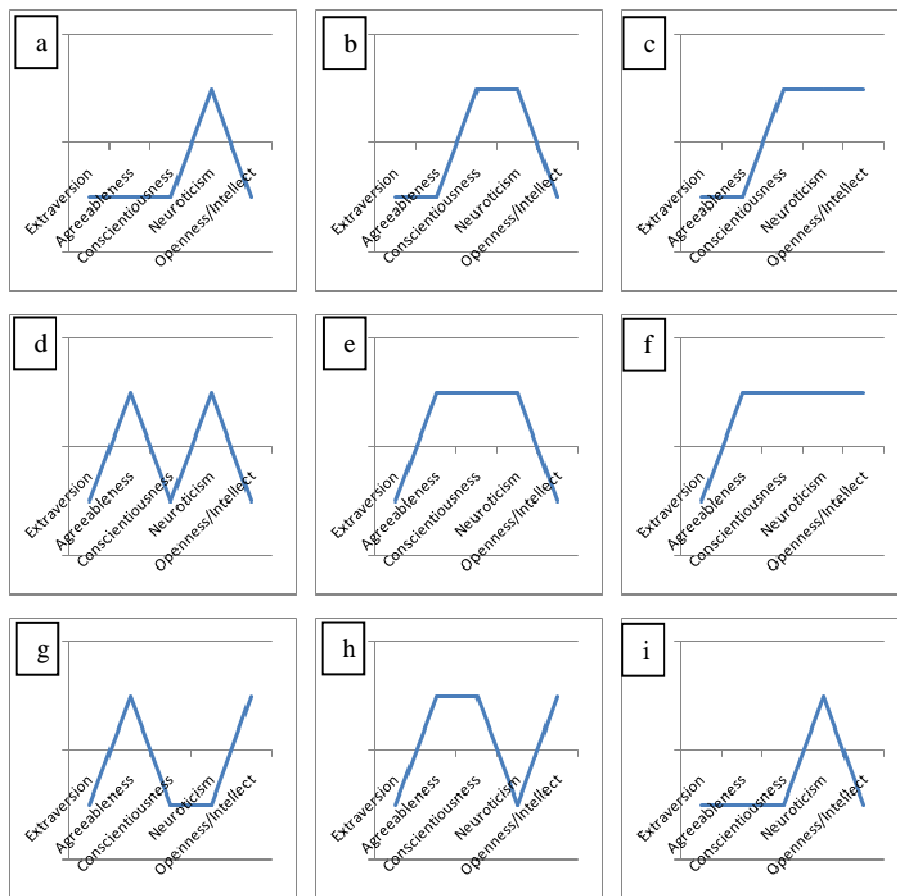
Figure 1. Profiles of Lower Extraversion Individuals who Involved in Accident

individuals who are ready to take a serious risk and force their desires in stressful situations may consider safety and risks as a challenge and then may take risks unwisely and dangerously.

Previous research supported the notion that the Big Five measure focuses on the sociable nature of extraverts more than on their thrill-seeking nature that makes them more attuned to safety conditions, and that they have more positive attitudes toward safety [19]. Their numerous social connections might be the contributing factors that make them feel more personally responsible for the well-being of others [20]. The finding of these two studies indicates that there are other factors that mediate the respondents' personality and their perception toward safety that results in the accident involvement behavior.

The current study is a stage of our research road map in finding an effective intervention at workplace to minimize the risk of accidents, in this stage, we focus on personality traits based intervention. By identifying the personality traits that might have been the propensity toward work-related accidents, hopefully the safety practitioners can used this information to minimize the work work-related accidents during the process of: 1)

identifying the priority scales of individuals whom need urgent training, and 2) selecting individuals that will be assigned to a less hazardous workplace in the individual selection process for high risk jobs [8].

We found that there are nine profiles of those with a low Extraversion dimension, as shown in Fig. 1. This study suggests that they may have a higher possibility to get involved in an accident. In this study, they are accounted for 48.9% of the respondents who tend to be less talkative, less energetic, more restrained rather than outspoken, and less dominant. Since the traits have been found to have significant correlations with accident experiences, an improvement in the safety culture is also expected as it can be a predictor for safety behavior [21-24]. Further, it is worth to discussing the profiles of those with low Extraversion found in this study as shown in Figure 1. We found that most of them have high neuroticism and low scores on other dimensions. Among those who had low Extraversion and were involved in accidents during the last five years, there were 37.5% respondents who had high scores in neuroticism and low scores in other dimensions. Neuroticism is associated with emotion stability. Neurotic individuals get frustrated easily, and they become hypersensitive to negative events [25]. In

additions, neurotic individuals are commonly characterized as nervous, high-strung, and anxious persons, and as a result, they are prone to worry with what might go wrong [26].

Several limitations are worth noting. The main concern is related to the respondents' ability to objectively respond to the questionnaire. As shown in Table 2, 95% of the respondents have a formal education up to high school. This may affect their understanding of the content in the questionnaire. We have anticipated this issue by giving necessary explanations and guidance during the questionnaire session.

Another issue is related to the self-report method used in this study. Though the questionnaire is anonymous, there might be fear among the respondents of telling the truth. However, the self-report data seem to be more accurate than archival data in which accidents or nearmiss accidents may be under-reported to the management. The issue, then, is how to group the workers based on their accident characteristics. In this study, we do not distinguish accident-involvement workers based on the frequency and severity of the accidents or nearmiss accidents.

Despite the limitations, this study has made several contributions. We found fair to good levels of reliability values of the translated BFI which can be used as an alternative, standardized tool for assessing personality traits. Given that Extraversion is among the least studied of the Big Five personality traits in their relation with accidents at workplace, this study provides more evidence on the correlation between Extraversion and accidents.

4. Conclusion

It is found that the Extraversion dimension, a characteristic of the personality traits based on the BFI, was has a negative correlation with the accident involvement. This knowledge can be used by companies as a strategy for personality traits intervention by assigning the right person on the right place in order to minimize the propensity of work-related accidents.

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