Research on the Work Style Construction and Safety Performance of Civil Aviation Safety Practitioners

Yuhan Wang[1], Ruijian Liu[2(✉)], and Zhidong Yang[1]

[1] Department of Aviation Safety Management,
Civil Aviation Management Institute of China, Beijing, China
yangzhidong@camic.cn
[2] School of Economics and Management,
Beijing University of Chemical Technology, Beijing, China
rjliu@mail.buct.edu.cn

Abstract. The good work style of safety practitioners is the key to ensure aviation safety. Therefore, CAAC has issued a series of policies and systems to guide the work style construction. In order to explore its effectiveness, based on the policy compliance, this paper evaluates the work style construction from the five dimensions of subject responsibility, leadership responsibility, post responsibility, coordination and linkage, publicity and education, measures the safety performance from the two dimensions of safety participation and safety compliance, and uses structural equation model to explore the relationship between work style construction and safety performance from the perspective of enterprise. The results show that the work style construction policies formulated by the sample enterprise can promote the safety performance when they are implemented alone, but when all the policies are implemented at the same time, there is a certain moderating effect between policies, which affects the policy effect of subject responsibility and coordination and linkage. For this reason, this paper suggests that senior managers should have an overall view when making policies, consider all factors as a whole, ensure mutual coordination within the policy system, and avoid mutual offsetting of policy effects.

Keywords: Work style · Safety performance · Civil aviation

1 Introduction

On May 14, 2018, Sichuan Airlines 3U8633, flying from Chongqing to Lhasa, the right front windshield of the cockpit broke and fell off during the mission. At the critical moment, the captain was calm and calm, and the crew cooperated closely. Finally, he successfully made a forced landing, saving 128 lives, which can be called a miracle of civil aviation in the world. The crew was awarded the honorary title of "hero crew of the Civil Aviation Administration of China (CAAC)". The outstanding performance of the hero crew reflects the strong sense of responsibility and superb professional skills of

X. Shi et al. (Eds.): *LISS 2021*, LNOR, pp. 196–207, 2022.
https://doi.org/10.1007/978-981-16-8656-6_19

civil aviation workers in China, which is the concentrated embodiment of the excellent work style of civil aviation safety practitioners and confirms the necessity of the work style construction. On the other hand, although CAAC has been flying safely for "120 + 4" months in a row, there are still surprises and risks in stability, and the symptoms of human responsibility caused by work style problems emerge in an endless stream, which reflects the urgency of the work style construction. In view of this, since 2018, China's civil aviation industry has started a special activity to rectify the work style. At the National Civil Aviation Safety Working Conference in 2020, the guidance on promoting the work style construction of civil aviation safety practitioners was issued, and all enterprises and institutions in the industry have followed the rectification. However, no one has studied the effectiveness of the relevant guidance, whether the implementation of the work style construction has promoted the safety performance, and what aspects of the work style construction have affected the safety performance, which cannot provide useful feedback for the policy revision. In view of this, this study selects Guangzhou Baiyun International Airport Co., Ltd. as an example to explore the effect of work style construction from the perspective of enterprise, so as to provide a reference for the industry to evaluate the effectiveness of style construction, and provide a new way for the development of civil aviation safety management in the world.

2 Index Selection and Hypothesis

2.1 Index Selection

Work style refers to the relatively stable attitude or behavior style in thought, work and life. Work style is the behavior characteristics reflected in people's work, and is a consistent style throughout the work. Good work style includes dedication, honor the duty, discipline, honesty, excellence, unity and cooperation, and courage to take responsibility. Specific to the civil aviation industry, the work style of civil aviation safety practitioners is a kind of psychological recognition and external response to safety behavior norms. The guiding opinions on promoting the work style construction of civil aviation safety practitioners was issued at the 2020 National Civil Aviation Safety Working Conference. The document specifies that the focus of the work style construction of the industry includes three aspects: implementation responsibility, coordination and linkage, publicity and education. The implementation responsibility includes three aspects: subject responsibility, leadership responsibility and post responsibility. Considering that the document is a programmatic document to guide enterprises and institutions in the industry to carry out work style construction, this study measures the level of work style construction from five aspects: subject responsibility, leadership responsibility, post responsibility, coordination and linkage, publicity and education. There are 25 items in the questionnaire, which are based on the document requirements and combined with the opinions and suggestions of industry experts and senior managers.

Many scholars have studied the measurement of safety performance. Siu et al. (2004) used two indicators of accident rate and occupational injury to measure safety results, in which accident rate refers to work-related accidents or near accidents and their frequency, and occupational injury refers to personal injury that needs to be removed from work for more than 3 days [1]. Motowidlo and Van Scotter (1994) proposed that task

performance and situational performance should be regarded as two dimensions of safety performance [2]. Neal et al. (2000) proposed a safety performance model based on job performance theory [3]. The content of performance refers to the safety behavior of job, including two dimensions of safety compliance and safety participation. This model is widely recognized and used in the construction industry, railway drivers, civil aviation maintenance and other fields by scholars, and has received good evaluation results, so the safety performance measurement scale is an effective way verified by practice. This study also measures safety performance from two dimensions of safety compliance and safety participation. Combined with the research theme, safety compliance refers to following safety procedures and working in a safe way, and safety participation refers to helping colleagues in the workplace and striving to improve workplace safety.

2.2 Model and Hypothesis

Neal and Griffin, Brown, Dedobbeleer, Flin and others believe that the company's safety atmosphere have a direct or indirect impact on the safety behavior of employees [2]. Neal et al. (2000) show that safety climate have a direct predictive effect on safety participation behavior, but it was not found that safety climate had a direct predictive effect on safety compliance behavior [3]. However, the research results of Hong et al. (2014) show that safety climate has a significant positive impact on safety compliance behavior and safety participation behavior [4]. AI-Refaie (2013) studied 324 Jordanian enterprises and concluded that the improvement of safety culture level can improve enterprise safety performance [5]. Cheyne et al. (2013) evaluated the behavior and working environment of 1189 employees in a large transportation enterprise. By using the questionnaire method, through data analysis, they concluded that the high support of enterprises for safety behavior can improve the safety performance [6]. Mohamed (2002) found in his research that there is a significant positive relationship between the quality of safety atmosphere and safety behavior. Managers' commitment to safety will lead to a more positive safety atmosphere [7]. Hasanzadeh et al. (2017) concluded that work experience and safety knowledge can significantly improve the risk perception and attention of construction personnel [8].

At the same time, CAAC's record of 124 consecutive months of safe flight also shows that responsibility implementation, publicity and education, coordination and linkage can promote the improvement of safety performance. Therefore, this study assumes that work style construction and its dimensions have a positive impact on safety performance and its dimensions. The theoretical model is shown in Fig. 1.

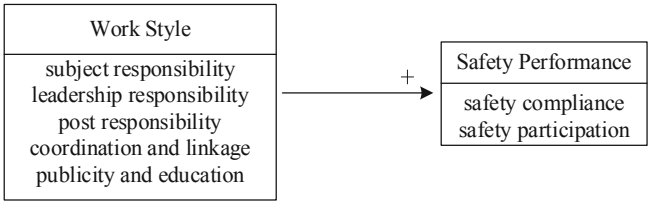

Fig. 1. The theoretical model

3 Research Objects and Questionnaire Distribution

This study selects Guangzhou Baiyun International Airport Co., Ltd. as the research object. In 2020, the passenger throughput reached 43.768 million, ranking the first in the world, becoming the airport with rapid recovery, the largest domestic passenger flow and the largest number of take-off and landing flights after the epidemic. Besides, this enterprise carried out work style construction earlier, and adopted a series of measures. The work style construction covers a wide range and has a certain accumulation, which provides practical support for exploring the relationship between work style construction and safety performance.

In order to ensure that the subjects can cover all departments, posts and employees of different ranks in the sample enterprise, the online questionnaire is adopted in this survey, and the electronic version of the questionnaire is compiled by using "questionnaire star", which is distributed in the form of link or QR code. At the same time, in order to ensure the authenticity and reliability of the information, in the introduction part of the questionnaire, we make a commitment to the information source, information use, and information confidentiality, and in the basic information filling part, we also delete the department and other highly identifiable information. The questionnaire was opened for one week, and 6153 questionnaires were collected. 253 unqualified questionnaires were deleted according to the criteria of whether the same IP was repeatedly submitted, the time taken to complete the questionnaire, whether the answers were obviously random and whether the answers were obviously conflicting. Finally, 5900 valid questionnaires were obtained, with an effective rate of 95.9%.

4 Data Analysis

4.1 Influence of Each Dimension of Work Style Construction on Safety Performance and Its Sub Dimensions

This section explores the influence of subject responsibility, leadership responsibility, post responsibility, coordination and linkage, publicity and education on safety performance and its two sub dimensions (safety compliance and safety participation). Taking the analysis of the impact of subject responsibility on safety performance and its two sub dimensions as an example, the analysis steps are described in detail, and the same steps are adopted for other variables, which will not be repeated.

- The influence of subject responsibility on safety performance. In order to test the effect of subject responsibility on safety performance, the path of structural equation model is drawn as shown in Fig. 2, and the results of model fitting are shown in Table 1. The results show that RMSEA = 0.046, less than 0.08, and the fitting indexes of CFI, NFI and IFI are all greater than 0.9, indicating that the model structure shown in Fig. 2 meets the fitting standard, that is, in the sample enterprise, the implementation of the company's subject responsibility does have an impact on the company's performance. Besides, the standardized path coefficient between them is 0.553 (the result reliability reaches 99%). It shows that the subject responsibility has a significant positive impact on safety performance, that is, the implementation of the subject responsibility indeed promote the improvement of safety performance level.

Table 1. Fitting index of the influence model of subject responsibility on safety performance

Path	Standardized estimate	C.R.	P	Test results
Safety performance <-- subject responsibility	.553	54.669	.000	support
RMSEA = 0.046, GFI = 0.986, AGFI = 0.976, CFI = 0.995, NFI = 0.994, IFI = 0.995 Fitting index value				

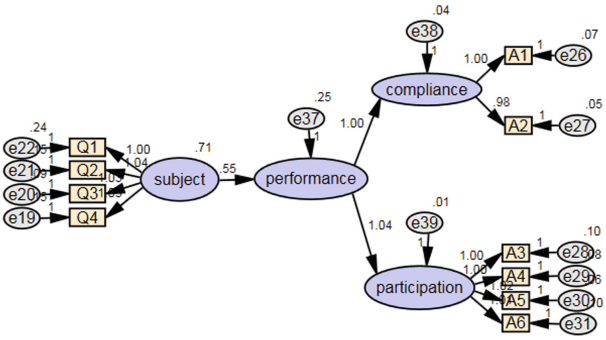

Fig. 2. Influence model of subject responsibility on safety performance

- The influence of subject responsibility on safety compliance and safety participation. Using the same method to test the influence of subject responsibility on safety compliance, the model path and the fitting index of the model are shown in Fig. 3 and Table 2 respectively. Based on the results, it can be seen that the RMSEA of the model is 0.041, less than 0.08, and other fitting indexes are greater than 0.9, which indicates that in the operation practice of the sample enterprise, the implementation of the subject responsibility indeed affect the performance of safety compliance. According to Fig. 3 and the standardized estimates, there is a positive correlation between subject responsibility and safety compliance, with a coefficient of 0.558 (99% confidence), indicating that there is a positive correlation between them, that is, the degree of safety compliance of employees will increase with the implementation of subject responsibility.

- Similarly, we can get the effect of subject responsibility on safety participation. According to the results of model path Fig. 4 and model fitting index Table 3, the implementation degree of subject responsibility of sample enterprise have a significant impact on safety participation, and the correlation coefficient is 0.575 (the reliability reaches 99%). It shows that there is a positive correlation between them, that is, the safety participation of employees will increase with the implementation of the subject responsibility. By using the same method, it can be concluded that other independent variables such as leadership responsibility, post responsibility, coordination

Table 2. Fitting index of the influence model of subject responsibility on safety compliance

Path	Standardized estimate	C.R.	P	Test results
Safety compliance <-- subject responsibility	.558	53.973	.000	support
RMSEA = 0.041, GFI = 0.995, AGFI = 0.987, CFI = 0.998, NFI = 0.998, IFI = 0.998				

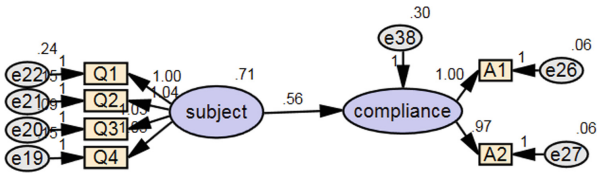

Fig. 3. Influence model of subject responsibility on safety compliance

and linkage, publicity and education have significant positive effects on safety performance and its two sub dimensions (safety compliance and safety participation). That is to say, strengthening the implementation of leadership responsibility and post responsibility, coordination and linkage, and publicity and education will promote the improvement of enterprise safety performance, as well as the safety compliance and safety participation of employees.

Table 3. Fitting index of the influence model of subject responsibility on safety participation

Path	Standardized estimate	C.R.	P	Test results
Safety participation <-- subject responsibility	.575	56.715	.000	support
RMSEA = 0.032, GFI = 0.994, AGFI = 0.990, CFI = 0.998, NFI = 0.998, IFI = 0.998				

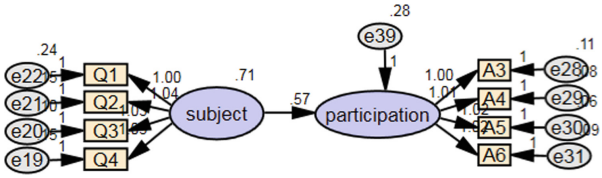

Fig. 4. Influence model of subject responsibility on safety participation

4.2 The Influence of Work Style Construction on Safety Performance and Its Dimensions

This section explores the impact of work style on safety performance and its two sub dimensions (safety compliance and safety participation). The analysis steps are as follows.

- The influence of work style construction on safety performance. Amos can be used to draw the structural equation path of work style construction and safety performance, as shown in Fig. 5, and the model fitting results are shown in Table 4. The results show that RMSEA = 0.068, less than 0.08, and CFI, NFI and IFI are all greater than 0.9, which indicates that the fitting indexes of the influence model meet the fitting standard. On this basis, draw the influence model of work style construction on safety performance. The results show that the standardized path coefficient between work style construction and safety performance is 0.660 (significant at the level of 0.001, that is, the reliability of the result is 99%), indicating that the fitting path is acceptable. There is a significant positive impact between work style construction and safety

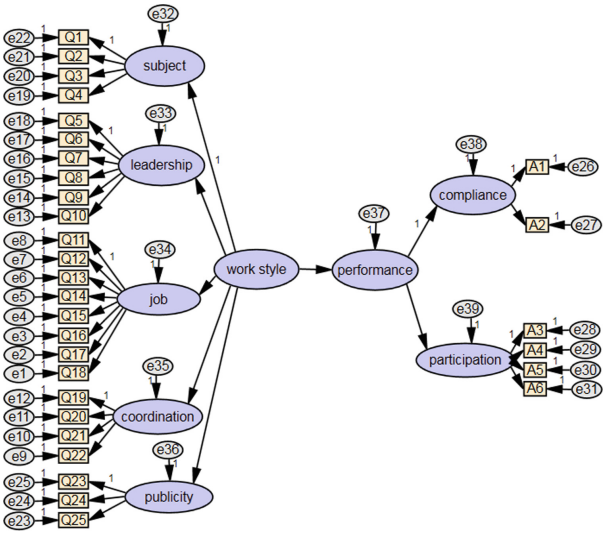

Fig. 5. Influence model of work style construction on safety performance

Table 4. Fitting index of influence model of work style construction on safety performance

Path	Standardized estimate	C.R.	P	Test results
Safety performance <-- work style construction	.660	59.075	.000	support
RMSEA = 0.068, GFI = 0.862, AGFI = 0.839, CFI = 0.960, NFI = 0.959, IFI = 0.960				

performance. Specifically, the level of safety performance will be improved with the strengthening of work style construction.

- Influence of work style construction on safety compliance and safety participation. Using the same method to test the influence of work style construction on safety compliance, we can get the model path and model fitting index as shown in Fig. 6 and Table 5 respectively. The results show that RMSEA = 0.076, less than 0.08, and CFI, NFI and IFI are all greater than 0.9, indicating that the fitting indexes of the model all meet the fitting standard. According to the structure chart, there is a significant influence between work style construction and safety compliance (one of the sub dimensions of safety performance) ($P < 0.001$, indicating that the credibility of the result is 99%), that is, there is a correlation between work style construction and safety compliance. The correlation coefficient is 0.666, which indicates that there is a positive correlation between them. Specifically, the degree of safety compliance will be improved with the strengthening of work style construction.

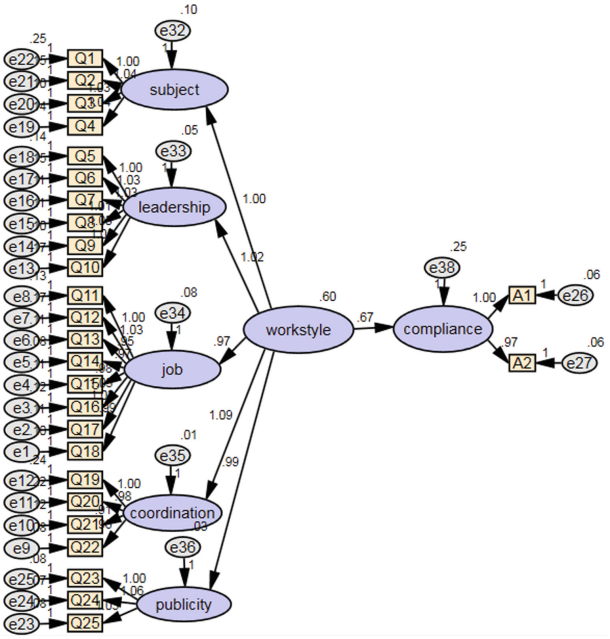

Fig. 6. Influence model of work style construction on safety compliance

Similarly, we can get the influence of work style construction on safety participation. According to the results of model path Fig. 7 and model fitting index Table 6, the degree of work style construction positively affect the degree of safety participation, that is, the degree of safety participation will increase with the strengthening of work

Table 5. Fitting index of influence model of work style construction on safety compliance

Path	Standardized estimate	C.R.	P	Test results
Safety compliance <-- work style construction	.666	58.668	.000	support
RMSEA = 0.076, GFI = 0.855, AGFI = 0.827, CFI = 0.957, NFI = 0.955, IFI = 0.957				

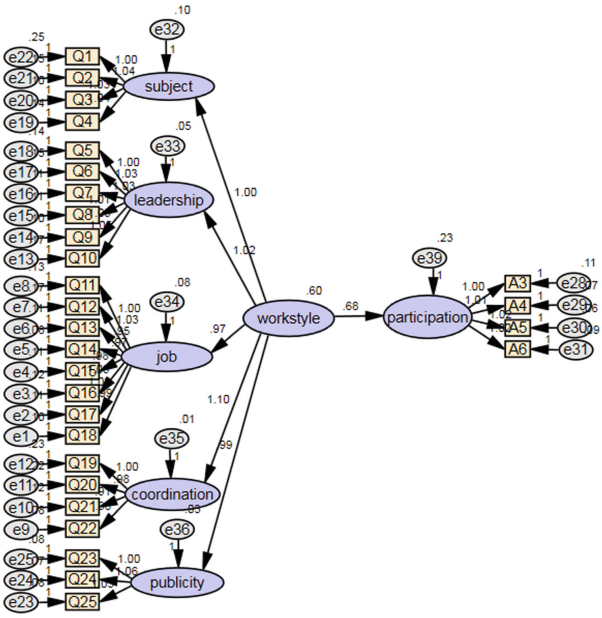

Fig. 7. Influence model of work style construction on safety participation

style construction. In addition, by comparing the standardized estimates, it can be seen that under the condition of the same promotion degree of work style construction, the improvement degree of employees' safety participation is greater than that of safety compliance.

Table 6. Fitting index of influence model of work style construction on safety participation

Path	Standardized estimate	C.R.	P	Test results
Safety participation <-- work style construction	.683	60.643	.000	support
RMSEA = 0.070, GFI = 0.864, AGFI = 0.841, CFI = 0.960, NFI = 0.954, IFI = 0.960				

4.3 The Influence of Different Dimensions of Work Style Construction on Safety Performance at the Same Time

Using the same analysis method, the path diagram is drawn as shown in Fig. 8, and the results of model fitting are shown in Table 7.

Table 7. Fitting index of five dimensions of work style construction on safety performance

Path	Standardized estimate	C.R.	P	Test results
Safety performance <-- subject responsibility	.069	2.130	.033	Support
Safety performance <-- leadership responsibility	.030	0.673	.501	Nonsupport
Safety performance <-- job responsibility	.578	17.113	.000	Support
Safety performance <-- coordination and linkage	−.635	−6.144	.000	Support
Safety performance <-- publicity and education	.687	8.566	.000	Support
RMSEA = 0.062, GFI = 0.882, AGFI = 0.860, CFI = 0.968, NFI = 0.966, IFI = 0.968				

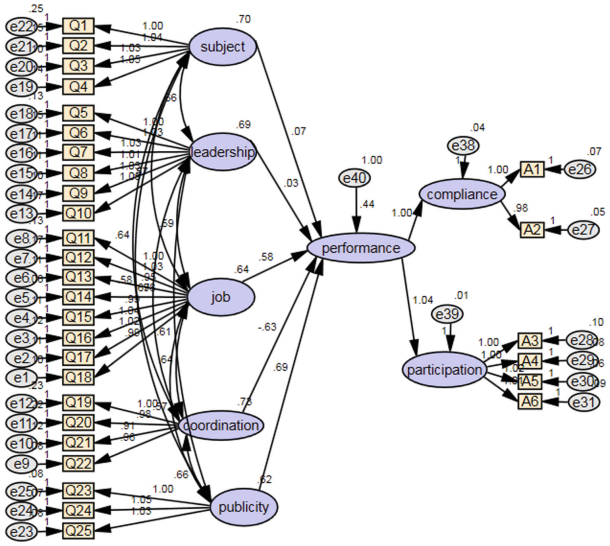

Fig. 8. Influence model of each dimension of work style construction on safety performance

The fitting results in Table 7 show that the simulation data of the equation RMSEA = 0.062, less than 0.08, CFI, NFI, IFI indicators are greater than 0.9, indicating that

the overall fitting effect of the model is good, that is, the overall structure of the model shown in Fig. 8 is reliable.

From the single dimension, the relationship between leadership responsibility and safety performance does not show a significant impact. Post responsibility, coordination and linkage, publicity and education are related to safety performance in 99% probability degree, while subject responsibility is slightly lower in this index, which is 95%.

From the perspective of influence direction, the data shows that subject responsibility, post responsibility and publicity and education have a positive impact on safety performance, that is, the improvement of subject responsibility, post responsibility and publicity and education will promote the improvement of safety performance. The level of coordination and linkage has a negative impact on safety performance, that is, the level of safety performance will decline with the promotion of the existing coordination and linkage system, which is in contradiction with the positive effect obtained from the previous analysis.

As far as the impact degree is concerned, based on the standardized estimates, when the same efforts are put into the subject responsibility, post responsibility, coordination and linkage, and publicity and education respectively, the impact degree on the safety performance level is not the same, the degree is about 0.069, 0.578, 0.635 and 0.687. That is to say, publicity and education has the greatest positive effect on the improvement of safety performance, and collaborative and linkage has a certain inhibitory effect on the safety performance.

From the above analysis, it can be seen that from a single dimension, all dimensions of work style construction do have a positive impact on safety performance and its dimensions; if the five dimensions of work style construction are considered at the same time, the impact of subject responsibility on safety performance is not significant, and coordination and linkage will have a negative impact on safety performance level, that is, the hypothesis above is partially true.

5 Conclusion and Suggestion

Based on the compliance of regulations, this study measures the construction level of work style from five dimensions of subject responsibility, leadership responsibility, post responsibility, coordination and linkage, publicity and education, and measures the safety performance from two dimensions of safety compliance and safety participation. The representative Guangzhou Baiyun International Airport Co., Ltd. is selected as the sample to explore the influence of the work style construction on the safety performance. The conclusions are as follows.

From the five dimensions of work style construction, the implementation of subject responsibility, leadership responsibility and post responsibility, as well as the strengthening of coordination and linkage and publicity and education will promote the improvement of safety performance. However, if the existing systems are implemented at the same time, there is a phenomenon that the leadership responsibility is not significant to the safety performance, and the coordination and linkage have a negative impact on the safety performance. The possible reason is that the policies and systems themselves have no problem, and they can promote the safety performance in the ideal state, but

when many policies are implemented at the same time in reality, there will be certain constraints and influences among them, As a result, the system cannot play a real role, which is due to the lack of coordination among policies. Therefore, it is suggested that senior managers should have an overall view and consider all factors when implementing the guidance and formulating policies.

Due to the large gap in the work style construction among various units in the industry, only one company is selected in this survey, and the conclusion may have some limitations. In the future, when the whole industry implements the work style construction, the research sample can be expanded to airlines, air traffic control, maintenance units and other civil aviation enterprises and institutions, and the impact of work style construction on safety performance can be more systematically analyzed from the perspective of industry development.

Acknowledgment. This research was supported by Beijing Social Science Foundation (19GLC072).

References

1. Siu, O., Phillips, D.R., Leung, T.: Safety climate and safety performance among construction workers in Hong Kong: the role of psychological strains as mediators. Accid. Anal. Prev. **36**, 359–366 (2004)
2. Motowidlo, S.J., Van Scotter, J.R.: Evidence that task performance should be distinguished from contextual performance. J. Appl. Psychol. **79**, 475–480 (1994)
3. Neal, A., Griffin, M.A., Hart, P.M.: The impact of organizational climate on safety climate and individual behavior. Saf. Sci. **34**, 99–109 (2000)
4. Hon, C.K.H., Chan, A.P.C., Yam, M.C.H.: Relationships between safety climate and safety performance of building repair, maintenance, minor alteration, and addition (RMAA) works. Saf. Sci. **65**, 10–19 (2014)
5. Al-Refaie, A.: Factors affect companies' safety performance in Jordan using structural equation modeling. Saf. Sci. **57**, 169–178 (2013)
6. Cheyne, A., Tomás, J.M., Oliver, A.: Multilevel models in the explanation of the relationship between safety climate and safe behaviour. Spanish J. Psychol. **16**, 1–11 (2013)
7. Mohamed, S.: Safety climate in construction site environments. J. Constr. Eng. Manag. **128**, 375–384 (2002)
8. Hasanzadeh, S., Esmaeili, B., Dodd, M.D.: Measuring the impacts of safety knowledge on construction workers' attentional allocation and hazard detection using remote eye-tracking technology. J. Manag. Eng. **33**, 1–17 (2017)