Peer-reviewed version available at *Sustainability* **2017**, *9*, 133; doi:10.3390/su9010133

Article

Comprehensive Evaluation on Employee Satisfaction of Mine Occupational Health and Safety Management System Based on FAHP and 2-Tuple Linguistic Information

Jiangdong Bao [1], Lena Abrahamsson [1], Jan Johansson [1,*] and Jingdong Zhang [2]

[1] Centre of Advanced Mining and Metallurgy, CAMM, Department of Human Work Science, Luleå University of Technology, Luleå 97751, Sweden; bao.jiangdong@ltu.se (J.B.); Lena.Abrahamsson@ltu.se (L.A.)

[2] Research Center for Environment and Health, Zhongnan University of Economics and Law, Wuhan 430000, China; jingdongzhang@znufe.edu.cn

* Correspondence: Jan.Johansson@ltu.se; Tel.: +46-920-491412

Abstract: In order to comprehensively evaluate the employee satisfaction of mine occupational health and safety management system, an analytic method based on fuzzy analytic hierarchy process and 2- tuple linguistic model was established. Firstly, based on the establishment of 5 first-grade indicators and 20 second- grade ones, the weight of each indicator is calculated and validated by method of FAHP and root mean square model. Secondly, a path based on the time-ordered Weighted Averaging Operator (T-OWA) model is constructed. Finally, the model is validated by empirical analysis. The results demonstrate that the employee satisfaction of the mine occupational health and safety management system is of the "general" rank. The method including the comprehensive evaluation of employee satisfaction and the quantitative analysis of language evaluation information ensures the authenticity of the language evaluation information.

Keywords: employee satisfaction; mine; OHSAS18001; FAHP; 2-tuple linguistic information

1. Introduction

To a large extent, employee satisfaction not only determines the survival and development of enterprises, but also the core idea of quality, environment, occupational health and safety management system. Scientific and effective evaluation of enterprise employee satisfaction is not only the requirement of the enterprise strategy development, but also has an important reference value for the continuous improvement of the enterprise. At present, the research on employee satisfaction mainly focuses on its composition, influencing factors and evaluation system. The evaluation method [1] concentrates upon the balance integral card, structural equation model, grey system model, fuzzy analytic hierarchy process, principal component analysis, factor analysis, logistic regression analysis and so on, however, the evaluation of employee satisfaction is a kind of subjective value judgment, which is fuzzy and uncertain. In the evaluation, it is usually difficult for the participants to accurately determine the satisfaction with precise numbers or language, the acquired language information is usually not directly involved in mathematical operations, resulting in loss of information and accuracy [2].

Herrera [3] put forward 2-tuple linguistic information and the corresponding aggregation operator for the first time, which can solve the defects of the above methods, and can ensure the integrity and authenticity of the information in the process of language information gathering and processing. Therefore, this paper applies 2-tuple linguistic information processing method to the evaluation of employee satisfaction, combined with FAHP model to ensure the reliability of the indicator weight. Also, the specific evaluation steps and calculation process are given, and the feasibility and effectiveness of the method is verified by a case.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 9 December 2016 doi:10.20944/preprints201612.0055.v1

Peer-reviewed version available at *Sustainability* **2017**, *9*, 133; doi:10.3390/su9010133

2. Mine Occupational Health and safety management system employee satisfaction indicators

In full consideration of the basis of employee satisfaction evaluation indicators given by domestic and foreign scholars [4-11], combined with the OHSAS18001 standard requirements [12], employee satisfaction evaluation first and second-grade indicators of the OHSAS18001 are given as is shown in Table 1.

Table 1. Occupational health and safety management system employee satisfaction indicators.

First-Grade Indicator	Second-Grade Indicator
U_1 Humanization of OHSAS	u_{11} Training opportunities
	u_{12} Promotion opportunities
	u_{13} Information openness
	u_{14} Access to development opportunities
U_2 Effectiveness of OHSAS	u_{21} Continuous improvement
	u_{22} Communication
	u_{23} Coordination and cooperation of work
	u_{24} Effectiveness of management
U_3 Economical efficiency of OHSAS	u_{31} Pay level
	u_{32} Welfare
	u_{33} Operating performance
	u_{34} Economic structure
U_4 Social efficiency of OHSAS	u_{41} Related party
	u_{42} Community
	u_{43} Customs of the people's life
	u_{44} Social culture
U_5Environmental efficiency of OHSAS	u_{51} Natural resource consumption
	u_{52} Comprehensive utilization of natural resources
	u_{53} Ecological management cost
	u_{54} Environmental sustainable development

2.1. Humanization of OHSAS

Humanization of OHSAS is to meet the needs of people's all-round development. Implementation of the project is bound to affect the people, mainly in the following aspects: training opportunities, promotion opportunities, Information openness and access to development opportunities.

2.2. Effectiveness of OHSAS

Effectiveness is the activity of planning and the degree to which the planning results are achieved. According to the requirements of OHSAS, Effectiveness is mainly manifested in the following aspects: continuous improvement, communication, coordination and cooperation of work and effectiveness of management.

2.3. Economical efficiency of OHSAS

Economical efficiency is an economic activity that can be consumed by the least active labor and physical labor, and the ability to achieve the greatest economic results, which is mainly manifested in the following aspects: pay level, welfare, operating performance and economic structure.

2.4 .Social efficiency of OHSAS

Social efficiency is a living creature as a collective activity, or as a member of society with characteristics which is beneficial to the collective and social development which is mainly manifested in the following aspects: related party, community, customs of the people's life and social culture.

Peer-reviewed version available at Sustainability 2017, 9, 133; doi:10.3390/su9010133

2.5. Environmental efficiency of OHSAS

Environmental efficiency is a kind of adaptation to nature and activities of protecting the nature which is mainly manifested in the following aspects: natural resource consumption, comprehensive utilization of natural resources, ecological management cost and environmental sustainable development.

3. Indicator weight of mine occupational health and safety management system based on FAHP model

3.1. Evaluation weight set

In this paper, the importance among indicators is scored by the relevant experts, to determine the weight value of each indicator in this factor and to construct the judgment matrix referring to 1 ~ 9 scale method proposed by A L Saaty to determine the specific values. If the parameter on the horizontal axis was less important than the parameter on the vertical axis, it carried a value between 1 and 9. Oppositely, it carried the value between the reciprocals of 1/2 and 1/9 [13].

Table 2. The experts scoring table of the importance among indicators.

Intensity of importance	Definition
1	Equal importance
2	Equal to moderate importance
3	Moderate importance
4	Moderate to strong importance
5	Strong importance
6	Strong to very strong importance
7	Very strong importance
8	Very to extremely strongly importance
9	Extreme importance

3.2. Consistency checking

The test index for the consistency of judgment is as follows： CR = CI/RI; In the equation，CI=(λ-n)/(n -1), n is the order of the judgment matrix. RI is random consistency index of judgment matrix [14]. Suppose the set RI is shown in Table 2.

If CR ≤ 10%, the matrix is consistent and FAHP can be continued. If CR > 10%, it requires revision because the matrix is not consistent. In this paper, the root mean square method is used to carry out the consistency test. The model calculation procedure is as follows：

1. Multiply the elements of B by line $u_{ij} = \prod_{j=1}^{n} b_{ij}$

2. The nth root of the resultant product $u_i = \sqrt[n]{u_{ij}}$

3. Normalize the root mean square vector and get the feature vector $W_i = \frac{u_i}{\sum_{i=1}^{n} u_i}$

4. Calculate the largest eigenvalue of the judgment matrix $\lambda_{max} = \sum_{i=1}^{n} \frac{(AW)_i}{(nW)_i}$

5. Calculate CR = CI/RI=(λ-n)/(n -1)/ RI

4. The employee satisfaction model of mine occupational health and safety management system based on 2-tuple linguistic information

4.1. 2-tuple linguistic information

Professor Herrera, a Spanish scholar, put forward 2-tuple linguistic information [15]method of the Linguistic aggregation information for the first time in 2000. It can solve the problem of the loss

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 9 December 2016 doi:10.20944/preprints201612.0055.v1

Peer-reviewed version available at *Sustainability* **2017**, *9*, 133; doi:10.3390/su9010133

and distortion of the language information so as to make the evaluation information more accurate. At the same time, he also proposed Time-ordered Weighted Averaging Operator(T-OWA) based on 2-tuple linguistic information in 2001. And it was successfully applied to multi attribute evaluation and decision analysis of multi granularity linguistic scales [16].

2-tuple linguistic information is the result of language evaluation with (s_k, u_k), in which s_k is the first K elements of the language information evaluation set S, and u_k is the symbol conversion value with $u_k \in$[-0.5，0.5). It represents the deviation between the linguistic information set and the most appropriate linguistic phrase in the pre-defined language information set S. s_k and u_k are described as follows.

- Definition 1 [15-17]: Language information evaluation set S, 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 good)}.
- Definition 2 [15-17]: If $s_k \in S$ is a language phrase, then the 2-tuple linguistic information can be obtained by the following θ function: $\theta: S \to S \times [-0.5, 0.5)$; $\theta(s_k) = (s_k, 0), s_k \in S$.
- Definition 3 [15-17]: If the real number $\beta \in [0, g]$ is the real one of the linguistic evaluation set S, then the β can be obtained by the function Δ and Δ^{-1} to achieve the basic conversion of 2-tuple linguistic information. $\Delta(\beta) = (s_k, u_k), k = Round(\beta), Round$ means to round up and round down number operator. $u_k = \beta - k; \Delta^{-1}(s_k, u_k) = k + u_k = \beta$.
- Definition 4 [15-17]: If $u_k = u_m$ and (s_m, u_m) are two 2-tuple linguistic information, the comparison operators of the two 2-tuple linguistic operators have 2 kinds of cases. If $k < m, then\,(s_k, u_k) < (s_m, u_m)$; if $k = m$, then there are 3 kinds of situations: (1) If $u_k = u_m, then\,(s_k, u_k) = (s_m, u_m)$ (2) If $u_k > u_m, then\,(s_k, u_k) > (s_m, u_m)$ (3) If $u_k < u_m, then\,(s_k, u_k) < (s_m, u_m)$.

4.2. The T-OWA operator [15,16,18]

It is used to aggregate the linguistic evaluation information of the experts. The definition of T-OWA operator is: If $\{(s_1, u_1), (s_2, u_2), \ldots, (s_m, u_m)\}$ is a set of 2- tuple linguistic evaluation information, and the definition of T-OWA operator Φ is defined as follows:

$$Q(r) = \begin{cases} 0 & r < a \\ (r-a)/(b-a) & a \le r \le b \quad \bar{s} \in S, \bar{a} \in [-0.5, 0.5) \\ 1 & r > b \end{cases} \tag{1}$$

In the equation, element c_i of vector $C = [c_1, c_2 \ldots, c_m]$ represents the one of the first i bit in the set $\{\Delta^{-1}(s_i, u_i), i = 1, 2, \ldots, m\}$, which is in accordance with the order of large to small. And $V = [v_1, v_2, \ldots, v_m]^T$ represents the weight vector of each expert.

4.3. The definition of fuzzy operator $Q(r)$

The definition is as follows $v_i = Q(i/m) - Q((i-1)/m)$, $v_i \in [0,1], \sum_{i=1}^{m} v_i = 1$ （2）

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 9 December 2016 doi:10.20944/preprints201612.0055.v1

Peer-reviewed version available at Sustainability 2017, 9, 133; doi:10.3390/su9010133

$$Q(r)=\begin{cases}0 & r<a\\ (r-a)/(b-a) & a\leqslant r\leqslant b\\ 1 & r>b\end{cases} \quad (3)$$

In the equation, $a,b\in[0,1]$, and under such a principle of at least half, most and as many as possible situation, parameter (a,b) is （0,0.5）, （0.3,0.8）, （0.5,1）.

5. Empirical analysis

The mine is located in the southwest of the Hubei Province in the central part of China, and it has general hydrogeological conditions. Additionally, OHSAS18001 has currently been utilized for the site for more than three years. As a result, it has a good reputation in the society as well as the local community. Utilizing the mine as an example, this paper evaluates and analyses the employee satisfactory of OHSAS through a fuzzy analytic hierarchy process (FAHP) method and a 2- tuple linguistic evaluation information.

5.1. The indicator weight and consistency test

In order to ensure the validity and consistency of the evaluation model, the indicators need to be tested. Additionally, thirty Chinese senior staff with more than 5 years working experience in the mine were invited to judge the importance of the indicators in the FAHP method. In this paper, the root mean square method is used to carry out the consistency test. The calculation procedure of the first grade indicators weight is shown as follows.

According to the aforementioned formulas, calculation of first- grade indicator is obtained as shown in Table 3: $u_{ij}=\prod_{j=1}^{n} b_{ij}$==6.000,1.000,0.667,0.900,0.056; $u_i=\sqrt[n]{u_{ij}}$ =1.431,1.000,0.922,0.979,0.561; $W_i=\frac{u_i}{\sum_{i=1}^{n} u_i}$ =0.292,0.204,0.188,0.200,0.115; $\lambda_{\max}=\sum_{i=1}^{n}\frac{(AW)_i}{(nW)_i}$ =5.333; CR = CI/RI=(λ-n)/(n -1)/1.24=0.074<0.1, Thus, the result has passed the consistency test.

Table 3. Calculation results of first- grade indicator.

	U_1	U_2	U_3	U_4	U_5	u_{ij}	u_i	W_i	AW_i	AW_i/W_i
U_1	1	2	1	1	3	6.000	1.431	0.292	1.434	4.902
U_2	1/2	1	1	2	1	1.000	1.000	0.204	1.054	5.157
U_3	1	1	1	1/3	2	0.667	0.922	0.188	0.981	5.207
U_4	1/5	1/2	3	1	3	0.900	0.979	0.200	1.270	6.347
U_5	1/3	1	1/3	1/2	1	0.056	0.561	0.115	0.579	5.054
							4.893	1.000		5.333

In the same way, the weight of the second grade indicators can be obtained, and the results are shown as below:

$$W_{u_{11}-u_{14}}=[0.464,0.121,0.225,0.189];\ W_{u_{21}-u_{24}}=[0.133,0.224,0.147,0.496]$$

$$W_{u_{31}-u_{34}}=[0.234,0.245,0.154,0.367];\ W_{u_{41}-u_{44}}=[0.138,0.374,0.204,0.284]$$

$$W_{u_{51}-u_{54}}=[0.328,0.148,0.210,0.314];\ W_{u_1-u_5}=[0.292,0.204,0.188,0.200,0.115]$$

5.2. Semantic comments on the employee satisfaction evaluation indicator

According to the evaluation of 2-tuple linguistic information, the evaluation indicator is divided into six grades, as shown in Table 4.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 9 December 2016 doi:10.20944/preprints201612.0055.v1

Peer-reviewed version available at Sustainability 2017, 9, 133; doi:10.3390/su9010133

Table 4. Grading instruction.

Semantic identity	Semantic grade	Assessment score	Grading instruction
s_1	W	50 below	worse
s_2	B	50-60	bad
s_3	N	60-70	normal
s_4	G	70-80	good
s_5	E	80-90	excellent
s_6	VG	90-100	very good

5.3 Employee satisfaction evaluation indicator score and corresponding 2- tuple linguistic judgment matrix

5 senior employees e_1、e_2、e_3、e_4 and e_5 are randomly selected to comprehensively evaluate the semantic grade of table 5.

Table5. Indicator score and 2- tuple linguistic judgment matrix.

First-grade indicator	Second-grade indicator	e_1	e_2	e_3	e_4	e_5
U_1	u_{11}	E/(s_5,0)	G/(s_4,0)	N/(s_3,0)	G/(s_4,0)	N/(s_3,0)
	u_{12}	N/(s_3,0)	N/(s_3,0)	G/(s_4,0)	N/(s_3,0)	G/(s_4,0)
	u_{13}	G/(s_4,0)	E/(s_5,0)	G/(s_4,0)	E/(s_5,0)	N/(s_3,0)
	u_{14}	N/(s_3,0)	E/(s_5,0)	G/(s_4,0)	N/(s_3,0)	G/(s_4,0)
U_2	u_{21}	N/(s_3,0)	N/(s_3,0)	G/(s_4,0)	B/(s_2,0)	B/(s_2,0)
	u_{22}	G/(s_4,0)	E/(s_5,0)	G/(s_4,0)	G/(s_4,0)	E/(s_5,0)
	u_{23}	E/(s_5,0)	G/(s_4,0)	G/(s_4,0)	E/(s_5,0)	G/(s_4,0)
	u_{24}	G/(s_4,0)	G/(s_4,0)	N/(s_3,0)	G/(s_4,0)	E/(s_5,0)
U_3	u_{31}	N/(s_3,0)	G/(s_4,0)	E/(s_5,0)	G/(s_4,0)	E/(s_5,0)
	u_{32}	E/(s_5,0)	E/(s_5,0)	G/(s_4,0)	E/(s_5,0)	G/(s_4,0)
	u_{33}	N/(s_3,0)	G/(s_4,0)	N/(s_3,0)	E/(s_5,0)	E/(s_5,0)
	u_{34}	G/(s_4,0)	N/(s_3,0)	N/(s_3,0)	E/(s_5,0)	E/(s_5,0)
U_4	u_{41}	G/(s_4,0)	E/(s_5,0)	G/(s_4,0)	G/(s_4,0)	G/(s_4,0)
	u_{42}	E/(s_5,0)	N/(s_3,0)	N/(s_3,0)	G/(s_4,0)	E/(s_5,0)
	u_{43}	G/(s_4,0)	G/(s_4,0)	E/(s_5,0)	N/(s_3,0)	G/(s_4,0)
	u_{44}	N/(s_3,0)	G/(s_4,0)	N/(s_3,0)	G/(s_4,0)	E/(s_5,0)
U_5	u_{51}	G/(s_4,0)	N/(s_3,0)	E/(s_5,0)	G/(s_4,0)	N/(s_3,0)
	u_{52}	G/(s_4,0)	N/(s_3,0)	N/(s_3,0)	G/(s_4,0)	N/(s_3,0)
	u_{53}	N/(s_3,0)	N/(s_3,0)	N/(s_3,0)	E/(s_5,0)	N/(s_3,0)
	u_{54}	G/(s_4,0)	E/(s_5,0)	G/(s_4,0)	G/(s_4,0)	N/(s_3,0)

5.4. The weight vector and 2-tuple linguistic information of the second grade indicator

According to the formula (3), the weight of the score is obtained as follows: $V=[0,1/14,3/14,5/14,5/14]^T$; According to the definition (3), the vector of u_{11} in accordance with the order from large to small is calculated as follows: $C=[5,4,3,3,2]$; According to the formula (1), it can be calculated as follows: $\left(\bar{s},\bar{u}\right)=\Phi((s_1,u_1),(s_2,u_2),(s_3,u_3),(s_4,u_4),(s_5,u_5))=\Delta\left(\sum_{i=1}^{5}\right)=2.710$, According to the definition (3), The 2-tuple linguistic information after the aggregation of u11 is obtained as follows: （s3,-0.290); In the same way, The 2-tuple linguistic information after the aggregation of other second grade indicators can be obtained as in Table 8. According to the formula (4), the 2-tuple linguistic information after integration of the second grade indictor as follows:

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 9 December 2016 doi:10.20944/preprints201612.0055.v1

Peer-reviewed version available at Sustainability 2017, 9, 133; doi:10.3390/su9010133

$$(s_1,u_1) = F((s_{11},u_{11}),(s_{12},u_{12}),(s_{13},u_{13}),(s_{14},u_{14})) = \Delta\left(\sum_{k=1}^{4} w_{1k}\Delta^{-1}(s_k,u_k)\right) = \Delta\left(\sum_{k=1}^{4} w_{1k}(k+u_k)\right)$$

$$= \Delta((0.464\times 2.710) + (0.121\times 2.714) + (0.225\times 3.000) + (0.189\times 3.286))$$

$$= \Delta(2.882) = (s_3, -0.120)$$

In the same way, the comprehensive β value and the comprehensive 2-tuple linguistic information can be obtained as shown in Table 6.

Table6. Indicator weight β value and 2-tuple linguistic information.

First-grade indicator	Weight	Second-grade indicator	Weight	β value of second grade indicator	2-tuple Linguistic information of second-grade indicator	Comprehensive β value of second-grade indicator	Comprehensive 2-tuple linguistic information of second- grade indicator
u_1	0.292	u_{11}	0.464	2.710	(s_3,-0.290)	2.882	(s_3,-0.120)
		u_{12}	0.121	2.714	(s_3,-0.290)		
		u_{13}	0.225	3.000	(s_3,0.000)		
		u_{14}	0.189	3.286	(s_3,0.290)		
u_2	0.204	u_{21}	0.133	2.286	(s_2,0.290)	3.364	(s_3,0.360)
		u_{22}	0.224	3.714	(s_4,-0.290)		
		u_{23}	0.147	4.071	(s_4,0.070)		
		u_{24}	0.496	3.286	(s_3,0.290)		
u_3	0.188	u_{31}	0.234	3.714	(s_4,-0.290)	3.537	(s_4,-0.460)
		u_{32}	0.245	4.286	(s_4,0.290)		
		u_{33}	0.154	3.357	(s_3,0.360)		
		u_{34}	0.367	3.000	(s_3,0.000)		
u_4	0.200	u_{41}	0.138	3.286	(s_3,0.290)	3.385	(s_3,0.390)
		u_{42}	0.374	3.357	(s_3,0.360)		
		u_{43}	0.204	3.643	(s_4,-0.360)		
		u_{44}	0.284	3.286	(s_3,0.290)		
u_5	0.115	u_{51}	0.328	3.286	(s_3,0.290)	2.966	(s_3,-0.030)
		u_{52}	0.148	2.286	(s_2,0.290)		
		u_{53}	0.210	3.000	(s_3,0.000)		
		u_{54}	0.314	2.929	(s_3,-0.070)		

In the same way, comprehensive 2-tuple linguistic information of first grade indicator can be calculated as follows:

$$(s,u) = F((s_1,u_1),(s_2,u_2),\ldots(s_5,u_5)) = \Delta\left(\sum_{j=1}^{5} w_j\Delta^{-1}(s_j,u_j)\right) = \Delta\left(\sum_{j=1}^{5} w_j(j+u_j)\right)$$

$$= \Delta((0.292\times 2.882) + (0.204\times 3.364) + (0.118\times 3.537) + (0.2000\times 3.385)$$

$$+ (0.115\times 2.966)) = \Delta(2.870) = (s_3, -0.130)$$

According to comprehensive 2-tuple linguistic information of first and second grade indicators, the mine that is managed according to the occupational health and safety management system achieves a grade of "good" economical efficiency of employee satisfactory with the others of " normal" grade. But the overall employee satisfaction of the OHSAS 18001 belongs to "general" grade, which still needs to be further improved.

6. Conclusion

Enterprise employee satisfaction evaluation is a kind of subjective judgment, whose method of preparation of the scale is easy to cause information distortion. Additionally, the integrity of information can not be preserved in the process of language integrating. And the 2-tuple linguistic information and operator methods overcome the above shortcomings. 5 indicators of OHSAS18001 employee satisfaction of humanization, effectiveness, economical efficiency, social efficiency, and environmental efficiency are given and combined with the characteristics of OHSAS18001. And the method of FAHP is used to calculate the weight of the first and second grade indicators, whose consistency is verified by the root mean square method. The reliability of the results is guaranteed. At the same time, the feasibility of the method is authenticated by the empirical study of 2-tuple linguistic information, which provides an important reference for the effective operation and strategic management of the mine OHSAS18001.

The geographical positions, management mode, and single system or multi system of different mines in China vary greatly. There are many different ways to evaluate the employee satisfaction of OHSAS1800. Thus, this method allows for necessary adjustments according to the actual situation and experience. For future work, the research in this area should be strengthened, the constructed model should be optimized, and in the selection of evaluation methods, we should consider effectively integrating 2-tuple linguistic information, projection operator and geometric weighted averaging operator to further enrich the model of employee satisfaction based on the 2-tuple linguistic information.

Acknowledgments: We thank the employees of the case study area for their cooperation in the study and leaders of the mine for the guidance. The Research Center for Environment and Health of Zhongnan University of Economics and Law in China funded the work reported in this paper.

Author Contributions: All authors contributed to design, method, and analysis reported in the paper. Jan Johansson and Jingdong Zhang conducted the fieldwork, collecting and processing the data reported in the paper. Jiangdong Bao and Lena Abrahamsson conducted the analysis and led the writing of the manuscript. Jiangdong Bao developed and prepared all tables and figures. All authors commented on the manuscript providing insights used in the analysis and discussion.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Tian Shengsi. Evaluation research of employee satisfactory degree based on two-tuple semantic meaning. *Journal of Henan Institute of Science and Technology*. 2010, 9, 12-16.
2. Carlsson C; Fullér R. Benchmarking in linguistic importance weighted aggregations. *Fuzzy Sets and Systems*. 2000, 114(1) , 35 -41.
3. Herrera F; Martínez L. A 2-tuple fuzzy linguistic representation model for computing with words. *IEEE Trans-actions on fuzzy systems*. 2000, 8(6) , 746-752.
4. Natalio Extremera; Lourdes Rey. Ability emotional intelligence and life satisfaction: Positive and negative affect as mediators. *Personality and Individual Differences*. 2016, 102, 98-101. [CrossRef]
5. Rui C.N. Baptista; Luís A.R. Paiva; Rui F.L.; Gonçalves; Luís M.N. ;Oliveira; Maria de Fátima C.R. Pereira; José C.A. Martins. Satisfaction and gains perceived by nursing students with medium and high-fidelity simulation: A randomized controlled trial. *Nurse Education Today*. 2016, 46, 127-132. [CrossRef]
6. Anastasia Stathopoulou; George Balabanis. The effects of loyalty programs on customer satisfaction, trust, and loyalty toward high- and low-end fashion retailers. *Journal of Business Research*. 2016, 69, 5801-5808. [CrossRef]
7. Elizabeth Agyeiwaah; Raymond Adongo; Alexandru Dimache; Amare Wondirad. Make a customer, not a sale: Tourist satisfaction in Hong Kong. *Tourism Management*. 2016, 57, 68-79. [CrossRef]
8. Olli-Pekka Malinen; Hannu Savolainen. The effect of perceived school climate and teacher efficacy in behavior management on job satisfaction and burnout: A longitudinal study. *Teaching and Teacher Education*. 2016, 60, 144-152. [CrossRef]
9. Anderson E W; Fornell C; Lehmann D R. Customer satisfaction, market share, and profitability: findings from Sweden. *The Journal of Marketing*. 1994, 53-66.
10. Anita Zehrer; Frieda Raich. The impact of perceived crowding on customer satisfaction. *Journal of Hospitality and Tourism Management*. 2016, 29, 88-98. [CrossRef]
11. Oliver R L. Measurement and evaluation of satisfaction processes in retail settings. *Journal of retailing*. 1981, 57(3) , 25 – 48.
12. General Administration of quality supervision, inspection and Quarantine of People's Republic of China. National standards of the People's Republic of China, GB/T28001-2011 Occupational Health and Safety Management Systems Requirements.

13. Azadeh, A.A.U.A.. An integrated fuzzy analytic hierarchy process and fuzzy multiple-criteria decision-making simulation approach for maintenance policy selection. *SIMULATION*. 2016, 1, 3-18.
14. Nguyen, T.N.L.H.. Application of fuzzy-analytic hierarchy process algorithm and fuzzy load profile for load shedding in power systems. *International Journal of Electrical Power and Energy Systems*. 2016, 77, 178-184.
15. Herrera F; Martinez L. A 2-tuple fuzzy linguistic representation model for computing with words. *IEEE Transactions on Fuzzy Systems*. 2000, 8 (6), 746-752.
16. Herrera F; Martinez L. A model based on linguistic 2-tuples for dealing with multi-granularity hierarchical linguistic contexts in multi-expert decision-making. *IEEE Trans on Systems，Man and Cybernetics*. 2001, 31(2), 227-234.
17. Herrera F; Herrera, Viedma E. Aggregation operators for linguistic weighted information. *IEEE Transactions on Systems . Man and Cybernetics 2 Part A : Systems* . 1997, 27 (5), 646 - 656.
18. XR Wang; ZP Fan. A method for group decision making problems with different forms of preference information. *Journal of Northeastern University (Natural Science)* . 2003, 24(2), 178-181.