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Retraction

Retracted: Risks and Opportunities of High-Quality Development of Higher Education from the Perspective of ISO45001:2018

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Bao, Y. Li, Y. Bao, X. Wang, C. Hu, and P. Dong, "Risks and Opportunities of High-Quality Development of Higher Education from the Perspective of ISO45001:2018," *Journal of Sensors*, vol. 2022, Article ID 9191744, 8 pages, 2022.

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Research Article

Risks and Opportunities of High-Quality Development of Higher Education from the Perspective of ISO45001:2018

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At present, the requirements of the high-quality development of higher education in China make the management and control of occupational health and safety risk in universities highly valued. However, the following problems perplexing the universities are people have always ignored the combination of the safety problems and risk management, and there are few studies on its health risk, which makes the management and control of occupational health and safety risk in universities far lag behind the pace of high-quality development of higher education. Therefore, it is very necessary to build a risk evaluation system for high-quality development of higher education with the help of ISO45001:2018 occupational health and safety management system tools. To reduce the degree of subjective assignment of weights by human evaluators, this study uses improved AHP and 2-tuple linguistic information method to evaluate the impact of eight factors such as safety risk management and health risk activities on the development of higher education. In addition, three-level indicators for each two-level indicator from the compliance of measures from multiple angles and batches. The results of this study will provide a valuable reference for the risk control and performance improvement (i.e., opportunity response) of higher education from the perspective of ISO45001:2018. It will also help to improve the connotation of relevant party management and promote the high-quality development of higher education.

1. Introduction

At present, the requirements of the high-quality development stage of China's higher education make more and more attention to the risk control of occupational health and safety in universities. From the perspective of connotative development of universities, the report of the 19th National Congress of the Communist Party of China puts forward that "to accelerate the construction of first-class universities and first-class disciplines to realize the connotative development of higher education". The so-called connotative development of higher education is to improve the level and quality of talent training as the core goal and optimize the content and means of education. However, at the same time, various campus safety incidents occurred frequently. For example, from 2018 to 2019, a total of 9278 campus cases occurred in 76 universities across China, resulting in 176 abnormal deaths, various physical and mental health diseases also occurred on the students, and the lack of social responsibility and environmental responsibility of many students seriously hinders the high-quality development of higher education. From the people-oriented perspective, higher education has always been the focus of social attention, and the people-oriented educational concept is the highest appeal of the educational community. However, the frequent occurrence of various health and safety risks seriously hinders the all-round development of university students' physical and mental health and also reflects the lack of health and safety education and moral education. The university students trained under this condition cannot adapt to the healthy development of society and environment, which shows the bias of talent training level.

In recent years, the campus safety situation is not optimistic. Campus health and safety risk accidents seriously threaten the healthy growth of students. Campus safety has become the focus of close attention of the government, society, and schools. At present, the research on campus safety at home and abroad mainly focuses on the current situation of university safety management and risk control of university safety management.

Throughout the research on this issue by scholars at home and abroad, it mainly focuses on the analysis method of using cases and historical data from the world education crisis [1], analyzing the collected relevant information, and calculate the violence tendency of students with the help of software [2]; reflecting the rapid rise of multiple cases, such as students' mental health problems, campus public security problems and laboratory safety problems [3, 4]; corresponding early warning mechanism [5], open teaching mechanism [6], solutions to problems such as unscientific emergency decision-making and lagging emergency plan [7]. It also analyzes the current lack of safety education, disadvantages of management rules, lack of management institutions and personnel, and lax disposal management of public safety in universities [8]; puts forward the early warning mechanism of campus safety [9], implements risk management in the strategic activity planning and constructs sustainable education [10], promotes the countermeasures against health risks in universities [11], and builds a prevention and control mechanism integrating early warning mechanism, emergency management mechanism, and risk evaluation management mechanism in universities to deal with major epidemic situations [12].

However, there is still a lack of relevant research on the combination of campus safety and risk management, and there are few studies on the health risk of campus, and the evaluation method system will also have information distortion. Importantly, ISO45001:2018 has made it clear in the new standard that the organization's health and safety risks need to pay attention not only to the organization's hazard sources (this is also the main aspect of such research before ISO45001:2018 standard is converted into Chinese standard in March 2020) but also to the organization's internal and external environment (e.g., the impact of COVID-19 on university campuses in 2020), the needs and expectations of staff and interested parties (e.g., the needs of parents and internship enterprises), performance evaluation (e.g., the assessment made by universities for health and safety), change management (e.g., new teachers and new students), outsourcing management (e.g., canteen food suppliers and property outsourcing), etc.

Therefore, the research on this subject has not formed a mature system at present. To finally explore the application technology and evaluation method system that can give practical guidance to the high-quality development of higher education in universities, more innovative research or a lot of detailed improvement work may be needed. Under the background of increasing attention to the high-quality development of higher education in China, it is necessary and urgent to timely start the research on the response to risks and opportunities of high-quality development of higher education from the perspective of ISO45001:2018.

In view of these points, on the basis of constructing the risk and opportunity response evaluation indicators of high-quality development of higher education, this study uses the improved AHP and 2-turple linguist information method to evaluate it and takes one university in Guangdong Province, China as an example, in order to provide reference for the risk and opportunity response and decision-making of high-quality development of higher education.

2. Methods and Materials

In order to explore the impact of higher education on safety risk management, health risk activities, living conditions and risks, to lay a solid foundation for the later evaluation of the indicator system, and to define the scope for the construction of the later evaluation indicator system, this study comprehensively and dynamically identifies, classifies, and arranges the faced and potential risks, systematically identifies the nature of the risks, comprehensively considers the factors affecting the high-quality development of colleges and universities through historical experience and other different methods, and comprehensively refers to the documents of [13–16] on the construction of campus safety and risk evaluation system, and ISO45001:2018 standard on occupational health and safety risk and hazard identification. An evaluation indicator system for the construction of risk evaluation and opportunity response of high-quality development of higher education from the perspective of ISO45001:2018 is preliminarily established as shown in Table 1.

2.1. Improved AHP. Analytic hierarchy process (AHP) was proposed by Professor Saaty [17] of the University of Pittsburgh in the mid-1970s to determine the relative importance of hierarchical factors and determine the comprehensive judgment of the relative importance of decision-making factors through the comparison between each two elements. The improved Analytic hierarchy process (AHP) is based on fuzzy mathematics and combined with the principle of fuzzy relationship. It is a method that makes the boundary unclear and nonquantitative factors quantitatively and comprehensively determined [18]. If the parameter on the horizontal axis is more important than the parameter on the vertical axis, the value of the parameter is between 1 and 9. On the contrary, it carries 1/2 and 1/9 reciprocating values [19]. Compared with the traditional AHP, the improved AHP adopts the importance intensity of 9/9-9/1 instead of 1-9, which can better explain the scoring accuracy shown by the index membership [20, 21]. Compared with the improved AHP, the traditional analytic hierarchy process is considered only applicable to specific qualitative indicators. On the other hand, the question of qualitative and quantitative indicators is not discussed enough [22]. The traditional AHP method considers the consistency of the judgment matrix more than the rationality of the judgment matrix [19, 23, 24]. Above all, Chen and Yang [25] initially apply the improved "9/9-9/1" analytic hierarchy process to calculate the indicator weight and find traditional AHP has some shortcomings in expert scoring such as the low accuracy rate, confused connection levels, and tedious data processing. Besides, the traditional AHP still serves its purpose for certain objectives and type of data set, and the improved

Table 1: One and two-level indicators of risk evaluation for high-quality development of higher education.

One-level indicator	Two-level indicator
U_1 safety risk management	U_{11} institution building
	U_{12} setting of safety risk information officer
	U_{13} responsibility system
	U_{14} inspection record
	U_{15} emergency plan
U_2 health risk activities	U_{21} mental health guidance
	U_{22} potential development
	U_{23} physical examination
	U_{24} disease prevention
	U_{25} parents and social health support
	U_{26} good health habits
	U_{27} physical exercise
	U_{28} health care
U_3 living conditions and risks	U_{31} catering safety
	U_{32} dormitory activities
	U_{33} electricity safety
	U_{34} medical epidemic prevention
	U_{35} subsidy to those in financial difficulties
	U_{36} physical exercise
U_4 safety risk literacy	U_{41} psychological counseling
	U_{42} safety risk training rate
	U_{43} construction of safety risk culture
	U_{44} suicide frequency
U_5 campus security and risk	U_{51} security allocation rate
	U_{52} access control machine monitoring
	U_{53} prevention and control mechanism
	U_{54} fire accident drill and frequency
	U_{55} frequency of criminal incidents
U_6 campus traffic and risk	U_{61} management and supervision
	U_{62} pedestrian management
	U_{63} nonmotor vehicle management
	U_{64} motor vehicle management
	U_{65} road and environment
	U_{66} frequency of traffic accidents
U_7 related party management	U_{71} parental needs
	U_{72} Enterprise demand
	U_{73} outsourcing management
	U_{74} government supervision
	U_{75} management of surrounding residents, enterprises, and shops
U_8 occupational health and safety management performance	U_{81} target management
	U_{82} knowledge management
	U_{83} internal and external environment of the organization
	U_{84} change management
	U_{85} social responsibility
	U_{86} environmental responsibility

AHP, for certain more advanced objectives and data sets, which may require greater specificity. Based on Table 1, the hybrid considerations of human and environmental factors may require such great specificity for all factors, which make it possible that improved AHP method is more suitable for this study.

The improved AHP model is consistent with the traditional AHP in calculation steps, and its modeling steps are as follows:

Step 1. Establishing evaluation factor set. The factor set of one-level indicators can be expressed as $U = \{U_1, U_2 \cdots\cdots\}$.

The factor set of two-level indicators can be expressed as $U_1 = \{U_{11}, U_{12} \cdots\cdots\}$, $U_2 = \{U_{21}, U_{22} \cdots\cdots\}$.

Step 2. Establishing evaluation weight set. In this study, the importance of each indicator in the factor set is evaluated and scored by experts in relevant fields, such as engineers who have worked for more than ten years; the weight value is determined, improved with reference to the 1-9 scale method proposed by Saaty, and a new 9/9-9/1 scale method is proposed to determine the specific value, so as to construct the judgment matrix.

Step 3. Consistency checking. The indicator to judge the consistency is $\mathrm{CR} = \mathrm{CI}/\mathrm{RI}$, where $\mathrm{CI} = (\lambda - \mathrm{n})/(\mathrm{n} - 1)$; n is the order of the judgment matrix, RI is the random consistency index of the judgment matrix, and the assumed RI is shown in Table 2.

The consistency check is valid when the number CR is less than 0.1; otherwise, it requires much relevant revision. In this paper, root mean square method is used for consistency test. The steps for calculating procedure are as follows:

(i) To multiply the judgment of each indicator by line $u_{ij} = \prod_{j=1}^{n} b_{ij}$

(ii) To calculate the resultant product by the nth root $u_i = \sqrt[n]{u_{ij}}$

(iii) To normalize the root mean square vector $w_i = u_i / \sum_{i=1}^{n} u_i$

(iv) To calculate the largest eigenvalue [26, 27] $\lambda_{\max} = \sum_{i=1}^{n} (\mathrm{AW})_i / (nW)_i$

(v) To calculate CR value as $\mathrm{CI}/\mathrm{RI} = (\lambda - n) \,/\, (n - 1)/\mathrm{RI}$

2.2. Tuple Linguistic Information. The Spanish scholar, Professor Herrera, introduced the linguistic aggregation information of 2-tuple linguistic information method [6]. This method can solve the problems of language information loss and distortion and make the evaluation results more accurate and complete. In 2001, he also proposed the time-ordered weighted averaging operator (T-OWA) based on his original 2-tuple linguistic information, which has been successfully applied to the problem analysis of multiattribute evaluation and decision-making in multigranular language scales [25].

Table 2: RI set value.

n	1	2	3	4	5	6	7	8
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41

2-tuple linguistic information means that the result of language evaluation is defined as (s_k, u_k), in which s_k stands for the first K element of the evaluation set, u_k is expressed as the conversion value, and $u_k \in [-0.5, 0.5)$. s_k and u_k are described as follows:

(i) Definition 1 [28, 29]: the language information evaluation set S is defined as

$$S = \{s_1 = W(worse), s_2 = B(bad), s_3 = N(normal), s_4 = G(good), s_5 = E(excellent), s_6 = VG(very\,\mathrm{good})\} \tag{1}$$

(ii) Definition 2 [28, 29]: let $A = \{a_1, a_2, \cdots a_m\}$ be a set of linguistic terms which can be aggregated; the convex combination value is defined in a way as follows.

For $m = 2$,

$$C^2\{\{w_1, 1 - w_1\}, \{b_1, b_2\}\} = (w_1 \odot s_j) \oplus ((1 - w_1) \odot s_i) = s_k, s_j, s_i \in S. \tag{2}$$

Such that $k = \min\{g, i + \mathrm{round}(w_1 .(j - i))\}$, where $g + 1$ is the cardinality value of S, round (.) is the usual round operation, and $\mathrm{b}_1 = \mathrm{s}_\mathrm{j}$, $\mathrm{b}_2 = \mathrm{s}_\mathrm{i}$.

For $m > 2$,

$$C^m\{w_k, b_k, k = 1, \cdots m\} = (w_1 \odot b_1) \oplus ((1 - w_1)) \odot C^{m-1}\{r/h, b_h, h = 2, \cdots m\}, \quad C^2\{\{w_1, 1 - w_1\} b_1, C^{m-1}\{r/h, b_h, h = 2, \cdots m\}\}, \tag{3}$$

where $W = [w_1, \cdots w_m]$ is a weighting vector associated with A, such that, (i) $wi \in [0, 1]$; and (ii) $\Sigma_i w_i = 1$; and $B = \{b_1, \cdots b_m\}$ is a vector such that $B = \{a_{\sigma(1)}, \cdots a_{\sigma(m)}\}$, where $a_{\sigma(j)} \le a_{\sigma(i)} \forall_i \le j$, and σ is a permutation over the values $a_i r/h = w_h / \Sigma_2^m w_k$, $h = 2, \cdots m$.

(iii) Definition 3 [28, 29]: define β as the result of an aggregation of the indicators of a set of labels assessed in a linguistic phrase set S, i.e., the result of a symbolic aggregation operation. In addition, $\beta \in [0, g]$ is defined the cardinality of S. Let $i = \mathrm{round}(\beta)$ and $\alpha = \beta - i$ be two values such that $i \in [0, g]$ and $\alpha \in [-0.5, 0.5)$, which can be called a symbolic translation

(iv) Definition 4 [28, 29]: in the circumstances of $\beta \in [0, g]$, β value can be calculated by Δ and Δ^{-1} to achieve the basic conversion of 2-tuple linguistic information. $\Delta(\beta) = (s_k, a_k)$, $k = \mathrm{Round}(\beta)$, where $a_k = \beta - k$; $\Delta^{-1}(s_k, a_k) = k + a_k = \beta$

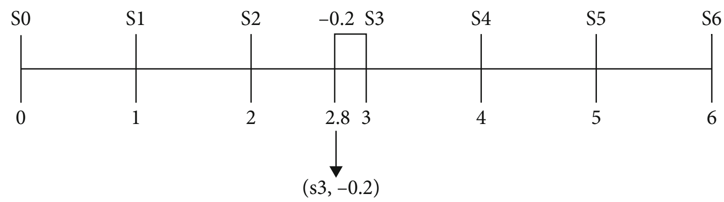

Figure 1: Example of a symbolic translation computation.

(v) Definition 5 [28, 29]:(s_k, a_k) and (s_m, a_m) are obtained as 2-tuple linguistic information values. If $k < m$, then$(s_k, a_k) < (s_m, a_m)$; if $k = m$, then there exist three hypotheses: (a) if$\beta = 2.8 a_k = a_m$, then$(s_k, a_k) = (s_m, a_m)$; (b) if $a_k > a_m$, then$(s_k, a_k) > (s_m, a_m)$; (c) if $a_k < a_m$, then$(s_k, a_k) < (s_m, a_m)$

(vi) Example [6]: let us suppose a symbolic aggregation operation over labels assessed in $S = \{s_0, s_1, s_2, s_3, s_4, s_5, s_6\}$that obtains as its result $\beta = 2.8$, then the representation of this counting of information by means of a 2-tuple will be$\Delta(2.8) = (s_3, -0.2)$. Graphically, it is represented in Figure 1

T-OWA operator [28, 29] is expressed as

$$(\bar{s}, \bar{a}) = \Phi((s_1, a_1), (s_2, a_2), \cdots (s_m, a_m)) = \Delta\left(\sum_{i=1}^{m} c_i v_i\right), \bar{s} \in S, \bar{a} \in [-0.5, 0.5). \quad (4)$$

In the Equation (4), $C = [c_1, c_2, \cdots c_m]$ represents one of the first i bit in the set $\{\Delta^{-1}(s_i, a_i), i = 1, 2, \cdots m\}$. $V = [v_1, v_2, \cdots v_m]^T$ represents the weight vector of each expert.

The definition of fuzzy operator Q (r) is as follows:

$$v_i = Q(i/m) - Q((i-1)/m), v_i \in [0, 1], \sum_{i=1}^{m} v_i = 1, \quad (5)$$

$$Q(r_i) = \begin{cases} 0 & r_i < a \\ (r_i - a)/(b - a) & a \le r_i \le b \\ 1 & r_i > b \end{cases}. \quad (6)$$

In the Equation (6), (0 and 0.5) represents a principle of at least half, similarly, (0.3, 0.8), and (0.5, 1), respectively, as most, and as many as possible. Normally, (0.3 and 0.8) are often used to calculate the 2-tuple linguistic information.

2-tuple linguistic information value after integration of the second grade indicator can be obtained by the following:

$$(s_j, a_j) = \Delta\left(\sum_{k=1}^{l} w_{jk}\right) \Delta^{-1}(s_k, a_k). \quad (7)$$

Comprehensive 2-tuple linguistic information of the first grade indicator can be gotten by the following:

$$(s, a) = \Delta\left(\sum_{j=1}^{q} w_j\right) \Delta^{-1}(s_j, a_j), s \in S, a \in [-0.5, 0.5). \quad (8)$$

The result of comprehensive 2-tuple linguistic information integrated with improved AHP is obtained to evaluate the risk control and performance improvement of higher education from the perspective of ISO45001:2018.

2.3. Data Acquisition. In order to evaluate the risks and opportunities of high-quality development of higher education, one university in Guangdong Province, China is taken as an example. The campus covers an area of 987000 square meters and a construction area of 468000 square meters. In the more than 100 years of school running history, the school has formed the feelings of "loving the country, the hometown and the school", the spirit of teaching and learning, and the quality of learning by people who seek truth. The university has 19 secondary colleges and 58 undergraduate enrollment majors, covering 9 disciplines such as economics. The university has more than 1400 teaching staff and has a team of teachers with reasonable structure and high level.

Five experts are selected to judge the importance of the established indicators. According to the calculation process (1)-(3) in step 4, the calculation results of W_I, A_{WI}, and A_{WI}/w_i values of one-level indicators are shown in Table 3.

3. Results

As can be seen from Table 3, that $W_{U_1-U_8} = [0.130, 0.212, 0.280, 0.076, 0.065, 0.085, 0.074, 0.078]$,$CR = 0.097 < 0.1$, the results passed the consistency test.

Similarly, the weight value and CR value of two-level indicators can be calculated:

$$\begin{aligned}
&W_{U_{11}-U_{15}} = [0.209, 0.142, 0.212, 0.122, 0.315], CR = 0.081 < 0.1,\\
&W_{U_{21}-U_{28}} = [0.117, 0.102, 0.114, 0.121, 0.132, 0.201, 0.095, 0.118], CR = 0.076 < 0.1,\\
&W_{U_{31}-U_{36}} = [0.125, 0.138, 0.236, 0.224, 0.105, 0.172], CR = 0.079 < 0.1,\\
&W_{U_{41}-U_{44}} = [0.215, 0.211, 0.357, 0.217], CR = 0.089 < 0.1,\\
&W_{U_{51}-U_{55}} = [0.113, 0.117, 0.096, 0.253, 0.421], CR = 0.074 < 0.1,\\
&W_{U_{61}-U_{66}} = [0.147, 0.112, 0.093, 0.145, 0.215, 0.288], CR = 0.074 < 0.1,\\
&W_{U_{71}-U_{75}} = [0.145, 0.156, 0.128, 0.223, 0.348], CR = 0.084 < 0.1,\\
&W_{U_{81}-U_{86}} = [0.115, 0.113, 0.214, 0.125, 0.158, 0.275], CR = 0.052 < 0.1.
\end{aligned} \quad (9)$$

Table 3: Calculation results of one-level indicators.

	U_1	U_2	U_3	U_4	U_5	U_6	U_7	U_8	W_i	Aw_i/W_i	CR = CI/RI
U_1	9/9	9/9	5/9	4/9	4/9	5/9	5/9	2/9	0.130	6.353	
U_2	9/9	9/9	5/9	1/9	2/9	4/9	4/9	3/9	0.212	6.932	
U_3	9/5	9/5	9/9	8/9	7/9	2/9	6/9	2/9	0.280	6.294	
U_4	9/4	9/1	9/8	9/9	7/9	5/9	2/9	4/9	0.076	6.799	0.097
U_5	9/4	9/2	9/7	9/7	9/9	3/9	1/9	4/9	0.065	6.315	
U_6	9/5	9/4	9/2	9/5	9/3	9/9	2/9	5/9	0.085	6.923	
U_7	9/5	9/4	9/6	9/2	9/1	9/2	9/9	4/9	0.074	6.224	
U_8	9/2	9/3	9/2	9/4	9/4	9/5	9/4	9/9	0.078	6.314	

Table 4: 2-tuple linguistic judgment matrix.

Indicator	*B* value	2-tuple linguistic information	Indicator	*B* value	2-tuple linguistic information	Indicator	*B* value	2-tuple linguistic information
U_{11}	2.93	(S_3,-0.07)	U_{34}	3.67	(S_4,-0.23)	U_{65}	3.14	(S_3,0.14)
U_{12}	2.67	(S_3,-0.23)	U_{35}	3.53	(S_4,-0.47)	U_{66}	3.05	(S_3,0.05)
U_{13}	2.67	(S_3,-0.23)	U_{36}	3.67	(S_4,-0.33)	U_{66}	3.26	(S_3,0.26)
U_{14}	3.00	(S_3,0.00)	U_{41}	2.73	(S_3,-0.27)	U_{71}	2.73	(S_3,-0.27)
U_{15}	2.47	(S_2,0.47)	U_{42}	2.44	(S_2,0.44)	U_{72}	2.87	(S_3,-0.13)
U_{21}	2.73	(S_3,-0.27)	U_{43}	2.53	(S_3,-0.47)	U_{73}	2.53	(S_3,-0.47)
U_{22}	3.24	(S_3,0.24)	U_{44}	2.53	(S_3,-0.47)	U_{74}	2.53	(S_3,-0.47)
U_{23}	3.07	(S_3,0.07)	U_{51}	2.67	(S_3,-0.33)	U_{75}	2.46	(S_2,0.46)
U_{24}	3.12	(S_3,0.12)	U_{52}	3.68	(S_4,-0.32)	U_{81}	2.80	(S_3,-0.20)
U_{25}	3.53	(S_4,-0.47)	U_{53}	3.70	(S_4,-0.30)	U_{82}	3.31	(S_3,0.31)
U_{26}	2.73	(S_3,-0.27)	U_{54}	2.35	(S_2,0.35)	U_{83}	3.42	(S_3,0.42)
U_{27}	2.60	(S_3,-0.40)	U_{55}	3.31	(S_3,0.31)	U_{84}	3.20	(S_3,0.20)
U_{28}	2.53	(S_3,-0.47)	U_{61}	2.80	(S_3,-0.20)	U_{85}	2.80	(S_3,-0.20)
U_{31}	2.53	(S_3,-0.47)	U_{62}	3.00	(S_3,0.00)	U_{86}	3.00	(S_3,0.00)
U_{32}	2.73	(S_3,-0.27)	U_{63}	3.00	(S_3,0.00)			
U_{33}	2.93	(S_3,-0.07)	U_{64}	2.60	(S_3,-0.40)			

The above data shows that the weight values of two-level indicators have passed the consistency test, and their values are valid.

According to Formula (4) and the weight value of U_{11}, β value of U_{11} can be calculated:

$$(\bar{s},\bar{a})=\Phi((s_1,a_1),(s_2,a_2),\cdots(s_{30},a_{30}))=\Delta\left(\sum_{i=1}^{5}\right)=2.93. \tag{10}$$

Referring to definitions 6-7, it can be calculated that the 2-tuple linguistic information of U_{11} after aggregation is (s_3, -0.07). Similarly, β value and the 2-Tuple Linguistic Information can be obtained by comprehensively considering the weight value of two-level indicators as shown in Table 4:

2-Tuple Linguistic Information of one-level indicators can be calculated as shown below (referring to Formula (5)):

$$\begin{aligned}(s_{11},a_{11})&=\Delta\left(\sum_{k=1}^{5}w_{1k}\Delta^{-1}(s_k,a_k)\right)=\Delta\left(\sum_{k=1}^{5}w_{1k}(k+a_k)\right)\\&=\Delta((0.209\times 2.93)+(0.142\times 2.67)\\&\quad+(0.212\times 2.67)+(0.122\times 3)+(0.315\times 2.93))\\&=\Delta(2.85)=(s_3,-0.15)\end{aligned} \tag{11}$$

Similarly, 2-Tuple Linguistic Information of other one-level indicators can be obtained as shown in Table 5:

It can be calculated that 2-tuple linguistic information after the comprehensive aggregation of the risks of high-quality development of higher education is as shown below

Table 5: Summary of 2-Tuple Linguistic Information of two-level indicators.

Indicator	Weight	*B* value	2-tuple linguistic information
U_1	0.130	2.85	$(S_3, -0.15)$
U_2	0.212	2.90	$(S_3, -0.10)$
U_3	0.280	3.55	$(S_4, -0.45)$
U_4	0.076	2.67	$(S_3, -0.33)$
U_5	0.065	2.60	$(S_3, -0.40)$
U_6	0.085	3.62	$(S_4, -0.38)$
U_7	0.074	2.76	$(S_4, -0.24)$
U_8	0.078	2.72	$(S_3, -0.28)$

(referring to Formula (6)):

$$(s, a) = \Delta\left(\sum_{k=1}^{8} w_{1k}\Delta^{-1}(s_k, a_k)\right) = \Delta\left(\sum_{k=1}^{8} w_{1k}(k + a_k)\right)$$
$$= \Delta((0.130 \times 2.85) + (0.212 \times 2.90) + (0.280 \times 3.55) + (0.076 \times 2.67) + (0.065 \times 2.60) + (0.085 \times 2.87) + (0.074 \times 3.62) + (0.078 \times 2.72)) = \Delta(3.07) = (s_3, 0.07). \quad (12)$$

In summary, the evaluation results of the improved AHP and 2-tuple linguistic information shows that:

According to the calculation results in Table 5, the risk control results of the high-quality development of higher education in the university are "good" (i.e., U_{52} access control monitoring and U_{25} parents and social health support), the evaluation results are "bad" (i.e., U_{15} emergency plan, U_{42} safety risk training rate, U_{54} fire accident drill and frequency, and U_{75} management of surrounding residents, enterprises, and shops), and the rest are of "normal" grade. The risk control result of the high-quality development of higher education in the university is "good" (i.e., U_2 health risk activities and U_6 campus traffic and risk), and the rest are of "normal" grade. And the overall result of the health and safety risk of the high-quality development of higher education in the university is (s_3,0.07), which belongs to the "normal" grade.

4. Discussion and Conclusion

Based on the analysis of the health and safety risk assessment results of the university, the university has the risk of out of control management in terms of emergency plan, safety risk training rate, fire accident drill and frequency, etc., which is easy to cause potential risks such as fire and chemical leakage. Therefore, the improvement direction (i.e., opportunity) of occupational health and safety risk in this university should be:

Feasible emergency plan should be established. The safety management department of the university should set up a contingency plan for the fire prevention, chemical leakage, COVID-19, fighting, theft, etc., which is organized by the secondary college. The teachers and students should also be organized to carry out emergency drills and other activities.

Timely safety risk training should be conducted. Professionals should be invited to conduct systematic training on safety regulations, identification, assessment and control of hazard sources, identification, assessment, and control of risk sources for teachers and students of the secondary college, which can be trained and rehearsed together with the established emergency plan.

The management of surrounding residents, enterprises, and shops should be strengthened. Activities carried out by residents, enterprises ,and shops around the university, such as burning straw by the residents, noise generated by enterprise processing equipment, and selling expired drinks by the shoppers, will have an impact on the environment of the university and the health and safety of teachers and students. Therefore, the control of these phenomena should be combined internally and externally.

From a systematic point of view, the university has risks in four aspects; the organization should comprehensively sort out its internal and external relevant management processes, so as to excavate and evaluate its relevant processes, and so as to prevent the occurrence of potential risks.

In addition, although the improved AHP evaluation method is a semiquantitative evaluation one, its evaluation indicator weight value will still be subjectively affected by the evaluator, but the combination with 2-tuple linguistic information improves the accuracy of the method. The evaluation results are expected to provide control methods for health and safety risks in universities, so as to promote the high-quality development of universities. It is worth mentioning that, as the selected evaluators are university teachers, their different knowledge and demands may lead to certain deviation in the evaluation results, so the evaluation results are dynamic. If universities comprehensively evaluate their health and safety risks, they still need to collect information sources and evaluators from multiple angles and batches.

Data Availability

The datasets analysed during the current study are available from the corresponding author on reasonable request.

Additional Points

Note. In order to improve the accuracy of the two-level evaluation indicators, before evaluation activities, this study establishes three-level indicators for each two-level indicator (e.g. U_{11}) from the compliance of measures (e.g. U_{111} the university has established a safety risk management organization), the effectiveness of operation (e.g. U_{112} the established safety risk organization can effectively manage safety risk), and the suitability of organization (e.g. U_{113} safety risk organization meets the needs of universities to reduce risks).

Conflicts of Interest

There is no conflict of interest.

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References

[1] P. Coombs, *World Education Crisis*, Z. Baoheng, Ed., People's Education Press, 2001.

[2] H. Lihua, *How to Maintain Campus Security Abroad*, Shenzhen Business Daily, 2010.

[3] Y. Shanchu, “Analysis on the current situation and countermeasures of university security in China,” *Education Management*, vol. 5, no. 2009, pp. 177-178, 2009.

[4] G. Jing, “Research on the current situation and countermeasures of university security,” *Education and Teaching Forum*, vol. 33, no. 2014, pp. 5–7, 2014.

[5] M. Chunjuan, “An analysis of the causes of college emergencies and the construction of crisis warning mechanism,” *Modern Communication*, vol. 1, pp. 22–28, 2012.

[6] T. Chunlin, “Analysis of the main factors affecting the safety of colleges and universities and countermeasures,” *Journal of Lanzhou Institute of Education*, vol. 28, no. 2012, pp. 93-94, 2012.

[7] Y. Haifei, “Analysis of crisis management in Chinese universities from the perspective of risk society,” *Knowledge Economy*, vol. 16, pp. 17-18, 2020.

[8] W. Xing, W. Qunhong, and H. Yanhua, “Analysis of public security problems and countermeasures in colleges and universities,” *Rural Health Management in China*, vol. 40, pp. 359–363, 2020.

[9] D. W. Emang, Z. F. Zaaba, A. Hussain, and N. A. Mohd, “Preliminary insights in security warning studies: an exploration in university context,” *Procedia Computer Science*, vol. 161, pp. 1191–1198, 2019.

[10] N. V. Syreyshchikova, D. Y. Pimenov, T. Mikolajczyk, and L. Moldovan, “Development of a risk management technique in strategic planning of universities. Case study of a Polytechnical Institute,” *Procedia Manufacturing*, vol. 46, pp. 256–262, 2020.

[11] M. Yamakawa, Y. Tanaka, and M. Sasai, “Health risk management behaviors and related factors among Japanese university students participating in short-term study abroad programs,” *Journal of Infection and Chemotherapy*, vol. 25, no. 11, pp. 866–872, 2019.

[12] Z. Shuai, Z. Zhenyin, and S. Min, “Research on prevention and control of major epidemic situation in universities under the new situation,” *Science and Technology of Chinese Universities*, vol. 5, pp. 13–16, 2020.

[13] L. Jiahui, *Research on the Construction and Evaluation of University Safety Culture*, Nanjing University of Posts and Telecommunications, 2019.

[14] S. Yunting, *Construction and Application of Campus Safety Evaluation System Based on AHP Evaluation Model*, Hubei University of Technology, 2019.

[15] H. Xiaozhou, *Research on campus security risk management*, Jinan University, 2017.

[16] M. Gaihuan, *Research on the Construction and Application of University Security Dynamic Evaluation System*, Hunan University of Science and Technology, 2013.

[17] T. L. Saaty, “Making and validating complex decisions with the AHP/ANP,” *Journal of Systems Science and Systems Engineering*, vol. 2, pp. 14–21, 2005.

[18] G. Wu, W. Cui, Y. Zhang, and P. Sun, “Ship safety assessment based on FMEA and fuzzy comprehensive evaluation methods,” *Harbin Gongcheng Daxue Xuebao*, vol. 28, pp. 263–268, 2007.

[19] C. P. Wei and Z. M. Zhang, “An algorithm to improve the consistency of a comparison matrix,” *Systems Engineering - Theory & Practice*, vol. 20, pp. 62–67, 2000.

[20] J. Bao, *Application of Statistical Methods on Occupational Health and Safety Management in the Mining Industry in Ezhou City*, Luleå University of Technology Press, China, 2018.

[21] J. Bao, J. Johansson, and J. Zhang, “Comprehensive evaluation on employee satisfaction of mine occupational health and safety management system based on improved AHP and 2-tuple linguistic information,” *Sustainability*, vol. 9, no. 1, p. 133, 2017.

[22] D. T. Wu and D. F. Li, “Shortcomings of analytical hierarchy process and the path to improve the method,” *Journal-Beijing Normal University Natural Science Edition*, vol. 12, pp. 264–267, 2004.

[23] Y. M. Wang, “An overview of priority methods of comparison matrix,” *Journal of Decision Making and Decision Support Systems*, vol. 5, p. 101, 1995.

[24] J. D. Bao, J. D. Zhang, F. Li, C. Y. Liu, and S. P. Shi, “Social benefits of the mine occupational health and safety management systems of mines in China and Sweden based on a fuzzy analytic hierarchy process: a comparative study,” *Journal of Intelligent & Fuzzy Systems*, vol. 31, no. 6, pp. 3113–3120, 2016.

[25] S. Chen and G. F. Yang, “Eco-environmental quality appraisal of yellow river delta wetland using the improved AHP method. South-to-north water divers,” *Water Science and Technology*, vol. 9, pp. 99–101, 2011.

[26] P. Chaudhary, S. K. Chhetri, K. M. Joshi, B. M. Shrestha, and P. Kayastha, “Application of an analytic hierarchy process (AHP) in the GIS interface for suitable fire site selection: a case study from Kathmandu Metropolitan City, Nepal,” *Socio-Economic Planning Sciences*, vol. 53, pp. 60–71, 2016.

[27] Z. H. Song and Q. M. Ma, “The application of excel in establishing evaluation index system based on AHP method,” *Statistical Decision-Making*, vol. 21, pp. 104-105, 2012.

[28] F. Herrera and L. Martinez, “A model based on linguistic 2-tuples for dealing with multigranular hierarchical linguistic contexts in multi-expert decision-making,” *IEEE Transactions on Systems, Man, and Cybernetics*, vol. 31, no. 2, pp. 227–234, 2001.

[29] F. Herrera and E. Herrera-Viedma, “Aggregation operators for linguistic weighted information,” *IEEE Transactions on Systems, Man, and Cybernetics-Part A: Systems and Humans*, vol. 27, no. 5, pp. 646–656, 1997.